Pro E500 G6
WORKSTATION SYSTEM
USER GUIDE

Contents

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Safety information

Electrical Safety

- Before installing or removing signal cables, ensure that the power cables for the system unit and all attached devices are unplugged.

- To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before relocating the system.

- When adding or removing any additional devices to or from the system, contact a qualified service technician or your dealer. Ensure that the power cables for the devices are unplugged before the signal cables are connected. If possible, disconnect all power cables from the existing system before you service.

- If the power supply is broken, do not try to fix it by yourself. Contact a qualified service technician or your dealer.

Operation Safety

- Servicing of this product or units is to be performed by trained service personnel only.

- Before operating the server, carefully read all the manuals included with the server package.

- Before using the server, make sure all cables are correctly connected and the power cables are not damaged. If any damage is detected, contact your dealer as soon as possible.

- To avoid short circuits, keep paper clips, screws, and staples away from connectors, slots, sockets and circuitry.

- Avoid dust, humidity, and temperature extremes. Place the server on a stable surface.

> This product is equipped with a three-wire power cable and plug for the user's safety. Use the power cable with a properly grounded electrical outlet to avoid electrical shock.

Lithium-Ion Battery Warning

CAUTION! Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

CLASS 1 LASER PRODUCT

Heavy System

CAUTION! This server system is heavy. Ask for assistance when moving or carrying the system.

About this guide

Audience

This user guide is intended for system integrators, and experienced users with at least basic knowledge of configuring a server.

Contents

This guide contains the following parts:

1. **Chapter 1: Product Introduction**

    This chapter describes the general features of the server, including sections on front panel and rear panel specifications.

2. **Chapter 2: Hardware Setup**

    This chapter lists the hardware setup procedures that you have to perform when installing or removing system components.

3. **Chapter 3: Motherboard Information**

    This chapter includes the motherboard layout and brief descriptions of the jumpers and internal connectors.

4. **Chapter 4: BIOS Setup**

    This chapter tells how to change system settings through the BIOS Setup menus and describes the BIOS parameters.

5. **Chapter 5: RAID Configuration**

    This chapter provides instructions for setting up, creating and configuring RAID sets using the available utilities.

Conventions used in this guide

To ensure that you perform certain tasks properly, take note of the following symbols used throughout this manual.

DANGER/WARNING: Information to prevent injury to yourself when trying to complete a task.

CAUTION: Information to prevent damage to the components when trying to complete a task.

IMPORTANT: Instructions that you MUST follow to complete a task.

NOTE: Tips and additional information to help you complete a task.

Typography

Bold text	Indicates a menu or an item to select.
Italics	Used to emphasize a word or a phrase.
<Key>	Keys enclosed in the less-than and greater-than sign means that you must press the enclosed key.
	Example: <Enter> means that you must press the Enter or Return key.
<Key1> + <Key2> + <Key3>	If you must press two or more keys simultaneously, the key names are linked with a plus sign (+).
	Example: <Ctrl> + <Alt> + <Del>
`Command`	Means that you must type the command exactly as shown, then supply the required item or value enclosed in brackets.
	Example: At DOS prompt, type the command line:
	`format A:/S`

References

Refer to the following sources for additional information, and for product and software updates.

ASUS websites

The ASUS websites worldwide provide updated information for all ASUS hardware and software products. Refer to the ASUS contact information.

Product Introduction

This chapter describes the general features of the server, including sections on front panel and rear panel specifications.

1.1   System package contents

Check your system package for the following items.

Model Name	Pro E500 G6
Accessories	1 x Pro E500 G6 Support DVD
	1 x Windows 10 DVD (for OS bundled model)
	1 x AC Power Cable
	1 x COM port Cable
Optional Items	Smart Card Reader
	Anti-Virus CD pack
	Print port cable
	DVD-RW
	Keyboard and mouse

If any of the above items is damaged or missing, contact your retailer.

1.2   Serial number label

Before requesting support from the ASUS Technical Support team, you must take note of the product's serial number containing 12 characters such as xxS0xxxxxxxx shown as the figure below. With the correct serial number of the product, ASUS Technical Support team members can then offer a quicker and satisfying solution to your problems.

1.3 Pro E500 G6 specifications summary

The ASUS Pro E500 G6 is a workstation featuring the ASUS W480/SYS motherboard.

Processor / System Bus		1 x Socket (LGA1200)
		Intel® Xeon® W-1200 Series Processors (up to 125W)
		Intel® 10th Generation Core™ i9/i7/i5/i3 processors
		* Refer to www.asus.com for Intel® CPU support list.
Core Logic		Intel® W480 Chipset
Memory	Total Slots	4 (2-channel per CPU, 4 DIMM per CPU)
	Capacity	Maximum up to 128GB (UDIMM)
	Memory Type	DDR4 2933/2666 MHz, ECC/Non-ECC UDIMM
		* Refer to ASUS server AVL for the latest update.
	Memory Size	32GB, 16GB, 8GB, 4GB (UDIMM)
		* Refer to ASUS server AVL for the latest update.
Expansion Slots	Total PCI/PCI-X /PCI-E Slots	6
	Slot Type	Location-1: PCIe x1 slots (Gen3 x1 link, FH, FL)*
		Location-2: PCIe x16 slots (Gen3 x16/x8 link, FH, FL)
		Location-3: PCIe x1 slots (Gen3 x1 link, FH, FL)*
		Location-4: PCIe x16 slots (Gen3 x0/x8 link, FH, FL)
		Location-6: PCIe x16 slots (Gen3 x4 link, FH, FL)
		Location-7: PCIe x16 slots (Gen3 x4 link, FH, FL)**
		* The bandwidth of PCIe link is shared with M.2_1.
		** The bandwidth of PCIe link is shared with 4 x SATA ports.
	M.2	1 x M.2_1 socket3, up to 2280 type (SATA mode & PCIe Gen3 x4 link)*
		1 x M.2_2 socket3, up to 22110 type (PCIe Gen3 x4 link)**
		* PCIe Bandwidth is shared between M.2 socket and PCIeX1.
		** SATA Bandwidth is shared between M.2 socket and SATA port.
Disk Controller	SATA Controller	**Intel® W480 Chipset:**
		8 x SATA 6Gb/s with 1 x M.2 (PCI-E Gen3 x2 link, NGFF 2280 / 2260 / 2242) or
		7 x SATA 6Gb/s with 1 x M.2 (SATA 6Gb/s)
		- 4 x SATA shared with PCIEX16_4
		Intel® RST (Windows®)
		(Support software RAID 0, 1, 10 & 5)
		(Support Intel® Optane memory)
Storage Bays	Storage Bay	3 x Internal 3.5" Storage bays
		1 x Internal 2.5" Storage bays
	MB on-board Connectors	2 x M.2 connectors
		8 x SATA 7-pin connector
	Default Cable	4 x SATA 6G cables
Networking		1 x Intel® I225-LM 2.5GbE LAN
		1 x Intel® I219-LM Gigabit LAN
VGA		CPU Integrated (Intel® UHD)
		Multi-VGA output support: DVI-D/HDMI/DisplayPort/VGA
		- Supports DVI-D with max. resolution 1920 x 1200@60 Hz

(continued on the next page)

Pro E500 G6 specifications summary

VGA	- Supports HDMI 1.4 with max. resolution 4096 x 2160@24 Hz - Supports DisplayPort 1.2 with max. resolution 4096 x 2304@60 Hz - Supports VGA with max. resolution 1920 x 1200@60 Hz
Graphic	Up to 1 GPU Card
Audio	Realtek® ALC887 7.1-Channel High Definition Audio CODEC
Auxiliary Storage Device Bay (Floppy / Optical Drive)	2 x 5.25" media bays (No ODD/DVD-RW)
Front I/O	2 x USB 3.2 Gen 1 ports 2 x USB 2.0 ports 1 x Headphone port 1 x Microphone port
Rear I/O	2 x USB 3.2 Gen 2 ports (1 port at Type A, 1 port at USB Type-C®) 4 x USB 3.2 Gen 1 ports 1 x HDMI port 1 x DisplayPort 1 x DVI-D port 1 x VGA port 2 x LAN ports (RJ-45) 1 x 7.1-channel Audio I/O ports (5+1 Audio jacks)
Switch/LED	Front Switch/LED: 1 x Power switch/LED 1 x Reset switch 1 x HDD Access LED
Security Options	Trusted Platform Module (TPM 2.0)
OS Support	Windows® 10 Pro for Workstation *** Refer to www.asus.com for the latest OS support.**
Management Software	ASUS Control Center
Dimension (HH x WW x DD)	423 mm x 190 mm x 435 mm 16.7" x 7.48" x 17.1"
Net Weight Kg (CPU, DRAM & HDD not included)	9.9 Kg
Gross Weight Kg (CPU, DRAM & HDD not included, Packing included)	12.1 Kg
Power Supply and Rating	300W Bronze ATX Power Supply (100-127/220-240Vac, 6/3A, 60-50Hz, Class I) 500W Gold ATX Power Supply (100-240Vac, 50/60Hz, 7-3.5A) 700W Gold ATX Power Supply (100-240Vac, 10-5A, 50/60Hz)
Environment	Operating temperature: 10°C ~ 35°C Non operating temperature: -40°C ~ 70°C Non operating humidity: 20% ~ 90% (Non condensing)

Specifications are subject to change without notice.

1.4 Front panel features

The Pro E500 G6 workstation features a simple yet stylish front panel design. The power and reset buttons, LED indicators, optical drive, and USB ports are all conveniently located at the front panel for easy access.

Optical Drive (Optional)

Empty 5.25-inch bay

Empty 5.25-inch bay

Card reader

Reset button

Power button

USB 3.2 Gen 1 ports

USB 2.0 ports*

Headphone port

Microphone port

HDD access LED
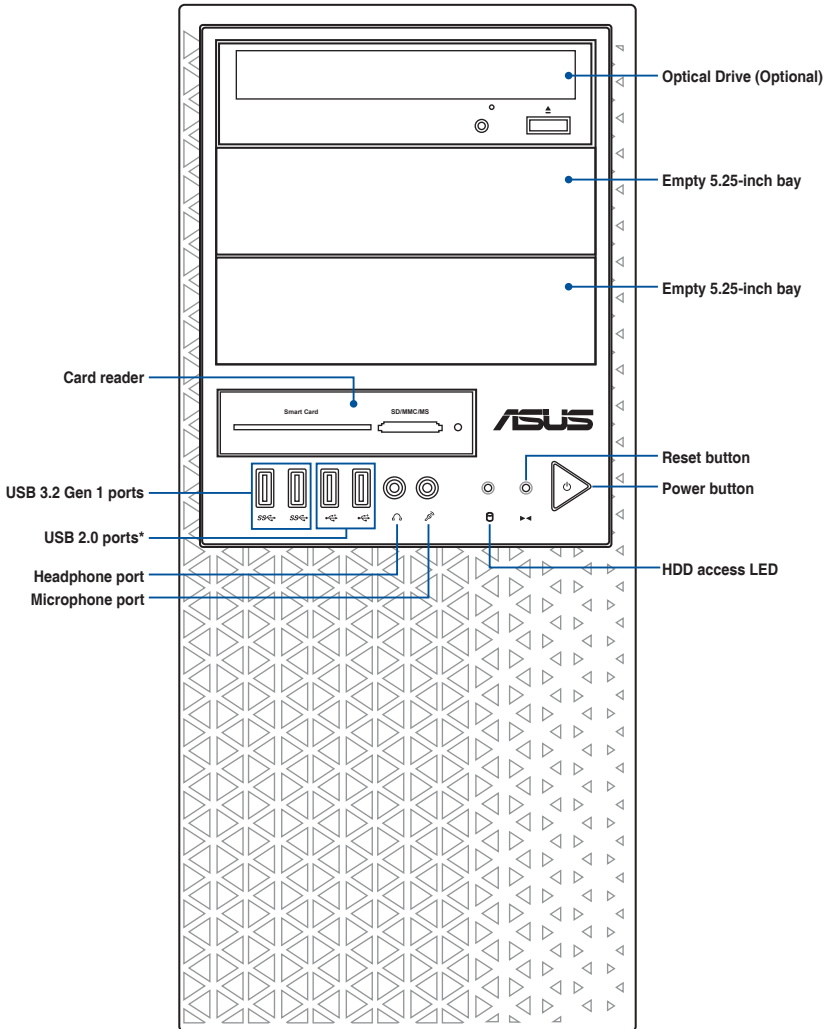
Refer to the Front panel LEDs section for the LED descriptions.

1.5 Rear panel features

The rear panel includes a slot for the motherboard rear I/O ports, expansion slots, a vent for the system fan, and the power supply module.

Power connector

Single power supply

VGA port

DisplayPort

HDMI port

DVI port

LAN port

120 mm x 120 mm system fan vents

USB 3.2 Gen 1 ports

USB 3.2 Gen 2 Type-C® port

USB 3.2 Gen 2 Type-A port

Audio ports

PCIe latch

Expansion slots
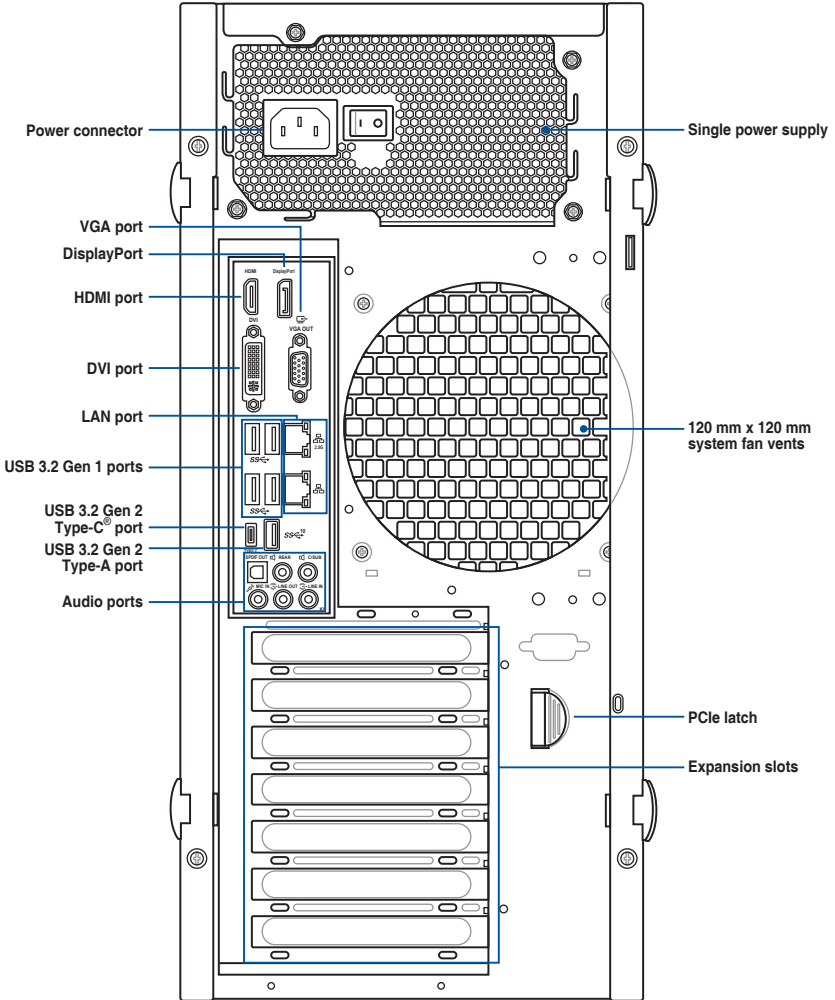
1.6   Internal features

The ASUS Pro E500 G6 Pedestal server system includes the basic components as shown:
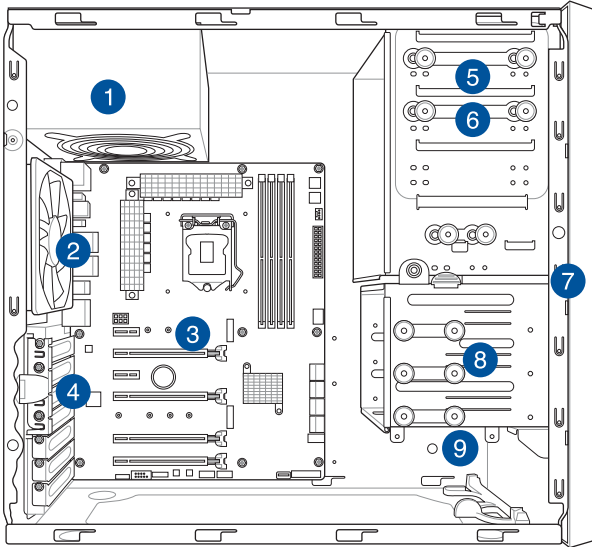
1.   Power supply unit

2.   120 mm x 120 mm system fan

3.   ASUS W480/SYS motherboard

4.   Expansion card locks

5.   Optical drive (Optional)

6.   1 x 5.25-inch drive bay

7.   Front I/O board (hidden)

8.   3 x 3.5-inch Internal storage bays

9.   1 x 2.5-inch Internal storage bay

Turn off the system power and detach the power supply before removing or replacing any system component.

The barebone server does not include a floppy disk drive. If you need to use a floppy disk, connect the USB floppy disk drive to any of the USB ports on the front or rear panel.

WARNING
HAZARDOUS MOVING PARTS
KEEP FINGERS AND OTHER BODY PARTS AWAY

1.7 LED information

1.7.1 Front panel LEDs
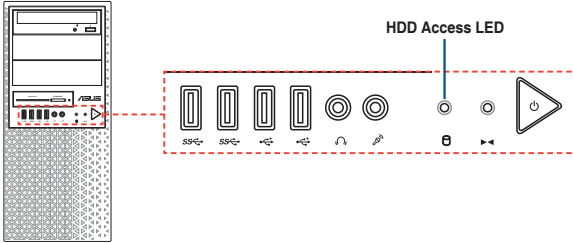
LED	Icon	Display status	Description
HDD Access LED	▯	OFF	No activity
		Blinking	Read/write data into the HDD

1.7.2 Rear panel LEDs

ACT/LINK LED
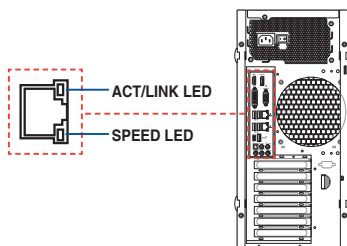
SPEED LED

Intel® I219-LM 1G LAN ports LED indications

Activity Link LED		Speed LED	
Status	**Description**	**Status**	**Description**
Off	No link	Off	10 Mbps connection
Orange	Linked	Orange	100 Mbps connection
Orange (Blinking)	Data activity	Green	1 Gbps connection
Orange (Blinking then steady)	Ready to wake up from S5 mode		

Intel® I225-LM 2.5G LAN ports LED indications

Activity Link LED		Speed LED	
Status	**Description**	**Status**	**Description**
Off	No link	Off	10/100 Mbps connection
Green	Linked	Orange	1 Gbps connection
Green (Blinking)	Data activity	Green	2.5 Gbps connection
Green (Blinking then steady)	Ready to wake up from S5 mode		

You can disable the LAN controllers in BIOS. Due to hardware design, the LAN1 port's LEDs may continue to blink even when disabled.

Hardware Setup

2

This chapter lists the hardware setup procedures that you have to perform when installing system components. It includes description of the jumpers and connectors on the motherboard.

2.1 Chassis cover

2.1.1 Removing the side cover

- Ensure that you unplug the power cord before removing the side cover.

- Take extra care when removing the side cover. Keep your fingers from components inside the chassis that can cause injury, such as the CPU fan, rear fan, and other sharp-edged parts.

- The images of the system shown in this section are for reference purposes only and may not exactly match the model you purchase.

To remove the side cover:

1. Remove the two screws that secure the side cover.

Screws
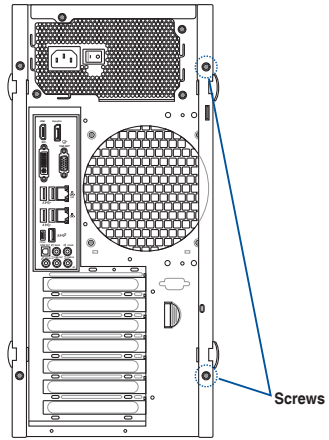
2. Press the side cover locks outward.

Side cover locks

Chapter 2: Hardware Setup
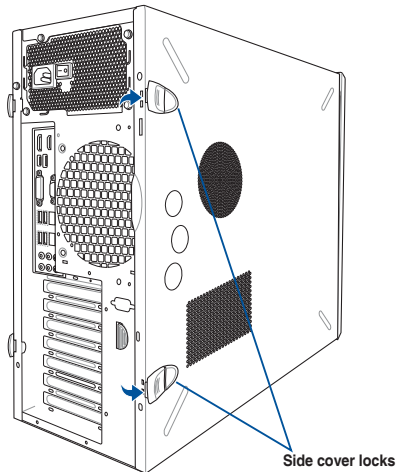
3. Slightly pull the side cover toward the rear just enough to detach it from the chassis.
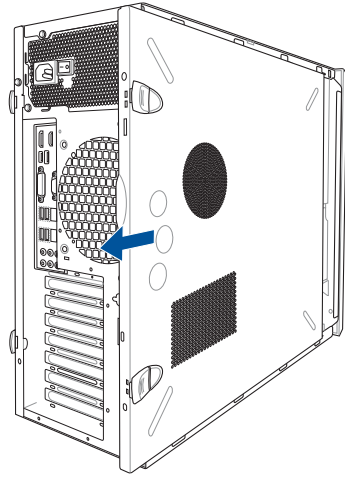
4. Remove the cover and set it aside.
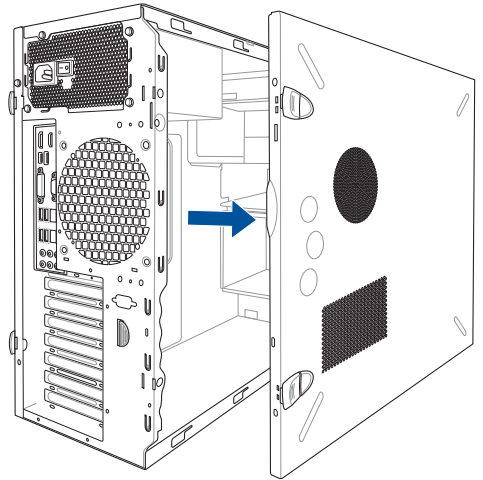
2.2 CPU installation

The motherboard comes with a surface mount LGA1200 socket for Intel® Xeon® W-1200 Series processors and Intel® 10ᵗʰ Generation Core™ i9/i7/i5/i3 processors.
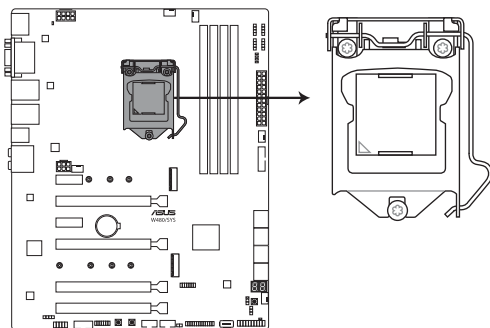
W480/SYS CPU LGA1200

Ensure that you install the correct CPU designed for LGA1200 socket only. DO NOT install a CPU designed for other sockets on the LGA1200 socket.

- Ensure that all power cables are unplugged before installing the CPU.

- Upon purchase of the motherboard, ensure that the PnP cap is on the socket and the socket contacts are not bent. Contact your retailer immediately if the PnP cap is missing, or if you see any damage to the PnP cap/socket contacts/motherboard components. ASUS will shoulder the cost of repair only if the damage is shipment/transit-related.

- Keep the cap after installing the motherboard. ASUS will process Return Merchandise Authorization (RMA) requests only if the motherboard comes with the cap on the LGA1200 socket.

- The product warranty does not cover damage to the socket contacts resulting from incorrect CPU installation/removal, or misplacement/loss/incorrect removal of the PnP cap.

1

- Load lever
  - A
  - B
- Retention tab

2

- Load plate

3

- CPU notches
- Gold triangle mark
- Alignment key
- Alignment key

4

- Load lever
  - C
  - A
  - B
- Retention lock

5

- Load lever
- Retention tab
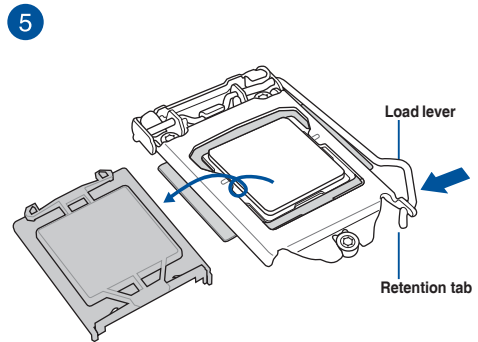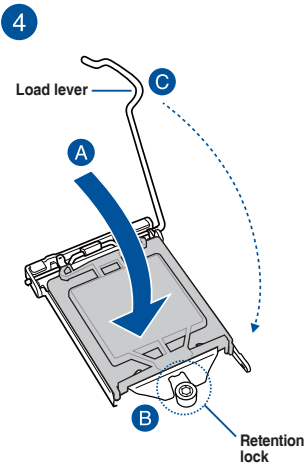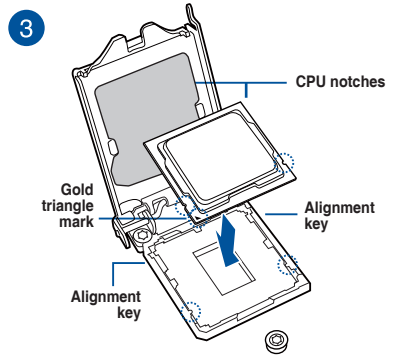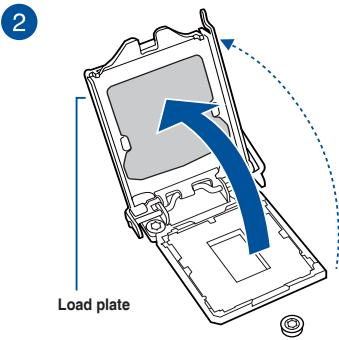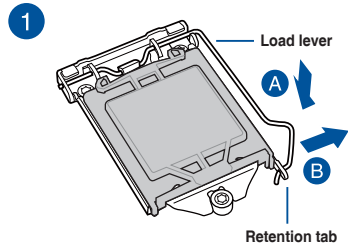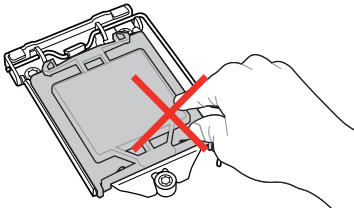
2.3 Cooling system installation
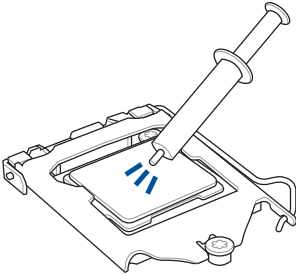
Apply the Thermal Interface Material to the CPU heatsink and CPU before you install the heatsink and fan, if necessary.

To install the CPU heatsink and fan assembly
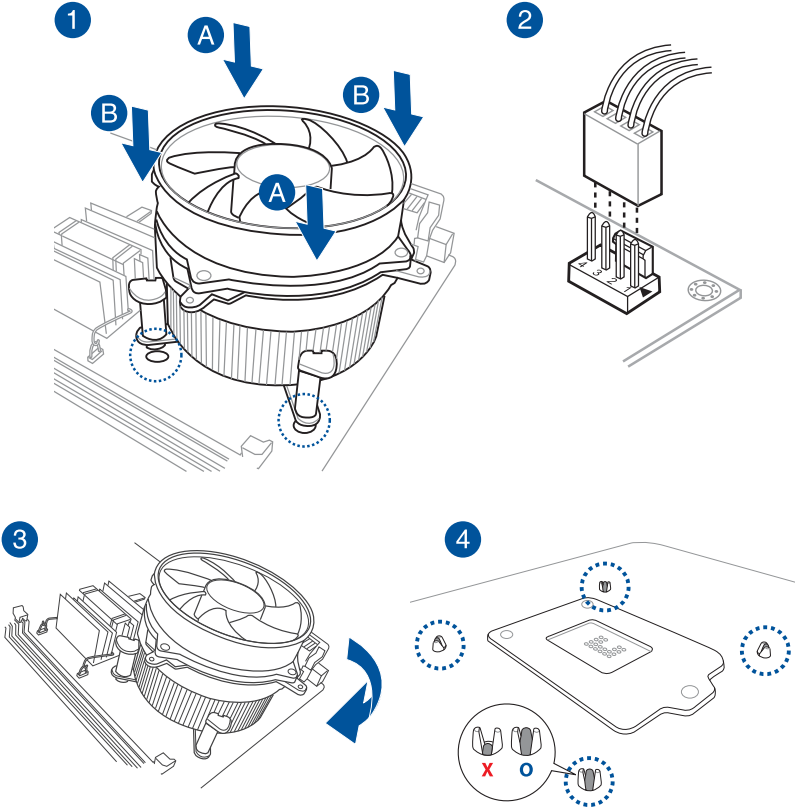
2.4   System memory

The motherboard comes with four DDR 4 (Double Data Rate 4) Dual Inline Memory Modules (DIMM) slots.

> ⚠️ A DDR4 module is notched differently from a DDR, DDR2 or DDR3 module. DO NOT install a DDR, DDR2 or DDR3 memory module to the DDR4 slot.
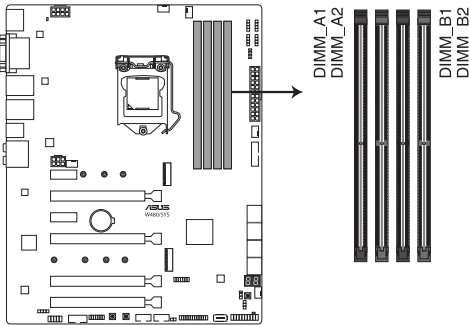
W480/SYS 288-pin DDR4 DIMM sockets

Recommended memory configurations
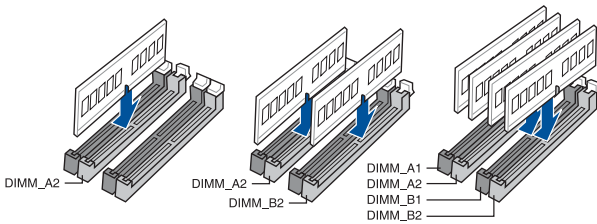
Memory configurations

You may install 4 GB, 8 GB 16 GB, and 32 GB unbuffered DDR4 DIMMs into the DIMM sockets.

You may install varying memory sizes in Channel A and Channel B. The system maps the total size of the lower-sized channel for the dual-channel configuration. Any excess memory from the higher-sized channel is then mapped for single-channel operation.

- The default memory operation frequency is dependent on its Serial Presence Detect (SPD), which is the standard way of accessing information from a memory module. Under the default state, some memory modules for overclocking may operate at a lower frequency than the vendor-marked value.

- For system stability, use a more efficient memory cooling system to support a full memory load (4 DIMMs) or overclocking condition.

- Always install the DIMMS with the same CAS Latency. For an optimum compatibility, we recommend that you install memory modules of the same version or data code (D/C) from the same vendor. Check with the vendor to get the correct memory modules.

- Visit the ASUS website for the latest QVL.

2.4.1   Installing a DIMM on a single clip DIMM socket

1.   Unlock a DIMM socket by pressing the retaining clip outward.

2.   Align a DIMM on the socket such that the notch on the DIMM matches the DIMM slot key on the socket.

DIMM notch

DIMM slot key   **Unlocked retaining clip**
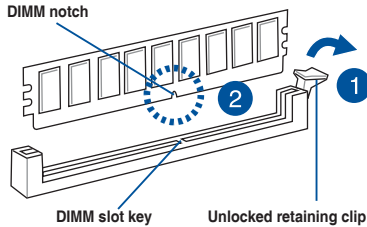
A DIMM is keyed with a notch so that it fits in only one direction. DO NOT force a DIMM into a socket in the wrong direction to avoid damaging the DIMM.

3.   Hold the DIMM by both of its ends then insert the DIMM vertically into the socket. Apply force to both ends of the DIMM simultaneously until the retaining clip snaps back into place and the DIMM cannot be pushed in any further to ensure proper sitting of the DIMM.

Locked Retaining Clip
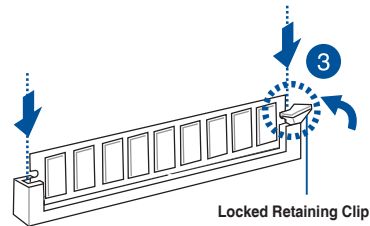
Always insert the DIMM into the socket vertically to prevent DIMM notch damage.

*   To install two or more DIMMs, refer to the user guide bundled in the motherboard package.

*   Refer to the ASUS website for qualified vendor lists of the memory modules.

Removing a DIMM from a single clip DIMM socket

1.   Press the retaining clip outward to unlock the DIMM.

2.   Remove the DIMM from the socket.
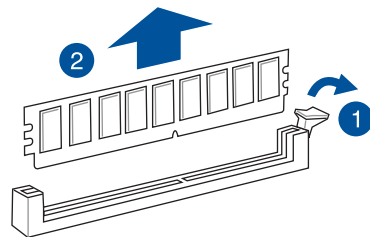
Support the DIMM lightly with your fingers when pressing the retaining clips. The DIMM might get damaged when it flips out with extra force.

2.5   Front panel cover

Before you can install a 5.25-inch drive, you should first remove the front panel cover.

> Ensure to unplug the power cable before installing or removing any system components. Failure to do so may cause damage to the motherboard and other system components!

2.5.1   Removing the front panel cover

To remove the front panel cover:

1.   Locate the front panel assembly lock then slide it outward to unlock the latches that secure the front panel cover to the chassis.

Assembly lock
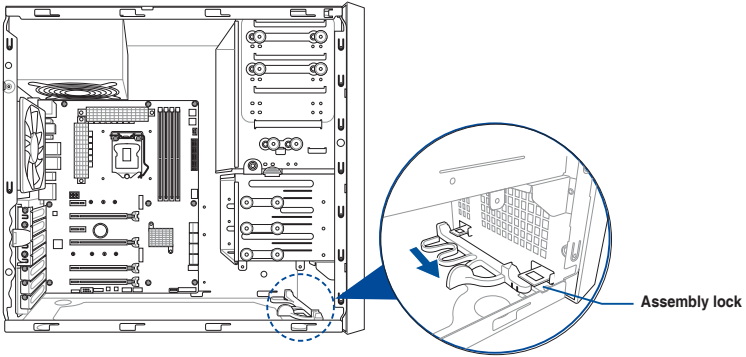
2.   Remove the front panel assembly from the chassis and set it aside.

Front panel assembly
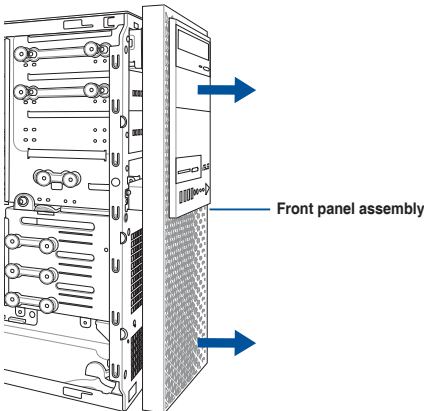
2.6   5.25-inch drives

This system comes with three 5.25-inch drive
bays located on the upper front section of the
chassis.

> If your system came with an optical
> drive, the optical drive occupies the
> topmost bay (1). The lower bays (2
> and 3) are available for additional
> 5.25-inch optical, zip, or floppy disk
> drives.
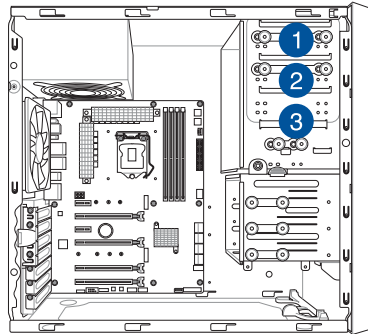
Installing a 5.25-inch drive

To install a 5.25-inch drive:

1. Remove the front panel cover. Refer to
    the **Removing the front panel cover**
    section for more information.

2. Pull the bay locks outward.

Bay locks

3. Remove the metal cover of the bay
    you intend to use.
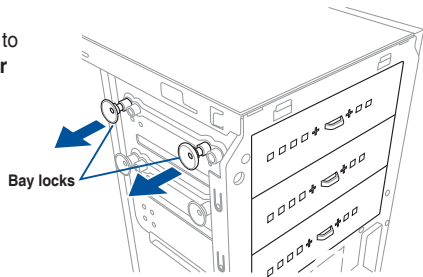
> Take extra care when removing the
> metal cover. Use tools such as a
> screw driver to bend and remove
> the metal cover to avoid physical
> injury.

Screw driver

Metal cover
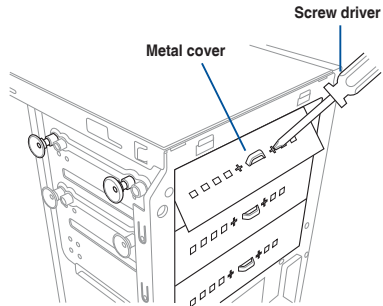
4.   Prepare the 5.25-inch drive.

5.   Insert and carefully push the drive into
      the bay until its screw holes align with
      the holes on the bay.
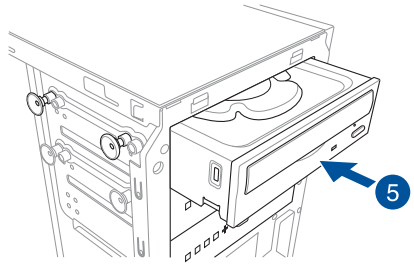
6.   Push the bay locks to secure the drive in
      place.

Bay locks
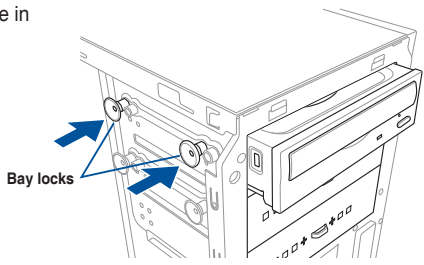
7.   Connect the SATA cable to the SATA
      connector of the drive.

8.   Connect a SATA power cable from the
      power supply to the power connector of
      the drive.

9.   Reinstall the front panel cover.

SATA power cable   **SATA cable**
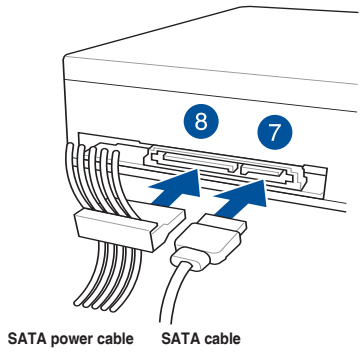
2.7   Hard disk drives (HDD)

The server system supports three (3) 3.5-inch Serial ATA hard disk drives via the hard disk drive bays and one 2.5-inch HDD/SSD drive at the bottom of the HDD cage.

Installing 3.5-inch HDDs

To install 3.5-inch Serial ATA hard disk drives:

1.   Remove the side cover of the chassis. Refer to the **Removing the side cover** section for more information.

2.   Prepare the 3.5-inch HDD and the bundled set of screws.

3.   Locate the HDD cage lock, press it up (A), then swing the HDD cage outwards (B) until it clicks in place.

A

HDD cage lock

HDD cage

B
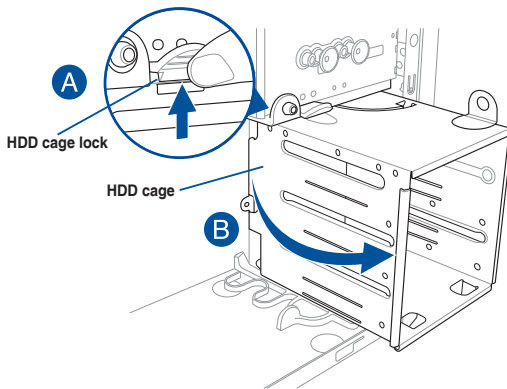
4.   Align and insert the 3.5-inch HDD into the drive bay ensuring that the screw holes on the HDD matches the screw holes on the HDD cage.

Screw hole (HDD cage)   Screw holes (HDD)
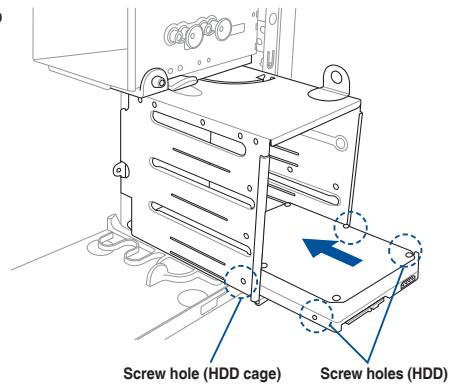
5.	Secure the 3.5-inch HDD to the HDD cage using the bundled set of screws.
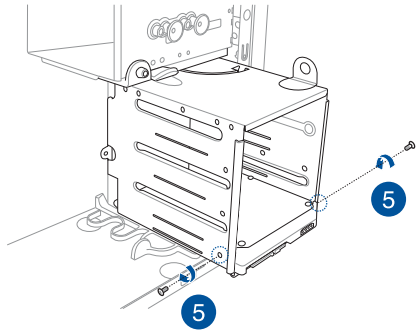
6.	Swing the HDD cage inwards until it clicks back into place.

7.	Connect the SATA cable and SATA power cable to the 3.5-inch HDD.
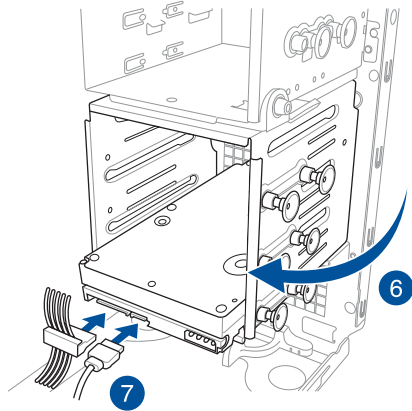
Installing 2.5-inch HDD/SSD

To install a 2.5-inch HDD/SSD:

1. Remove the side cover of the chassis. Refer to the **Removing the side cover** section for more information.

2. Prepare the 2.5-inch HDD/SDD and the bundled set of screws.

3. Lay the system on its side on a flat and stable surface.

4. Locate the HDD cage lock, press it up (A), then swing the HDD cage outwards (B).

5. Align and insert the 2.5-inch HDD/SSD into the drive bay as shown. Push it all the way until its screw holes align with the holes on the drive bay.
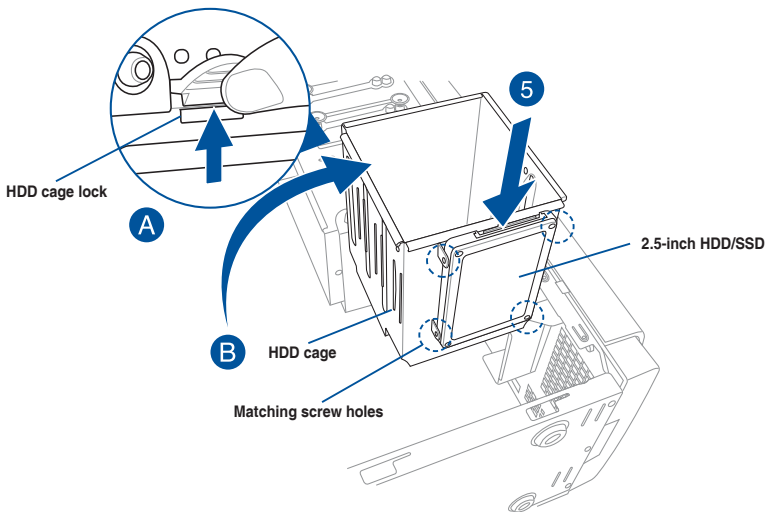
6.	Secure the 2.5-inch HDD/SSD to the HDD cage using the bundled set of screws.
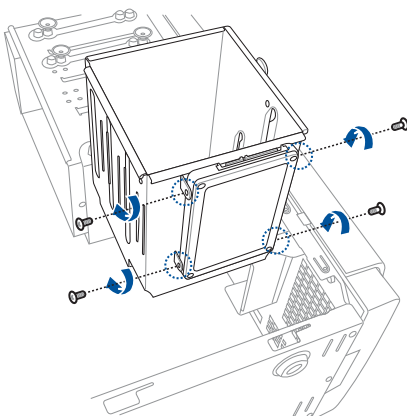
7.	Swing the HDD cage inwards until it clicks back into place.
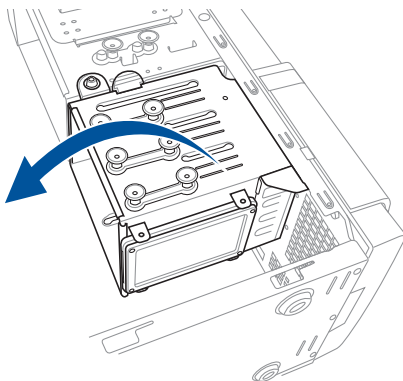
8.	Connect a SATA cable and a SATA power cable to the 2.5-inch HDD/SSD.
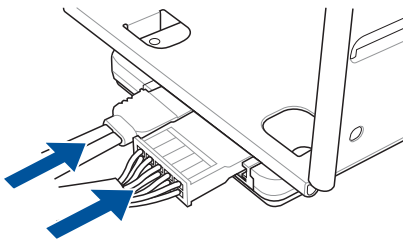
2.8 Expansion slots

Unplug the power cord before adding or removing expansion cards. Failure to do so may cause you physical injury and damage motherboard components.
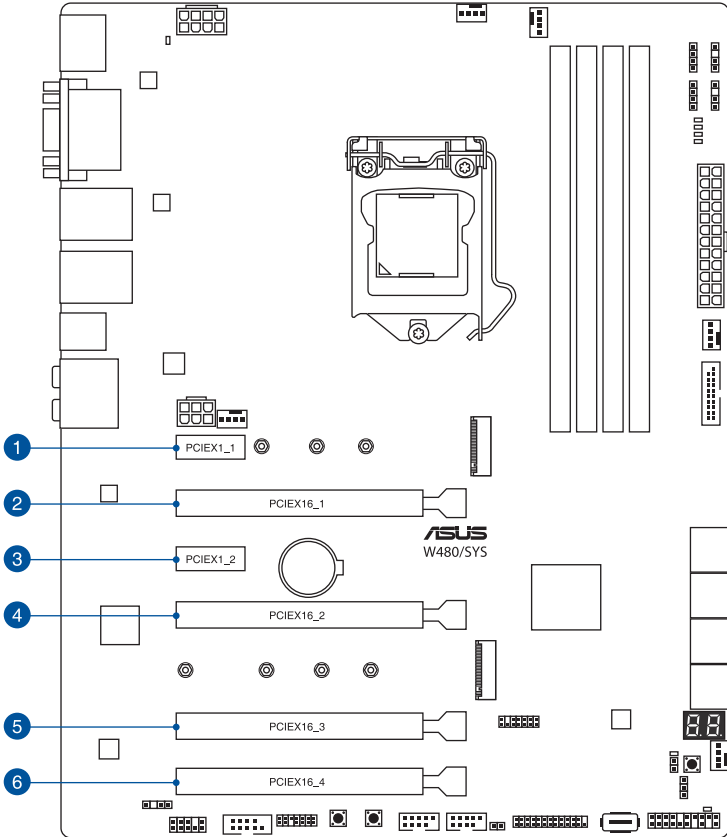
Slot No.	Slot Description
1	PCIE x1_1 slot
2	PCIE x16_1 slot
3	PCIE x1_2 slot
4	PCIE x16_2 slot
5	PCIE x16_3 slot
6	PCIE x16_4 slot

2.8.1 Installing an expansion card

To install an expansion card:

1. Lay the system on its side on a flat, stable surface.

2. Press the PCIe latch (A), hold it by its edge then lift it towards the rear (B).

Edge of the PCIe latch
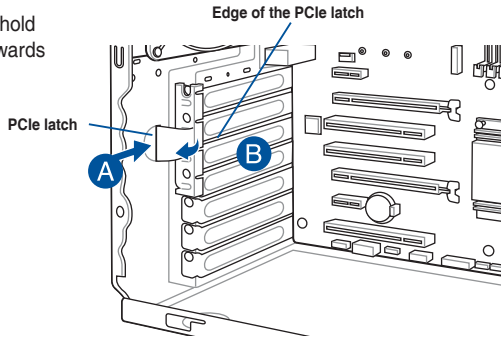
PCIe latch

3. Remove the screw (A) that secures the metal bracket to the chassis then remove the metal bracket (B).

Screw
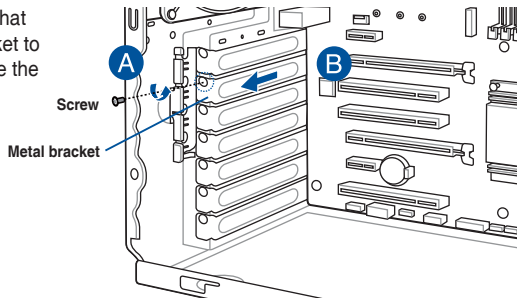
Metal bracket

4.	Align and insert the expansion card into the PCIe slot.

Expansion card   **PCIe slot**
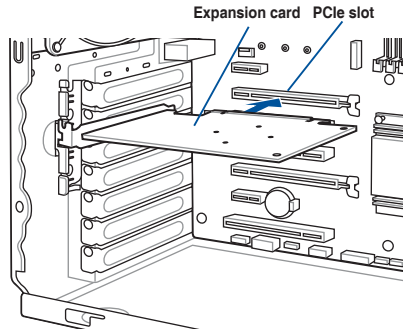
5.	Lift the PCIe latch inwards until it clicks into place securing the expansion card to the chassis.

PCIe latch
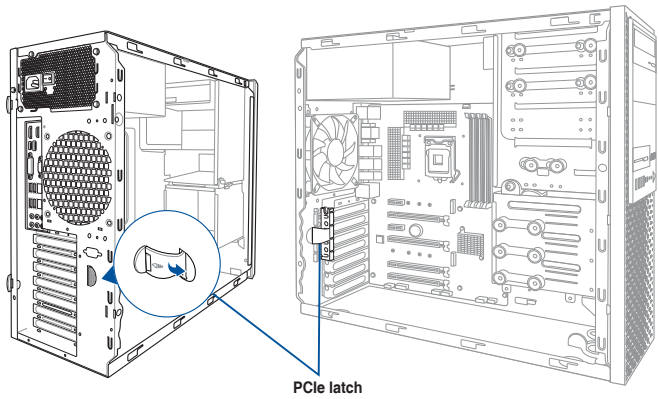
6.	(Optional) Replace the screw of the metal bracket.
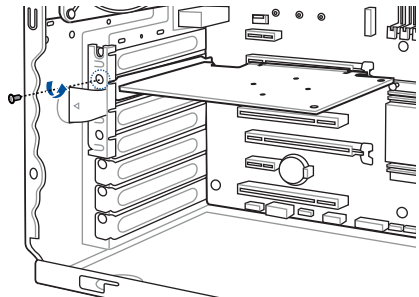
2.8.2 Configuring an expansion card

VGA configuration	PCI Express operating mode		
	PCIe 3.0 x16_1 (gray)	**PCIe 3.0 x16_2**	**PCIe 3.0 x16_3**
Single VGA/PCIe card	x16 (Recommended for single VGA card)	N/A	N/A
Dual VGA/PCIe cards	x8	x8	N/A
Triple VGA/PCIe cards	x8	x8	x4

- In single VGA card mode, use the PCIe 3.0 x16_1 slot (gray) for a PCI Express x16 graphics card to get better performance.

- We recommend that you provide sufficient power when running CrossFireX™ mode.

- We recommend you connect the EATX12V_1 cable when running CrossFireX™.

- Connect a chassis fan to the motherboard connector labeled CHA_FAN1/2 when using multiple graphics cards for better thermal environment.

2.8.3 Installing M.2 (NGFF) cards

To install an M.2 card:

1. Locate the M.2 connector (M.2(SOCKET3)) on the motherboard.

W480/SYS M.2 socket
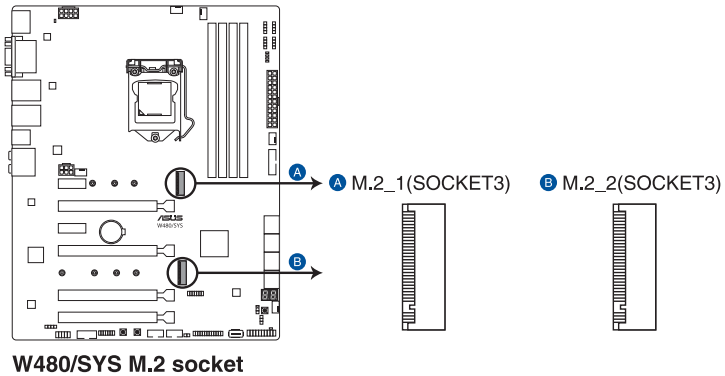
2. Remove the screw on the stand screw.
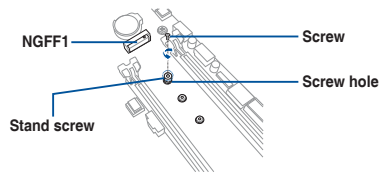
3. Prepare the M.2 card.

4. Align and insert the M.2 card into the M.2 connector (M.2(SOCKET3)).
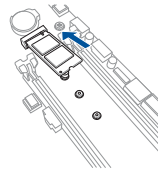
5. Secure the M.2 card with the screw you removed in step 2.
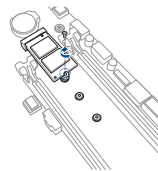
- Please pay attention when removing the screw, the stand screw might be removed together with it.

- Ensure that the M.2 card is positioned between the screw and the stand screw before securing it.

2.9 System fan

This section describes how to remove the system fan in the event that you need to install or remove previously installed or new system components, or when the system fan needs to be replaced because it was damaged or became defective.

To remove the system fan:

1. Disconnect the system fan cable from the CHA_FAN1 connector on the motherboard.
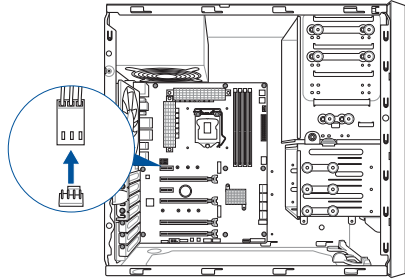
2. Remove the four system fan screws at the rear panel. Keep the screws for later use.

Hold the system fan with one hand while removing the system fan screws.
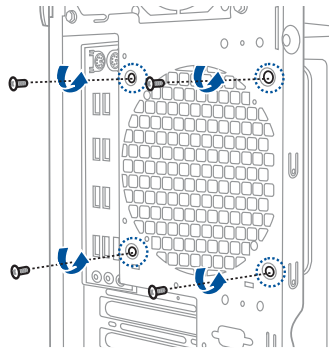
3. Remove the system fan.

Follow the previous instructions in reverse order if you want to reinstall the system fan.
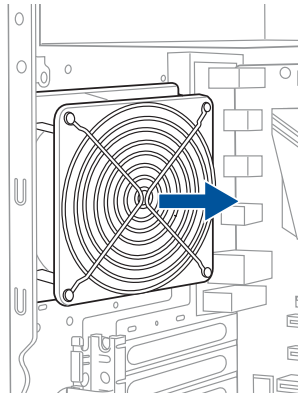
2.10 BIOS update utility

USB BIOS FlashBack™

USB BIOS FlashBack™ allows you to easily update the BIOS without entering a bootable environment, ideal for BIOS recovery, rollback, or updates to support new CPUs. Simply insert a USB storage device to the USB port (the USB port is marked the I/O shield) then press the USB BIOS FlashBack™ button for three seconds to start the update process.

To use USB BIOS FlashBack™:

1. Download the latest BIOS from the support site at www.asus.com/support/ and save it to a USB storage device.

- We recommend you to use a USB 2.0 storage device to save the latest BIOS version for better compatibility and stability.

- When downloading or updating the BIOS file, rename it as **W480S.CAP** for this motherboard.

2. Insert the USB storage device to the USB FlashBack™ port.

3. Shut down your computer.

USB9
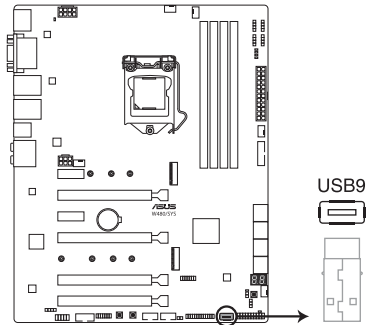
4. On your motherboard, press the BIOS FlashBack™ button for three seconds until the FlashBack™ LED blinks three times, indicating that the BIOS FlashBack™ function is enabled.
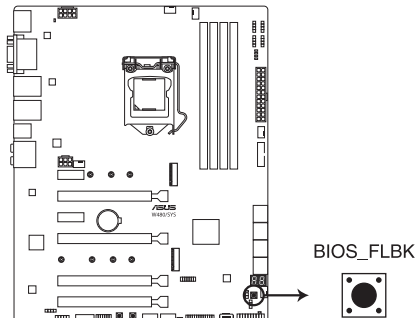
BIOS_FLBK

W480/SYS BIOS_FLBK button

Refer to section **Onboard LEDs** for more information of the FlashBack™ LED.

5.   Wait until the light goes out, indicating that the BIOS updating process is completed.

For more BIOS update utilities in BIOS setup, refer to the section **Updating BIOS** in Chapter 4.

*   Do not unplug portable disk, power system, or short the CLRTC header while BIOS update is ongoing, otherwise update will be interrupted. In case of interruption, please press and hold the BIOS_FLBK button for 3 seconds again to restart the process.

*   If the light flashes for five seconds and turns into a solid light, this means that the BIOS FlashBack™ is not operating properly. Please check the following when this happens:

    -   The USB drive should only contain a single partition.
    -   The USB drive should be formatted to a FAT32, FAT16, or NTFS filesystem.
    -   The BIOS filename should be correctly named, and in the root folder of the USB drive.
    -   If the problem persists, the USB drive may not be compatible, please try another USB drive of a different brand/model.

    Then retry the flashback by pressing the BIOS FlashBack™ button for three seconds until the FlashBack™ LED starts to blink.

2.11   Motherboard rear and audio connection

2.11.1   Rear I/O connection
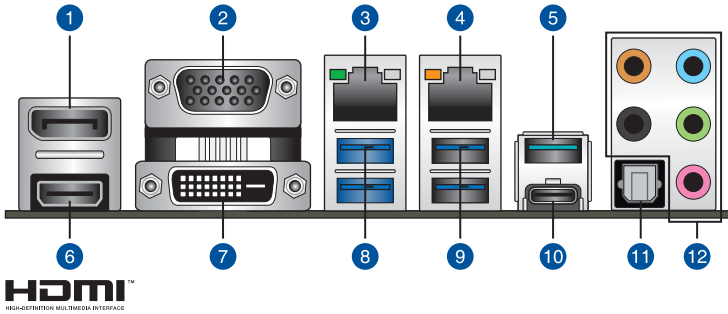
Rear panel connectors			
1.	DisplayPort	7.	DVI-D port
2.	VGA port	8.	USB 3.2 Gen 1 ports 5 and 6
3.	Intel® LAN I225	9.	USB 3.2 Gen 1 ports 3 and 4
4.	Intel® LAN I219	10.	USB 3.2 Gen 2 Type-C® port EC1
5.	USB 3.2 Gen 2 Type-A port E1	11.	Optical S/PDIF Out port
6.	HDMI 1.4b port	12.	Audio I/O ports*

* : Refer to the tables below for audio port definitions.

* Audio 2, 4, 5.1 or 7.1-channel configuration

Port	Headset 2-channel	4-channel	5.1-channel	7.1-channel
Light Blue	Line In	Line In	Line In	Side Speaker Out
Lime	Line Out	Front Speaker Out	Front Speaker Out	Front Speaker Out
Pink	Mic In	Mic In	Mic In	Mic In
Orange	–	–	Center/Sub woofer	Center/Sub woofer
Black	–	Rear Speaker Out	Rear Speaker Out	Rear Speaker Out

2.11.2   Audio I/O connections

Audio I/O ports

orange		light blue
black		lime
		pink
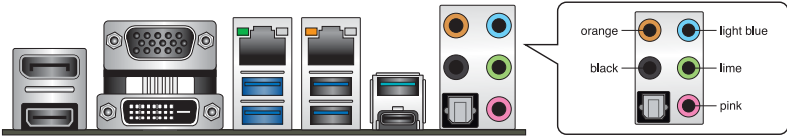
Connect to Headphone and Mic

Connect to Stereo Speakers
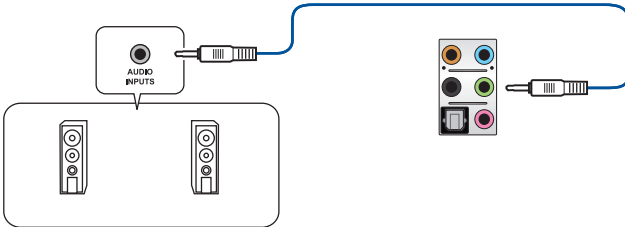
Connect to 2-channel Speakers
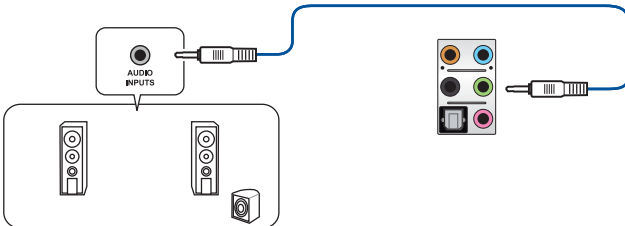
Connect to 4-channel Speakers
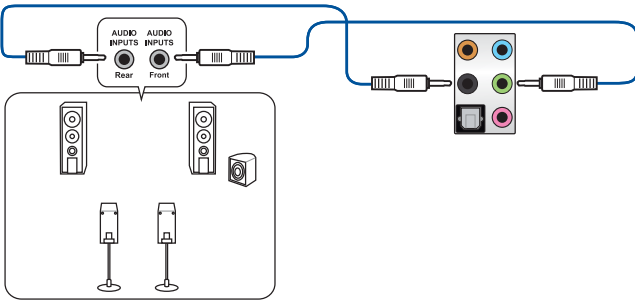
Connect to 5.1-channel Speakers
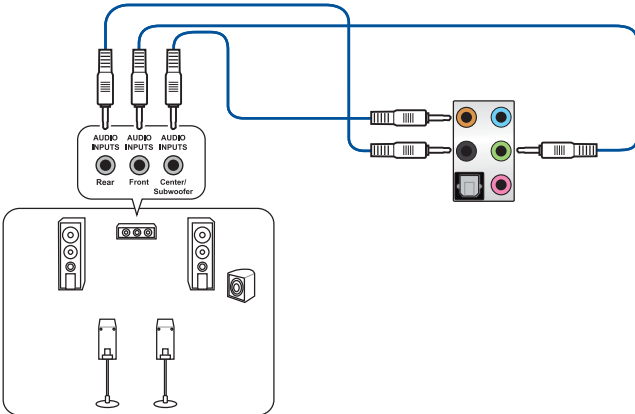
Connect to 7.1-channel Speakers
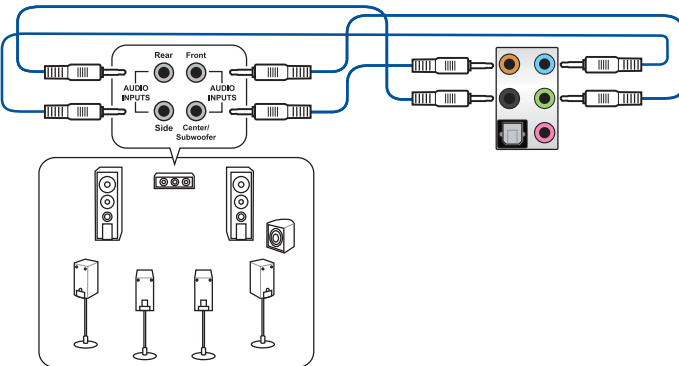
Motherboard Information

3

This chapter includes the motherboard layout and brief descriptions of the jumpers and internal connectors.

3.1 Motherboard layout

Chapter 3: Motherboard Information
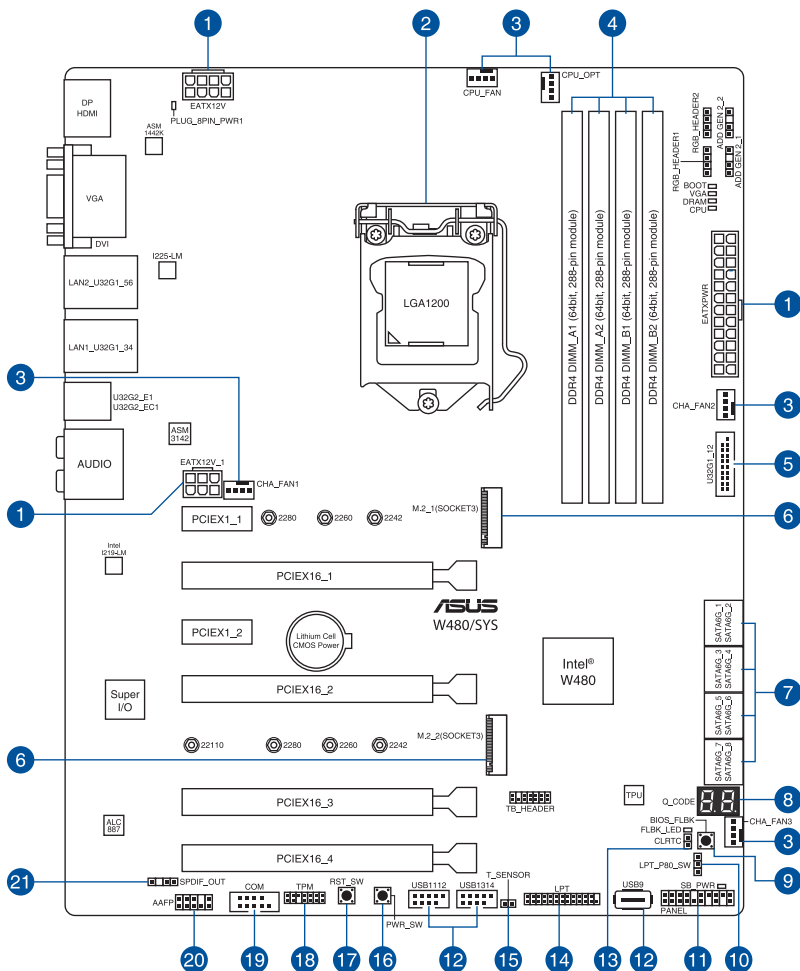
Layout contents

Connectors/Jumpers/Buttons and switches/Slots	Page
1. ATX power connectors (24-pin EATXPWR; 8-pin EATX12V; 6-pin EATX12V_1)	3-15
2. LGA1200 CPU socket	2-4
3. Fan connectors (4-pin CPU_FAN; 4-pin CPU_OPT; 4-pin CHA_FAN1-3)	3-13
4. DDR4 DIMM slots	2-7
5. USB 3.2 Gen 1 connector (20-1 pin U32G1_12)	3-11
6. M.2 sockets (M.2_1; M.2_2)	3-16
7. Intel® Serial ATA 6 Gb/s connectors (7-pin SATA6G_1-8)	3-9
8. Q-Code LED	3-8
9. BIOS FlashBack™ button	2-23
10. LPT and Q-Code switch (3-pin LPT_P80_SW)	3-6
11. System panel connector (20-3 pin PANEL)	3-14
12. USB 2.0 connectors (10-1 pin USB1112, USB1314; 4-pin Type-A USB9)	3-12
13. Clear RTC RAM (2-pin CLRTC)	3-5
14. LPT connector (26-1 pin LPT)	3-17
15. Thermal Sensor connector (2-pin T_SENSOR)	3-17
16. Power-on button	3-4
17. Reset button	3-4
18. TPM connector (14-1 pin TPM)	3-10
19. Serial port connector (10-1 pin COM1)	3-12
20. Front panel audio connector (10-1 pin AAFP)	3-10
21. Digital audio connector (4-1 pin SPDIF_OUT)	3-13

3.2 Onboard buttons and switches

Onboard buttons and switches allow you to fine-tune performance when working on a bare or open-case system. This is ideal for overclockers and gamers who continually change settings to enhance system performance.

1. **Power-on button**

   The motherboard comes with a power-on button that allows you to power up or wake up the system. The button also lights up when the system is plugged to a power source indicating that you should shut down the system and unplug the power cable before removing or installing any motherboard component.

   W480/SYS Power on button
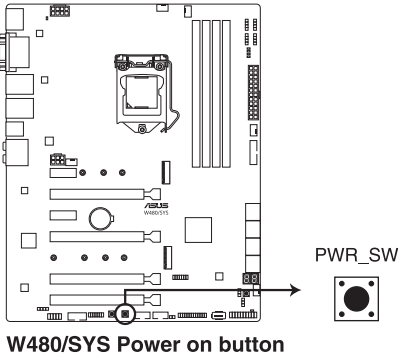
2. **Reset button**

   Press the reset button to reboot the system.

   W480/SYS Reset button
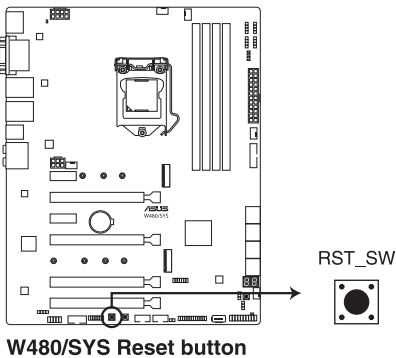
3.3 Jumpers

1. **Clear RTC RAM (2-pin CLRTC)**

   This header allows you to clear the Real Time Clock (RTC) RAM in CMOS. You can clear the CMOS memory of date, and system setup parameters by erasing the CMOS RTC RAM data. The onboard button cell battery powers the RAM data in CMOS, which include system setup information such as system passwords.

   To erase the RTC RAM:

   1. Turn OFF the computer and unplug the power cord.

   2. Use a metal object such as a screwdriver to short the two pins.

   3. Plug the power cord and turn ON the computer.

   4. Hold down the <Del> key during the boot process and enter BIOS setup to re-enter data.

   ⚠ Except when clearing the RTC RAM, never short-circuit the CLRTC jumper. Shorting the CLRTC jumper will cause system boot failure!

   ✎ If the steps above do not help, remove the onboard battery and short the two pins again to clear the CMOS RTC RAM data. After clearing the CMOS, reinstall the battery.
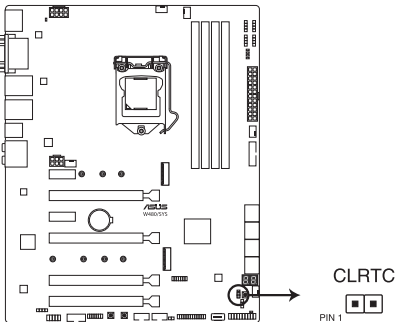
W480/SYS Clear RTC RAM

2.   **LPT and Q-Code switch (3-pin LPT_P80_SW)**

This header allows you to enable either LPT (Line Printing Thermal) connector or Q-Code at a time.

LPT_P80_SW

Enable Q-Code   Enable print port
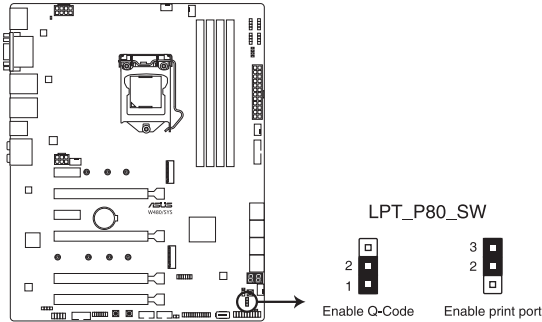
W480/SYS LPT_P80_SW setting

To switch between LPT and Q-Code:

1.   Turn OFF the computer and unplug the power cord.

2.   Move the jumper cap to switch between LPT and Q-Code.

3.   Plug the power cord and turn ON the computer.

3.4   Onboard LEDs

1.   **Q LED (CPU, DRAM, VGA, BOOT)**

Q LED checks key components (CPU, DRAM, VGA card, and booting devices) in sequence during motherboard booting process. If an error is found, the corresponding LED remains lit until the problem is solved. This user-friendly design provides an intuitive way to locate the root problem within seconds.
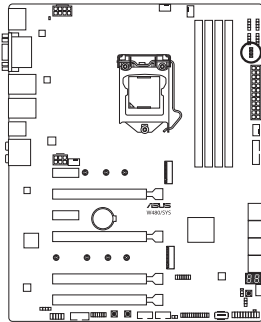
BOOT (YELLOW GREEN)
VGA (WHITE)
DRAM (YELLOW)
CPU (RED)

W480/SYS Q LEDs

> The Q LEDs provide the most probable cause of an error code as a starting point for troubleshooting. The actual cause may vary from case to case.

2.   **USB BIOS FlashBack™ LED (FLBK_LED)**

The BIOS FlashBack™ LED flashes when you press the BIOS FlashBack™ button for BIOS update.
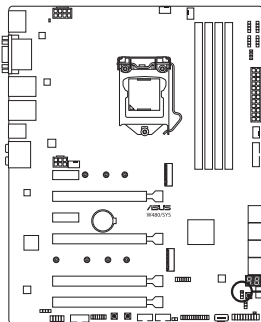
FLBK_LED

W480/SYS FLBK LED

3. **Q-Code LED**

The Q-Code LED design provides you with a 2-digit error code that displays the system status. Refer to the Q-Code table on the next page for details.
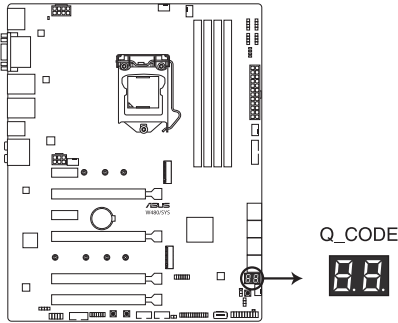
W480/SYS Q-Code LED

The Q-Code LED provides the most probable cause of an error code as a starting point for troubleshooting. The actual cause may vary from case to case.

3.5 Internal connectors

1. **Intel® Serial ATA 6 Gb/s connectors (7-pin SATA6G_1-8)**

   These connectors connect to Serial ATA 6 Gb/s hard disk drives via Serial ATA 6 Gb/s signal cables.

   If you installed Serial ATA hard disk drives, you can create a RAID 0, 1, 5, and 10 configuration with the Intel® Rapid Storage Technology enterprise through the onboard Intel® W480 chipset.
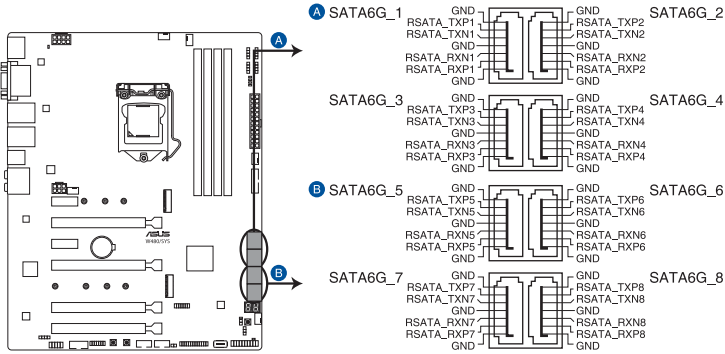
W480/SYS Intel® Serial ATA 6 Gb/s connectors

- These connectors are set to **[AHCI Mode]** by default. If you intend to create a Serial ATA RAID set using these connectors, set the SATA Mode item in the BIOS to **[Intel RST Premium with Intel Optane System Acceleration(RAID)]**.

- SATA6G_2 port shares bandwidth with M.2_1 socket. When M.2_1 slot runs in SATA mode, the SATA6G_2 port will be disabled.

2.   **Front panel audio connector (10-1 pin AAFP)**

This connector is for a chassis-mounted front panel audio I/O module that supports HD Audio. Connect one end of the front panel audio I/O module cable to this connector.
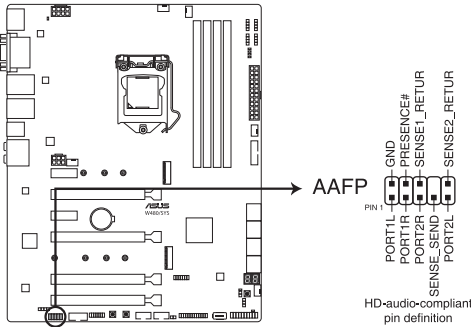
W480/SYS Front panel audio connector

We recommend that you connect a high-definition front panel audio module to this connector to avail of the motherboard's high-definition audio capability.

3.   **TPM connector (14-1 pin TPM)**

This connector supports a Trusted Platform Module (TPM) system, which securely store keys, digital certificates, passwords and data. A TPM system also helps enhance network security, protect digital identities, and ensures platform integrity.
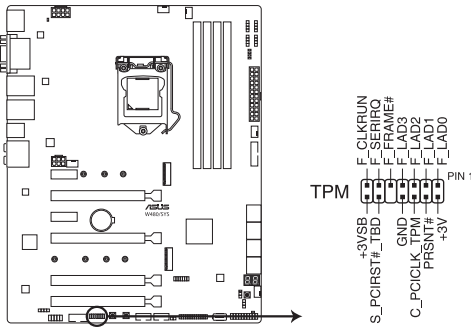
W480/SYS TPM connector

The TPM module is purchased separately.

4. USB 3.2 Gen 1 connector (20-1 pin U32G1_12)

This connector allows you to connect a USB 3.2 Gen 1 module for additional USB 3.2 Gen 1 front or rear panel ports. With an installed USB 3.2 Gen 1 module, you can enjoy all the benefits of USB 3.2 Gen 1 including faster data transfer speeds of up to 5 Gb/s, faster charging time for USB-chargeable devices, optimized power efficiency, and backward compatibility with USB 2.0.

U32G1_12

PIN 1

Vbus	Vbus
IntA_P2_SSRX-	IntA_P1_SSRX-
IntA_P2_SSRX+	IntA_P1_SSRX+
GND	GND
IntA_P2_SSTX-	IntA_P1_SSTX-
IntA_P2_SSTX+	IntA_P1_SSTX+
GND	GND
IntA_P2_D-	IntA_P1_D-
IntA_P2_D+	IntA_P1_D+
	GND
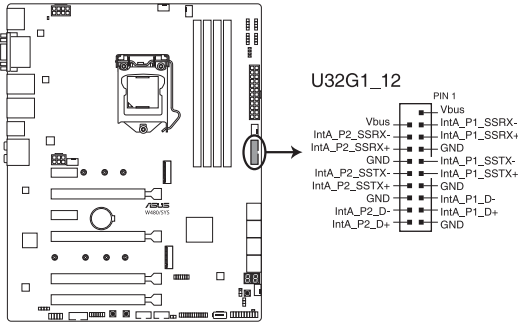
W480/SYS USB 3.2 Gen 1 connector

The USB 3.2 Gen 1 module is purchased separately.

The plugged USB 3.2 Gen 1 device may run on xHCI or EHCI mode depending on the operating system's setting.

5. **USB 2.0 connectors (10-1 pin USB1112, USB1314; 4-pin Type-A USB9)**

The 10-1 pin connector allows you to connect a USB 2.0 module for additional USB 2.0 front or rear panel ports. The 4-pin USB (Universal Serial Bus) Type-A port is available for connecting USB 2.0 devices. These USB connectors comply with USB 2.0 specification that supports up to 480 Mbps connection speed.

W480/SYS USB 2.0 connectors
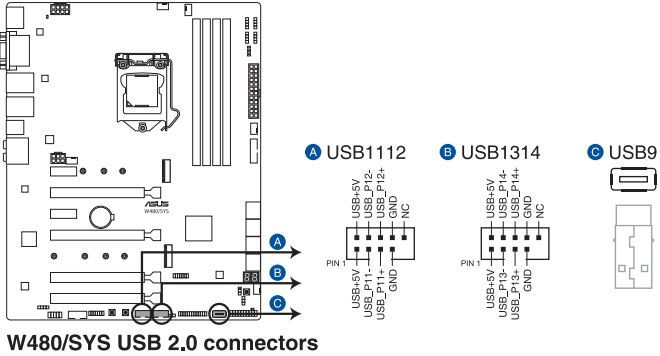
DO NOT connect a 1394 cable to the USB connectors. Doing so will damage the motherboard!

6. **Serial port connector (10-1 pin COM1)**

This connector is for a serial (COM) port. Connect the serial port module cable to this connector, then install the module to a slot opening at the back of the system chassis.

W480/SYS Serial port connector
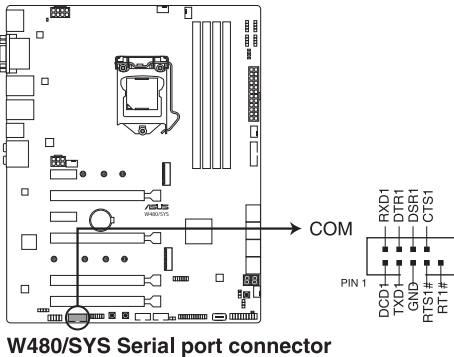
7. **Fan connectors (4-pin CPU_FAN; 4-pin CPU_OPT; 4-pin CHA_FAN1-3)**

Connect the fan cables to the fan connectors on the motherboard, ensuring that the black wire of each cable matches the ground pin of the connector.
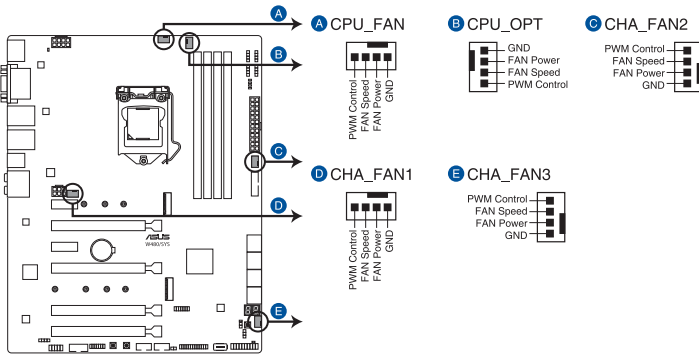
W480/SYS FAN connectors

⚠️
- DO NOT forget to connect the fan cables to the fan connectors. Insufficient air flow inside the system may damage the motherboard components. These are not jumpers! Do not place jumper caps on the fan connectors!
- Ensure that the CPU fan cable is securely installed to the CPU fan connector.

8. **Digital audio connector (4-1 pin SPDIF_OUT)**

This connector is for an additional Sony/Philips Digital Interface (S/PDIF) port. Connect the S/PDIF Out module cable to this connector, then install the module to a slot opening at the back of the system chassis.
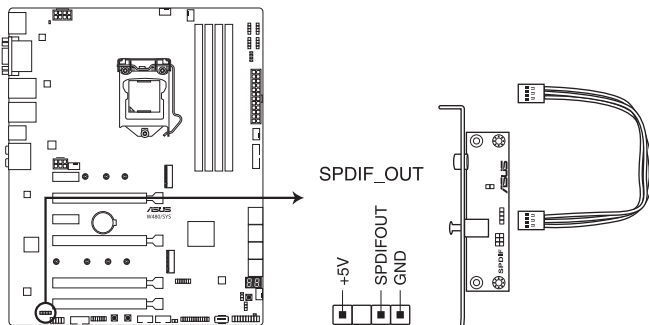
W480/SYS Digital audio connector

✎ The S/PDIF module is purchased separately.

9.   **System panel connector (20-3 pin PANEL)**

This connector supports several chassis-mounted functions.
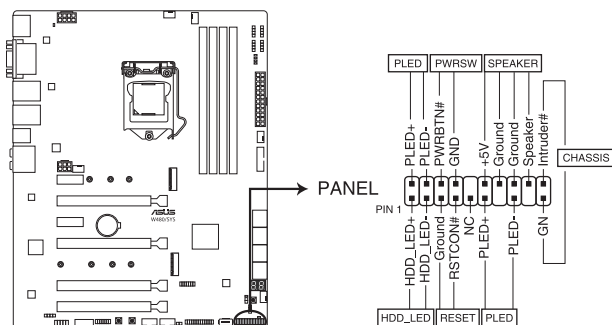
W480/SYS System panel connector

• **System power LED (2-pin or 3-1 pin PLED)**

The 2-pin or 3-1 pin connector is for the system power LED. Connect the chassis power LED cable to this connector. The system power LED lights up when you turn on the system power, and blinks when the system is in sleep mode.

• **Hard disk drive activity LED (2-pin HDD_LED)**

This 2-pin connector is for the HDD Activity LED. Connect the HDD Activity LED cable to this connector. The HDD LED lights up or flashes when data is read from or written to the HDD.

• **System warning speaker (4-pin SPEAKER)**

This 4-pin connector is for the chassis-mounted system warning speaker. The speaker allows you to hear system beeps and warnings.

• **ATX power button/soft-off button (2-pin PWRSW)**

This connector is for the system power button. Pressing the power button turns the system on or puts the system in sleep or soft-off mode depending on the operating system settings. Pressing the power switch for more than four seconds while the system is ON turns the system OFF.

• **Reset button (2-pin RESET)**

This 2-pin connector is for the chassis-mounted reset button for system reboot without turning off the system power.

• **Chassis intrusion connector (2-pin CHASSIS)**

This connector is for a chassis-mounted intrusion detection sensor or switch. Connect one end of the chassis intrusion sensor or switch cable to this connector. The chassis intrusion sensor or switch sends a high-level signal to this connector when a chassis component is removed or replaced. The signal is then generated as a chassis intrusion event.

10. ATX power connectors (24-pin EATXPWR; 8-pin EATX12V; 6-pin EATX12V_1)

These connectors are for ATX power supply plugs. The power supply plugs are designed to fit these connectors in only one orientation. Find the proper orientation and push down firmly until the connectors completely fit.

A EATX12V

+12V DC
+12V DC
+12V DC
+12V DC

GND
GND
GND
GND

PIN 1

B EATXPWR

+3 Volts	GND
+12 Volts	+5 Volts
+12 Volts	+5 Volts
+5V Standby	+5 Volts
Power OK	floating
GND	GND
+5 Volts	GND
GND	GND
+5 Volts	PSON#
GND	GND
+3 Volts	-12 Volts
+3 Volts	+3 Volts

PIN 1

C EATX12V_1

GND
GND
GND

+12V DC
+12V DC
+12V DC

PIN 1
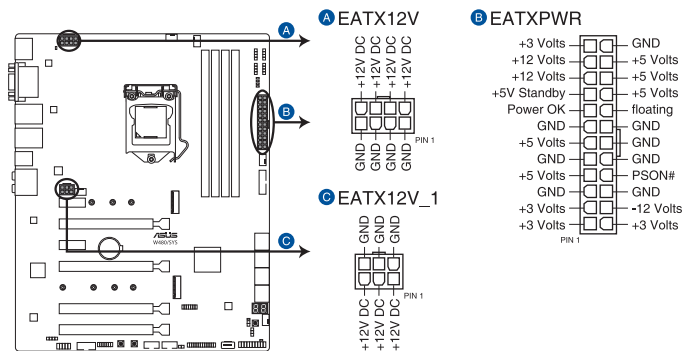
W480/SYS ATX power connectors

Ensure to connect the 8-pin power plug, or connect both the 8-pin and 6-pin power plugs.

- For a fully configured system, we recommend that you use a power supply unit (PSU) that complies with ATX 12 V Specification 2.0 (or later version) and provides a minimum power of 350 W.

- DO NOT forget to connect the 8-pin EATX12V power plug. Otherwise, the system will not boot.

- We recommend that you use a PSU with a higher power output when configuring a system with more power-consuming devices. The system may become unstable or may not boot up if the power is inadequate.

- If you want to use two or more high-end PCI Express x16 cards, use a PSU with 1000W power or above to ensure the system stability, and recommend connecting the 6-pin EATX12V_1 power plug.

11.   M.2 sockets (M.2_1; M.2_2)

These sockets allow you to install M.2 SSD modules.
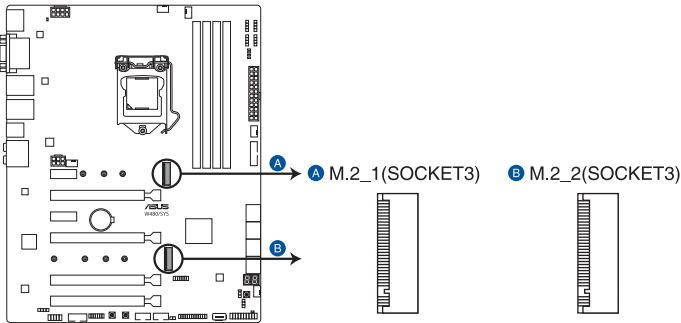
W480/SYS M.2 socket

- M.2_1 socket supports PCIe 3.0 x4 and SATA mode M Key design and type 2242 / 2260 / 2280 PCIe and SATA storage devices.

- M.2_2 socket supports PCIe 3.0 x4 M Key design and type 2242 / 2260 / 2280 / 22110 PCIe storage devices.

- M.2_1 socket shares bandwidth with SATA6G_2 port. When M.2_1 slot runs in SATA mode, the SATA6G_2 port will be disabled.

- These sockets support IRST (Intel® Rapid Storage Technology).

- These sockets support Intel® Optane memory.

The M.2 SSD module is purchased separately.

12. LPT connector (26-1 pin LPT)

The LPT (Line Printing Terminal) connector supports devices such as a printer. LPT standardizes as IEEE 1284, which is the parallel port interface on IBM PC-compatible computers.
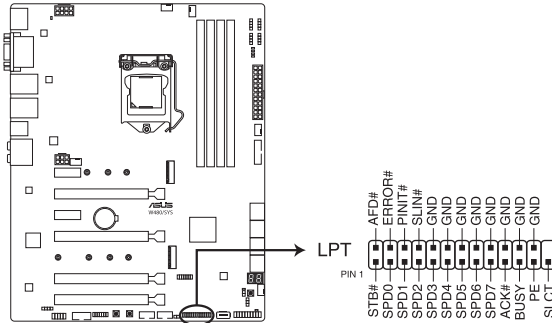
W480/SYS Parallel port connector

13. Thermal Sensor connector (2-pin T_SENSOR)

The Thermal Sensor connector allows you to connect a sensor to monitor the temperature of the devices and the critical components inside the motherboard. Connect the thermal sensor and place it on the device or the motherboard's component to detect its temperature.
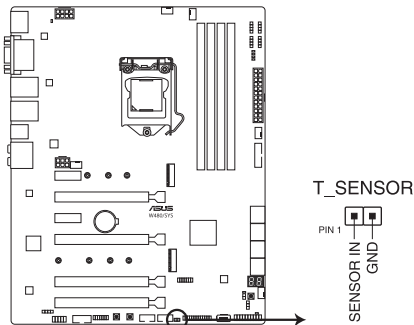
W480/SYS Thermal Sensor connector

The thermal sensor is purchased separately.

4

BIOS Setup

This chapter tells how to change the system settings through the BIOS Setup menus. Detailed descriptions of the BIOS parameters are also provided.

4.1   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 **W480S.CAP**. 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. Please refer to the latest BIOS version for settings and options.

4.2 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.

4.2.1 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** 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 a quick overview of the system status

Selects the display language of the BIOS setup program

Searches by BIOS item name, enter the item name to find the related item listing

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.

4.2.2 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

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 MyFavorites menu.

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

Search (F9)

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

Hot keys

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

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.

4.2.3   Q-Fan 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

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
CHA3 FAN

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)

Select a profile to apply to your fans

Click to apply the fan setting

Click to undo the changes

Click to go back to main menu

Select to manually configure your fans

Configuring fans manually

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

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

| PWM | DC |

Optimize All
CPU FAN
CHA1 FAN
CHA2 FAN
CHA3 FAN

Standard   Silent   Turbo   Full Speed   Manual

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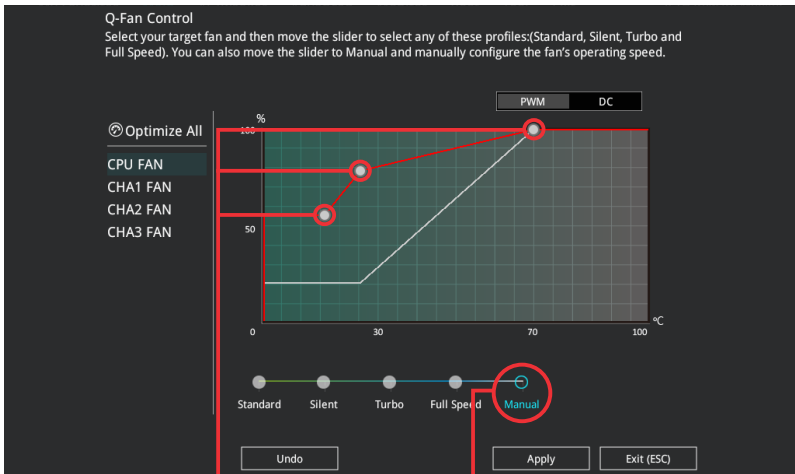
Speed points   **Select to manually configure your fans**

To configure your fans:

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

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

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

4.3 My Favorites

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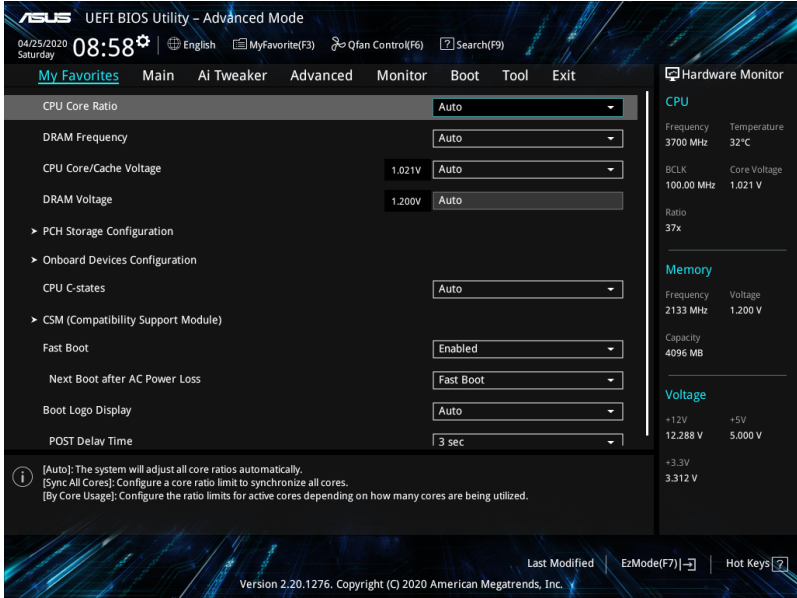
My Favorites comes with several performance, power saving, and fast boot related items by default. You can personalize this screen by adding or removing items.

Adding items to My Favorites

To add BIOS items:

1.   Press <F3> on your keyboard or click 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.

Main menu panel

Submenu panel

Selected shortcut items

Delete all favorite items

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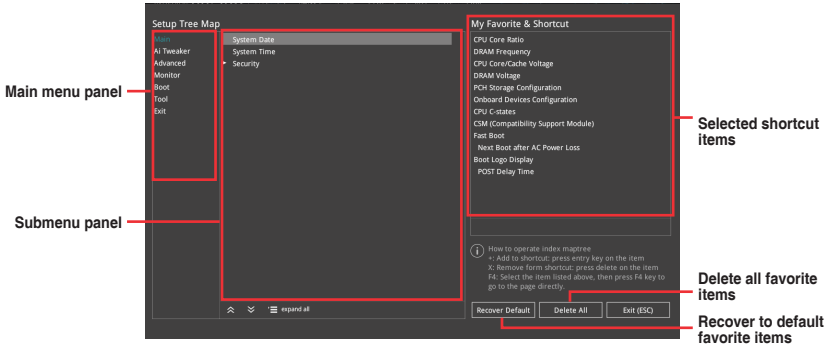
3.   Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and click + or press <Enter> on your keyboard.

> 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.

4.4   Main menu

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

Security

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

• If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See the motherboard for information on how to erase the RTC RAM via the Clear CMOS jumper.

• 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]**.

4.5 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 motherboard model, as well as the CPU and DIMM model you installed on the motherboard.

Scroll down to display other BIOS items.
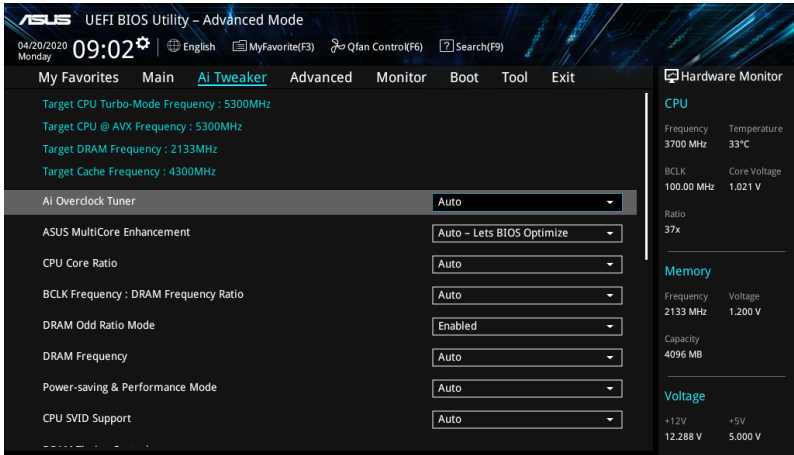
Ai Overclock Tuner

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.

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

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

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

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

XMP

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

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

BCLK Frequency

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

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

BCLK Spread Spectrum

This item allows you to enable or disable the BCLK Spread Spectrum. When set to **[Enabled]** the peak value of EMI emissions is reduced. Set to **[Disabled]** for a more accurate Base Clock.
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.

CPU Core Ratio

This item allows you to set the CPU core ratios.

Configuration options: [Auto] [Sync All Cores] [By Core Usage] [AI Optimized]

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

The following item appears only when **CPU 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.

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

Turbo Ratio Limit 0-7
Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually define a ratio for TurboRatioLimits.

Turbo Ratio Cores 0-7
Enter **[Auto]** to apply the CPU default core number setting or manually define a core number for TurboRatioLimits that must be higher than or equal to the previous core number.

Do not set the Core Ratio Limit to **[Auto]** if you wish to assign a value for the next Turbo Ratio Limit or Turbo Ratio Cores.

DRAM Odd Ratio Mode

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

Configuration options: [Enabled] [Disabled]

DRAM Frequency

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

Configuration options: [Auto] [DDR4-800MHz] - [DDR4-8533MHz]

CPU SVID Support

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

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

DRAM Timing Control

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

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

Primary Timings

DRAM CAS# Latency

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

DRAM RAS# to CAS# Delay

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

DRAM RAS# ACT Time

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

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 wach valid command cycle.

Configurations: [4] - [7]

Secondary Timings

DRAM RAS# to RAS# Delay L

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

DRAM RAS# to RAS# Delay S

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

DRAM REF Cycle Time

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

DRAM REF Cycle Time 2

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

DRAM REF Cycle Time 4

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

DRAM Refresh Interval

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

DRAM WRITE Recovery Time

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

DRAM READ to PRE Time

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

DRAM FOUR ACT WIN Time

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

DRAM WRITE to READ Delay

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

DRAM WRITE to READ Delay L

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

DRAM WRITE to READ Delay S

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

DRAM CKE Minimum Pulse Width

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

DRAM Write Latency

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

Skew Control

> ### ODT RTT WR (CHA)
> Configuration options: [Auto] [0 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK] [255 DRAM CLOCK]
>
> ### ODT RTT PARK (CHA)
> Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]
>
> ### ODT RTT NOM (CHA)
> Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]
>
> ### ODT RTT WR (CHB)
> Configuration options: [Auto] [0 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK] [255 DRAM CLOCK]
>
> ### ODT RTT PARK (CHB)
> Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]
>
> ### ODT RTT NOM (CHB)
> Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]
>
> ### ODT_READ_DURATION
> Configuration options: [Auto] [0] - [7]
>
> ### ODT_READ_DELAY
> Configuration options: [Auto] [0] - [7]
>
> ### ODT_WRITE_DURATION
> Configuration options: [Auto] [0] - [7]
>
> ### ODT_WRITE_DELAY
> Configuration options: [Auto] [0] - [7]
>
> ### Data Rising Slope
> Configuration options: [Auto] [0] - [15]
>
> ### Data Rising Slope Offset
> Configuration options: [Auto] [0] - [1]

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

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

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

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

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

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

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

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

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

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

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

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

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

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

RTL IOL Control

DRAM RTL INIT Value
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM0 Rank0)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM0 Rank1)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM1 Rank0)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM1 Rank1)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM0 Rank0)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM0 Rank1)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM1 Rank0)
Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM1 Rank1)
Configuration options: [Auto] [0] - [127]

DRAM IOL (CHA DIMM0 Rank0)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM0 Rank1)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM1 Rank0)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM1 Rank1)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM0 Rank0)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM0 Rank1)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM1 Rank0)
Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM1 Rank1)
Configuration options: [Auto] [0] - [15]

IO Latency offset

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

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

IO Latency RFR delay

CHA RFR delay
Configuration options: [Auto] [0] - [127]

CHB RFR delay
Configuration options: [Auto] [0] - [127]

Memory Training Algorithms

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

Early Command Training
Configuration options: [Enabled] [Disabled]

SenseAmp Offset Training
Configuration options: [Enabled] [Disabled]

Early ReadMPR Timing Centering 2D
Configuration options: [Enabled] [Disabled]

Read MPR Training
Configuration options: [Enabled] [Disabled]

Receive Enable Training
Configuration options: [Enabled] [Disabled]

Jedec Write Leveling
Configuration options: [Enabled] [Disabled]

LPDDR4 Write DQ DQS Retraining
Configuration options: [Enabled] [Disabled]

Early Write Time Centering 2D
Configuration options: [Enabled] [Disabled]

Early Read Time Centering 2D
Configuration options: [Auto] [Enabled] [Disabled]

Write Timing Centering 1D
Configuration options: [Enabled] [Disabled]

Write Voltage Centering 1D
Configuration options: [Enabled] [Disabled]

Read Timing Centering 1D
Configuration options: [Enabled] [Disabled]

Dimm ODT Training*
Configuration options: [Auto] [Enabled] [Disabled]

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

Write Drive Strength/Equalization 2D*
Configuration options: [Enabled] [Disabled]

Write Slew Rate Training*
Configuration options: [Enabled] [Disabled]

Read ODT Training*
Configuration options: [Enabled] [Disabled]

Read Equalization Training*
Configuration options: [Enabled] [Disabled]

Read Amplifier Training*
Configuration options: [Enabled] [Disabled]

Write Timing Centering 2D
Configuration options: [Enabled] [Disabled]

Read Timing Centering 2D
Configuration options: [Enabled] [Disabled]

Command Voltage Centering
Configuration options: [Enabled] [Disabled]

Write Voltage Centering 2D
Configuration options: [Enabled] [Disabled]

Read Voltage Centering 2D
Configuration options: [Auto] [Enabled] [Disabled]

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

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

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

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

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]

Memory Test
Configuration options: [Enabled] [Disabled]

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

Receive Enable Centering 1D
Configuration options: [Enabled] [Disabled]

Retrain Margin Check
Configuration options: [Enabled] [Disabled]

CMD Drive Strength and Tx Equalization
Configuration options: [Auto] [Enabled] [Disabled]

CMD Slew Rate Training
Configuration options: [Auto] [Enabled] [Disabled]

Write Drive Strength Up/Dn independently
Configuration options: [Enabled] [Disabled]

Third Timings

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TWRPRE

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

TRDPRE

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

tREFIX9

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

OREF_RI

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

Misc.

MRC Fast Boot

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

Delay after Train

This item allows you to enable 10 second delay after training for DRAM to reach a
certain temperature during extreme overclocking.
Configuration options: [Disabled] [Enabled]

DRAM CLK Period

This item allows you to set the DRAM clock period.
Configuration options: [Auto] [1] - [58]

Memory Scrambler

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

Channel A DIMM Control

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

Channel B DIMM Control

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

MCH Full Check

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

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]

DLLBwEn

Select values 2 to 4 for best memory overclocking.
Configuration options: [Auto] [0] - [7]

Legacy Mode

This item allows you to enable or disable to work around issues in Legacy Mode.
Configuration options: [Enabled] [Disabled]

SPD Write Disable

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

Digi+ VRM

CPU Load-line Calibration

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

CPU Current Capability

This item allows you to set the shut off current limit for external voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value.
Configuration options: [Auto] [100%] - [170%]

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

CPU VRM Switching Frequency

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

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

The following item appears only when **CPU VRM Switching Frequency** is set 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 to 500 with an interval of 50.

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

VRM Spread Spectrum
This item allows you to reduce the magnitude of peak noise from the VRM. Enable this item to reduce peak noise. Disable this settings when overclocking.
Configuration options: [Auto] [Disabled] [Enabled]

The following item appears only when **VRM Spread Spectrum** is set to **[Disabled]**.

Active Frequency Mode
Enable this item to enhance the power saving option.
Configuration option: [Disabled] [Enabled]

CPU Power Duty Control

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

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

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

CPU Power Phase Control

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

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

The following items appear only when using the onboard graphics.

CPU Graphics Load-line Calibration

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

CPU Graphics VRM Switching Frequency

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

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

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

CPU Graphics Power Phase Control

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] [Standard] [Extreme]

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

Boot Voltages

CPU Core/Cache Boot Voltage

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

CPU System Agent Boot Voltage

Configuration options: [Auto] [0.7000] - [1.7500]

CPU VCCIO Boot Voltage

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

PLL Termination Boot Voltage

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

CPU Standby Boot Voltage

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

Internal CPU Power Management

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

Maximum CPU Core Temperature

This item allows you to set the allowable temperature for CPU cores. The CPU will throttle or shutdown when it reaches this temperature to prevent damaging the cores. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [62] - [115]

Turbo Mode Parameters

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] - [255.75]

CPU Graphics Current Limit

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]

Long Duration Package Power Limit

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

Package Power Time Window

An Intel parameter of "power limit 1" and specified in seconds. The applied value indicates how long the Turbo ratio can be active when TDP is exceeded.
Configuration options: [Auto] [1] - [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. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [4095]

IA AC Load Line

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

IA DC Load Line

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

TVB Voltage Optimizations

This item controls thermal based voltage optimizations for processors that implement the Intel Thermal Velocity Boost (TVB) feature.
Configuration options: [Auto] [Enabled] [Disabled]

TVB Ratio Clipping

This service controls Core frequency reduction caused by high package temperatures for processors that implement the Intel Thermal Velocity Boost (TVB) feature. It is required to be disabled for supporting overclocking at frequencies higher than the default max turbo frequency. Uses Overclocking Mailbox command 0x18/0x19.
Configuration options: [Auto] [Enabled] [Disabled]

V-Max Stress

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

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] - [53]

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] - [53]

Max. CPU Graphics Ratio

This item allows you to configure the CPU graphics ratio. The ratio may vary depending on the system loading.

Configuration options: [Auto] [1] - [23]

CPU Core/Cache Voltage

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

The following item appears only when **CPU Core/Cache Voltage** is set 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 **CPU Core/Cache 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 Core Voltage Offset

CPU Core Voltage Offset

This item allows you to configure the input voltage for the CPU by the external voltage regulator.
Configuration options: [Auto] [-0.635] - [0.635]

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

Offset Mode Sign

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

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

Additional Turbo Mode CPU Core Voltage

This item allows you to configure the amount of voltage fed to the CPU cores when running in Turbo mode. Increase the voltage when configuring a high CPU core frequency. This voltage will be affeced by the offset value.
Configuration options: [Auto] [0.250] - [1.920]

Offset Voltage

This item allows you to configure the CPU core voltage offset value. Save changes and reset the system for the change to take effect.
Configuration options: [Auto] [0.001] - [0.999]

DRAM Voltage

Configuration options: [Auto] [1.000] - [2.000]

CPU VCCIO Voltage

Configuration options: [Auto] [0.900] - [1.800]

CPU System Agent Voltage

Configuration options: [Auto] [0.700] - [1.750]

PLL Termination Voltage

Configuration options: [Auto] [0.800] - [1.600]

CPU Graphics Voltage Mode

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

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

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

CPU Graphics Voltage Override

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

> The following items appear only when **CPU Graphics Voltage Mode** 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 Core Voltage Offset

CPU Graphics Voltage Offset

This item allows you to configure the input voltage for the CPU by the external voltage regulator.
Configuration options: [Auto] [-0.635] - [0.635]

PCH Core Voltage

Configuration options: [Auto] [0.900] - [1.800]

DRAM REF Voltage Control

DRAM CTRL REF Voltage on CHA/CHB

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

DRAM DATA REF Voltage on CHA 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]

4.6   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.
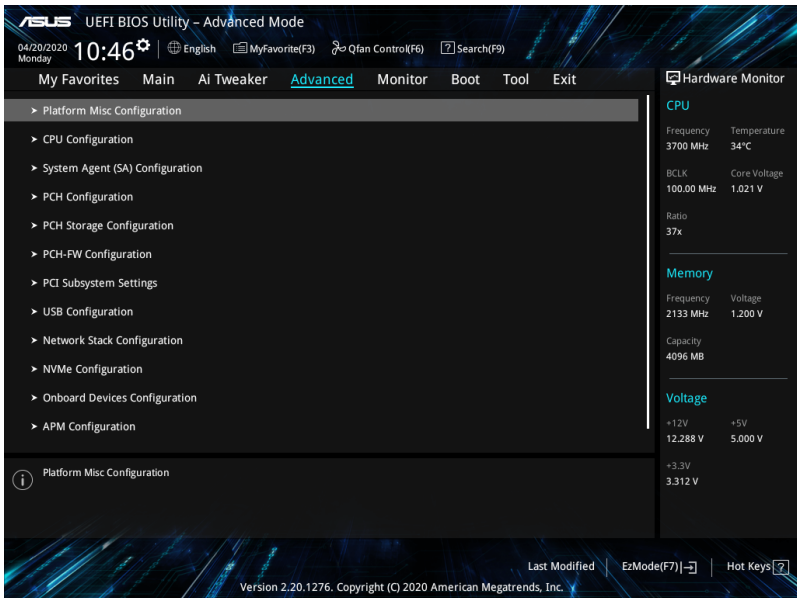
4.6.1 Platform Misc Configuration

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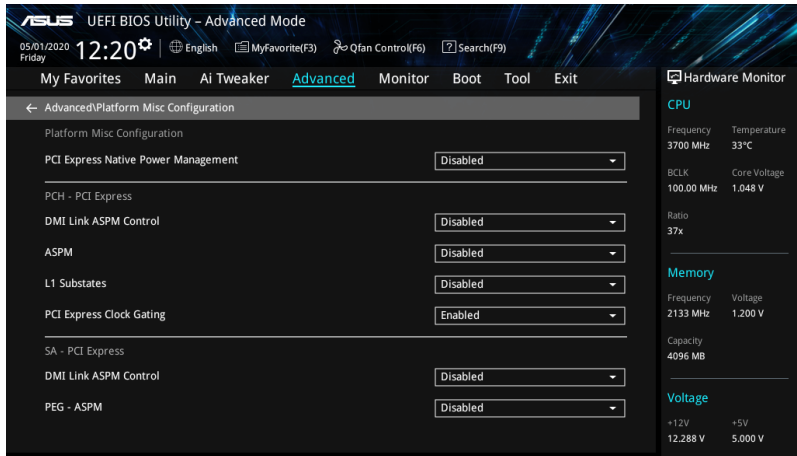
PCI Express Native Power Management

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

Configuration options: [Disabled] [Enabled]

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

Native ASPM

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

PCH - PCI Express

DMI Link ASPM Control

This item allows you to control the Active State Power Management of the DMI Link.

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

ASPM

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

L1 Substates

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

PCI Express Clock Gating

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

SA - PCI Express

DMI Link ASPM Control

This item allows you to enable or disable control of the Active State Power Management on SA side of the DMI Link.

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

PEG - ASPM

This item 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] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

4.6.2 CPU Configuration

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

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

Scroll down to display other BIOS items.

Software Guard Extensions (SGX)

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

Configuration options: [Disabled] [Software Controlled]

Tcc Offset Time Window

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

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

Hardware Prefetcher

This item allows you to enable or disable the MLC streamer prefetcher.

Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

This item 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]

Active Processor Cores

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

Configuration options: [All] [1] - [9]

Hyper-Threading

This item 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.

The following item appears only when **Hyper-Threading** is set to **[Enabled]**.

Per Core Hyper-Threading
Hyper-Threadign of Core 0-9

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

MonitorMWait

This item allows you to enable or disable MonitorMWait.

Configuration options: [Disabled] [Enabled]

CPU - Power Management Control

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

Boot performance mode

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

Intel(R) SpeedStep(tm)

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

Intel(R) Speed Shift Technology

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

Intel(R) Turbo Boost Max Technology 3.0

This item allows you to disable or enable Intel(R) Turbo Boost Max Technology 3.0 support. When disabled, it will report the maximum ratio from CPPC v2 MSR 0x771. Default is to set ITBMT enable when BIOS identify ITBMT supported from OC mailbox 0x1C.
Configuration options: [Enabled] [Disabled]

> ### *Turbo Mode*
> This item allows you to automatically set the CPU cores to run faster than the base operating frequency when it is below the operating power, current and temperature specification limit. (Requires EMTTM enabled too)
>
> Configuration options: [Enabled] [Disabled]

The following item appears only when **Intel(R) Turbo Boost Max Technology 3.0** is set to **[Enabled]**.

> ### *Runtime SMM Polling*
> Set timer for runtime polling periodic SMM ti check favored core max ratio (PerCore) if updated by reading overclocking mailbox command 0x1C.
>
> Configuration options: [Disabled] [16 mSec - 64 Sec]

CPU C-states

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

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

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

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

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

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

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

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

Configuration options: [Enabled] [Disabled]

CPU C9 Report
This item allows you to disable or enable the CPU C9 report to the operating system.

Configuration options: [Enabled] [Disabled]

CPU C10 Report
This item allows you to disable or enable the CPU C10 report to the operating system.

Configuration options: [Enabled] [Disabled]

Package C State Limit
This item allows you to set the C-state limit for the CPU package.

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

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

Configuration options: [Disabled] [Enabled]

Dual Tau Boost
This item allows you to enable Dual Tau Boost feature. This is only applicable for CMLS 35W/65W/125W sku.

Configuration options: [Disabled] [Enabled]

4.6.3   System Agent (SA) Configuration
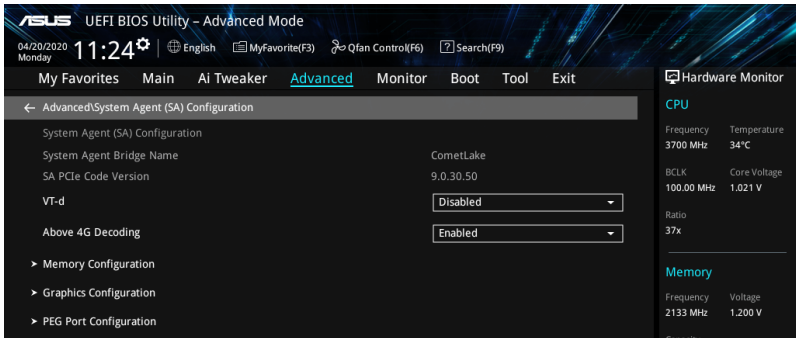
VT-d

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

Configuration options: [Enabled] [Disabled]

Above 4G Decoding

This item enables or disables 64-bit capable devices to be decoded in above 4G address space if your system supports 64-bit PCI Decoding.

Configuration options: [Enabled] [Disabled]

Memory Configuration

This item allows you to set memory configuration parameters.

Memory Remap

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

Graphics Configuration

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

Primary Display

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

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]

RC6(Render Standby)

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

PEG Port Configuration

This item allows you to configure the PEG Port settings.

> The items in this submenu may vary according to your motherboard.

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]

4.6.4   PCH Configuration
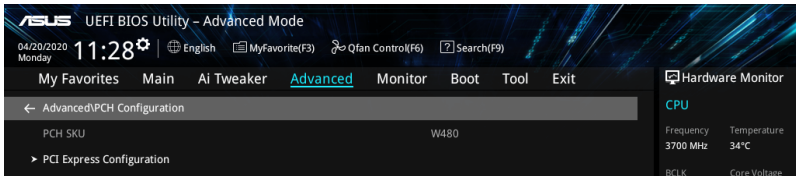
PCI Express Configuration

This item allows you to configure the PCI Express slots.

PCIe Speed

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

4.6.5 PCH Storage Configuration

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

Scroll down to display the other BIOS items.
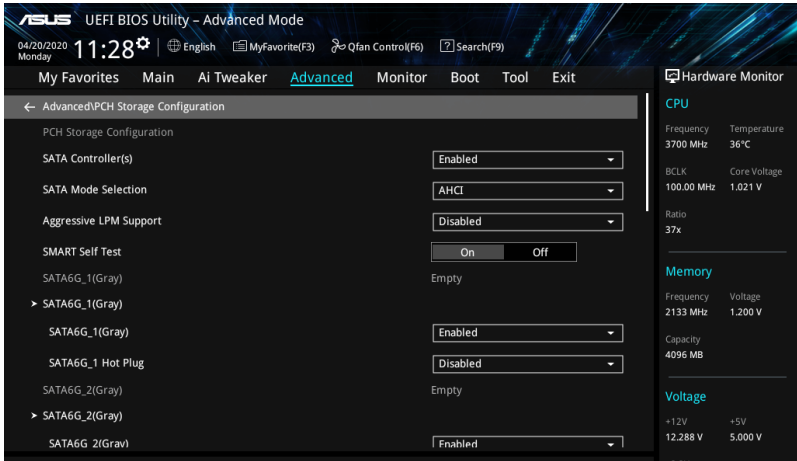
SATA Controller(s)

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

Configuration options: [Disabled] [Enabled]

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

SATA Mode Selection

This item allows you to set the SATA configuration.

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

Aggressive LPM support

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

Configuration options: [Disabled] [Enabled]

SMART Self Test

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

Configuration options: [On] [Off]

SATA6G_1(Gray) - SATA6G_6(Gray)

The items in this submenu may vary according to your motherboard.

SATA6G_1(Gray) - SATA6G_6(Gray)

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

SATA6G_1 - SATA6G_6 Hot Plug

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

4.6.6   PCH-FW Configuration

This item allows you to configure the firmware TPM.
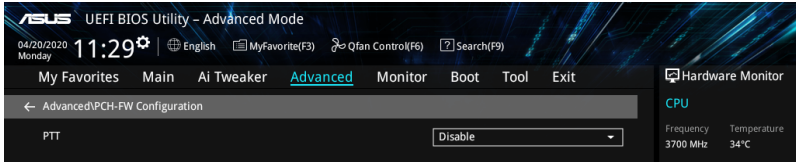
PTT

This item allows you to enable or disable PTT in SkuMgr.

Configuration options: [Disabled] [Enabled]

4.6.7 PCI Subsystem Settings
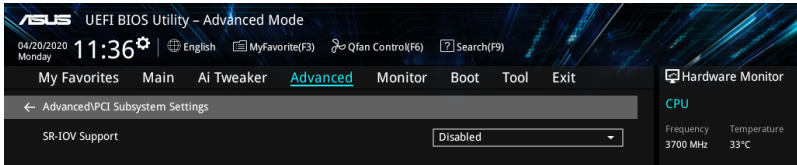
SR-IOV Support

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

Configuration options: [Disabled] [Enabled]

4.6.8 USB Configuration

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

The items in this menu may vary according to your motherboard.
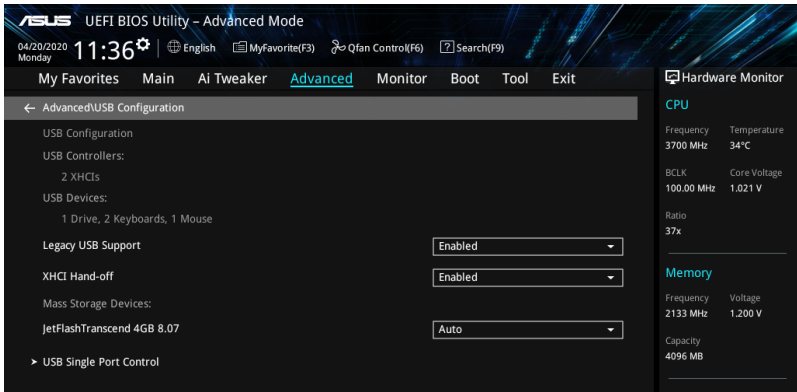
The **Mass Storage Devices** item shows the auto-detected values. If no USB device is detected, the item shows **None**.

Legacy USB Support

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

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

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

XHCI Hand-off

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

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

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

USB Single Port Control

This item 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.

4.6.9   Network Stack Configuration

> The items in this menu may vary according to your motherboard.
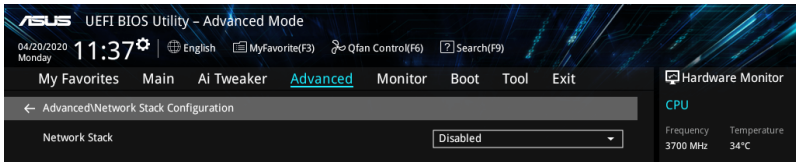
Network stack

This item allows you to disable or enable the UEFI network stack.

Configuration options: [Disable] [Enable]

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

Ipv4/Ipv6 PXE Support

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

4.6.10   NVMe Configuration

This menu displays the NVMe controller and Drive information of the connected devices.
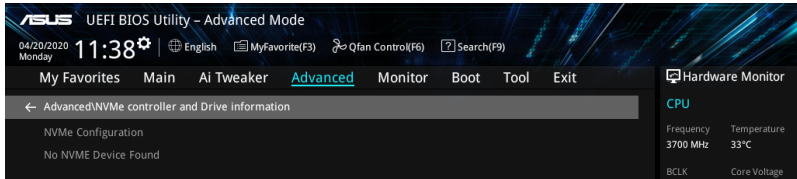
4.6.11   Onboard Devices Configuration

The items in this menu may vary according to your motherboard.

Scroll down to view the other BIOS items.
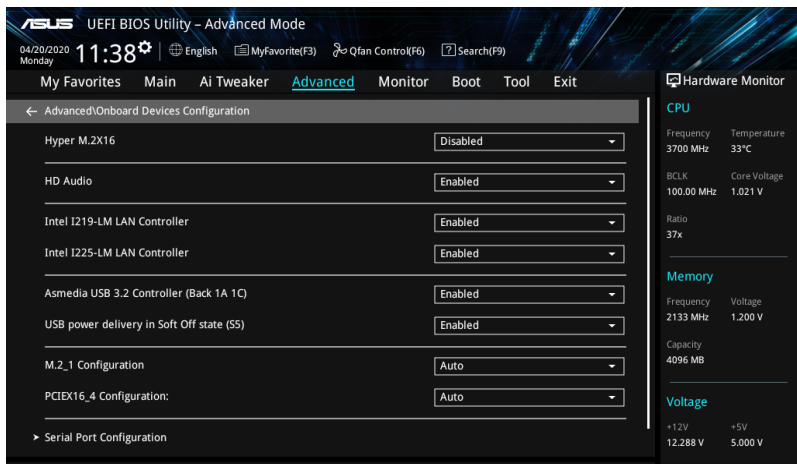
Hyper M.2X16

This item allows you to set different configurations for the Hyper M.2X16 card. The configurations may differ between motherboards. Please refer to your motherboard's user manual for more information on the configurations.

HD Audio

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

Configuration options: [Disabled] [Enabled]

Intel I219-LM LAN Controller

This item allows you to enable or disable the onboard NIC.

Configuration options: [Disabled] [Enabled]

Intel I225-LM LAN Controller

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

Configuration options: [Disabled] [Enabled]

Asmedia USB 3.2 Controller (Back 1A 1C)

Configuration options: [Disabled] [Enabled]

USB power delivery in Soft Off State (S5)

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

Configuration options: [Disabled] [Enabled]

M.2_1 Configuration

[Auto]	Auto-detects the M.2 device mode. If a SATA device is detected, SATA6G_2 will be disabled.
[SATA mode]	Only supports M.2 SATA devices. Please note that SATA6G_2 port cannot be used in this mode.
[PCIE mode]	Only supports M.2 PCIE devices.

PCIEX16_4 Configuration

[Auto]	Enables SATA port 5 and port 6. PCIEX16_4 width is x2.
[x4 mode]	Only supports PCIEX16_4. Please note that from SATA port 5 to port 8 cannot be used in this mode.
[Disabled]	Supports all SATA device. Please note that PCIEX16_4 cannot be used in this mode.

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

This item allows you to enable or disable the Serial port.
Configuration options: [On] [Off]

The following item appear only when **Serial Port** is set to **[On]**.

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]

4.6.12   APM Configuration
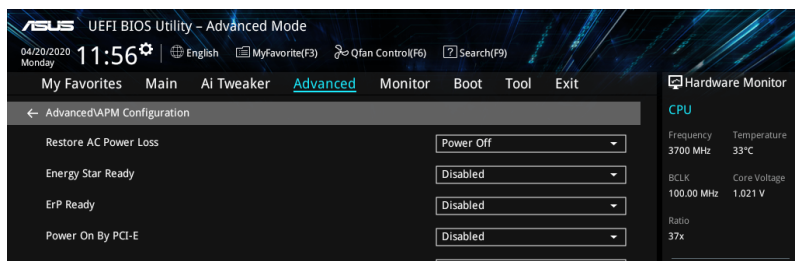
Restore AC Power Loss

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

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

Energy Star Ready

Configuration options: [Disabled] [Enabled]

ErP Ready

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

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

Power On By PCI-E

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

Configuration options: [Disabled] [Enabled]

Power On By RTC

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

Configuration options: [Disabled] [Enabled]

4.6.13　HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.
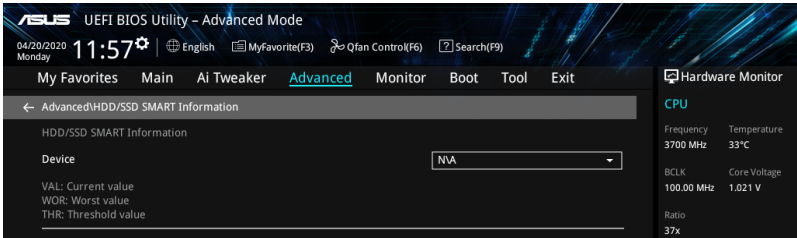
NVM Express devices do not support SMART information.

4.7 Monitor menu

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

The items in this menu may vary according to your motherboard.

Scroll down to display the other BIOS items.
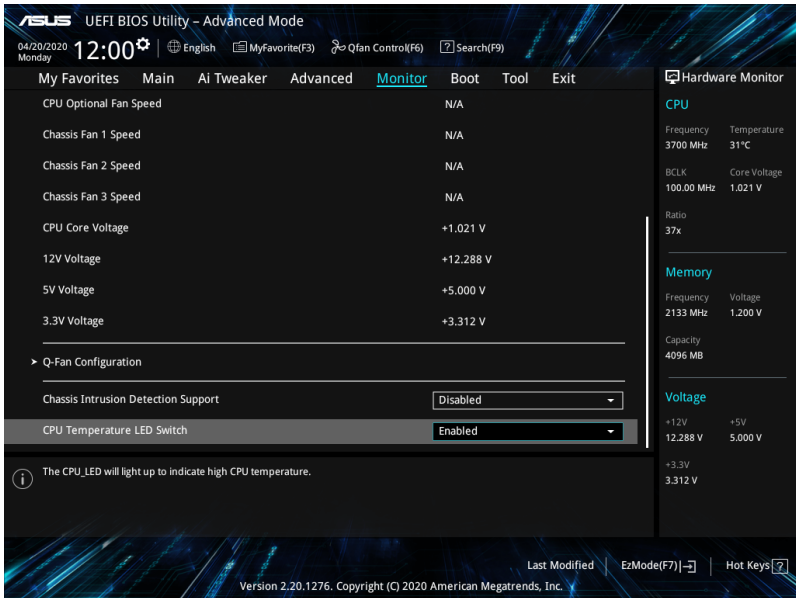
CPU Temperature, CPU Package Temperature, Motherboard Temperature, Chipset Temperature, T_Sensor Temperature [xxx°C/xxx°F]

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

CPU Fan Speed, CPU Optional Fan, Chassis Fan 1-3 Speed [xxxx RPM]

The onboard hardware monitor automatically detects and displays the CPU fan, CPU optional fan, and chassis 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.xxxx V]

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

Q-Fan Configuration

AI Cooling

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

Configuration options: [Enabled] [Disabled]

Q-Fan Tuning

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

CPU Q-Fan Control

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

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

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

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

[Disabled]   Disables the Q-Fan Control.

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

CPU Fan Step Up

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

CPU Fan Step Down

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

CPU Fan Speed Lower Limit

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

CPU Fan Profile

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

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

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

[Turbo]   Set to achieve maximum CPU fan speed.

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

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

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

CPU Middle Temperature
Use the <+> or <-> keys to adjust the middle limit of the CPU temperature.

CPU 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 temperature source is lower than the limit.

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

Chassis Fan(s) Configuration

Chassis Fan 1-3 Q-Fan Control

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

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

Chassis Fan 1-3 Q-Fan Source

The assigned fan will be controlled according to the selected temperature source. Configuration options: [CPU] [MotherBoard] [PCH] [Chipset] [T_Sensor] [Multiple Sources]

Chassis Fan 1-3 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 1-3 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 1-3 Fan Speed Low Limit

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

Chassis Fan 1-3 Profile

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

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

> The following items appear only when **Chassis Fan 1-3 Profile** is set to **[Manual].**

Chassis Fan 1-3 Upper Temperature
Use the <+> or <-> keys to adjust the upper limit of the Chassis fan 1-3 temperature. The Chassis fan 1-3 will operate at the maximum duty cycle when the temperature source is higher than the limit.

Chassis Fan 1-3 Max. Duty Cycle (%)
Use the <+> or <-> keys to adjust the maximum Chassis fan 1-3 duty cycle. When the temperature source reaches the upper limit, the Chassis fan 1-3 will operate at the maximum duty cycle.

Chassis Fan 1-3 Middle Temperature
Use the <+> or <-> keys to adjust the middle limit of the Chassis fan 1-3 temperature.

Chassis Fan 1-3 Middle. Duty Cycle (%)
Use the <+> or <-> keys to adjust the Chassis fan 1-3 middle duty cycle.

Chassis Fan 1-3 Lower Temperature
Use the <+> or <-> keys to adjust the lower limit of the Chassis fan 1-3 temperature. The Chassis fan 1-3 will operate at the minimum duty cycle when the temperature source is lower than the limit.

Chassis Fan 1-3 Min. Duty Cycle (%)
Use the <+> or <-> keys to adjust the minimum Chassis fan 1-3 duty cycle. When the temperature source is under the limit, the Chassis fan 1-3 will operate at the minimum 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

This item allows you to turn the CPU Temperature LED on or off.

Configuration options: [Enabled] [Disabled]

4.8 Boot menu

The Boot menu items allow you to change the system boot options.
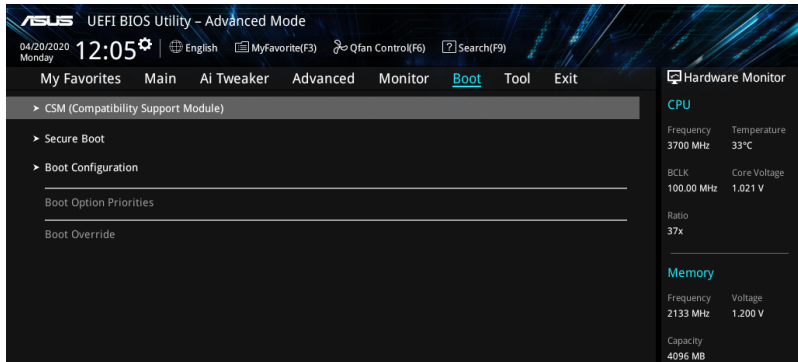
CSM (Compatibility Support Module)

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

Launch CSM

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

[Disabled]   Disable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.

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

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

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

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

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

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

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

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

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

Secure Boot

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

OS Type

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

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

Key Management

Clear Secure Boot keys

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

Save all Secure Boot variables

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

PK Management

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

> *Save To File*
> This item allows you to save the PK to a USB storage device.

> *Set New key*
> This item allows you to load the downloaded PK from a USB storage device.

> *Delete key*
> This item allows you to delete the PK from your system. Once the PK is deleted, all the system's Secure Boot keys will not be active.

> Configuration options: [Yes] [No]

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

KEK Management

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

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

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

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

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

Delete key
This item allows you to delete the KEK from your system.

Configuration options: [Yes] [No]

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

DB Management

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

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

Set New key

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

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

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

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

DBX Management

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

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

Set New Key

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

Append Key

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

Delete Key

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

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

Boot Option Priorities

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

- To access Windows® OS in Safe Mode, press <F8 > after POST (Windows® 8 not supported).

- To select the boot device during system startup, press <F8> when ASUS Logo appears.

Boot Override

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

4.9   Tool menu

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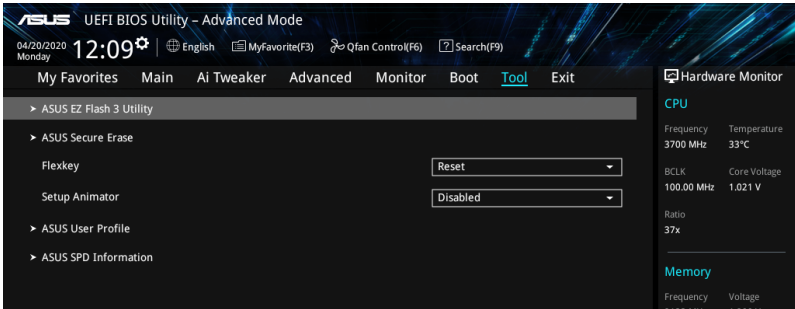
Flexkey

[Reset]   Reboots the system.

[DirectKey]   Boot directly into the BIOS.

Setup Animator

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

4.9.1   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**.

4.9.2   Secure Erase

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

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

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

Displays the available SSDs

SSD Secure Erase

Port #	SSD Name	Status	Total Capacity
P4	ADATA S596 Turbo	Ready	64.0GB

SSD speed performance may degrade over time due to accumulated files and frequent data-writing. Secure Erase completely cleans your SSD and restores it to its factory settings.
WARNING: Ensure that you run Secure Erase on a compatible SSD. Running Secure Erase on an incompatible SSD will render the SSD totally unusable.
NOTE: For the list of Secure Erase-compatible SSDs, visit the ASUS Support site at www.asus.com/support

> **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.

4.9.3 ASUS User Profile

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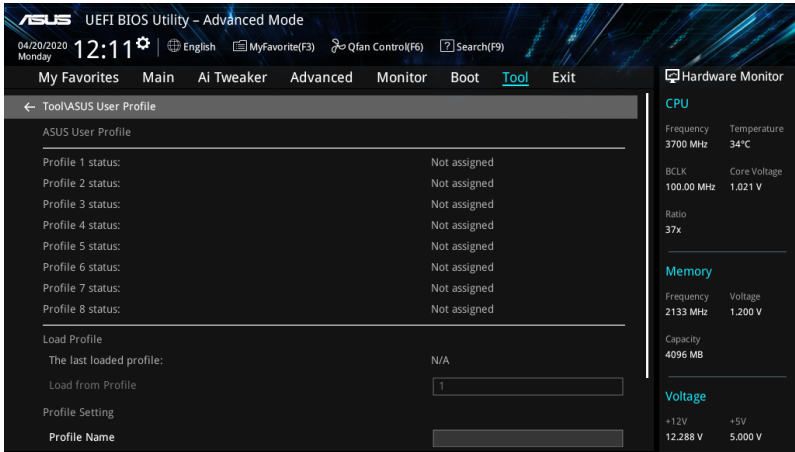
Load from Profile

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

- DO NOT shut down or reset the system while updating the BIOS to prevent the system boot failure!

- We recommend that you update the BIOS file only coming from the same memory/ CPU configuration and BIOS version.

Profile Name

This item allows you to key in a profile name.

Save to Profile

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

Load/Save Profile from/to USB Drive

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

4.9.4   ASUS SPD Information

This item allows you to view the DRAM SPD information.
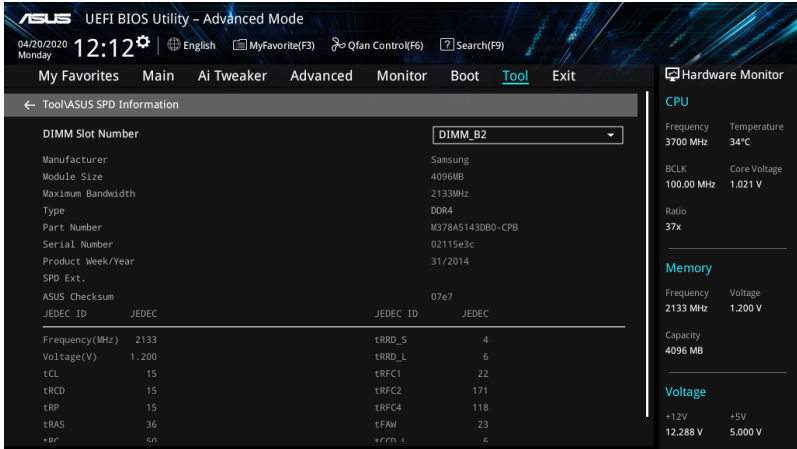
4.10   Exit menu

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.
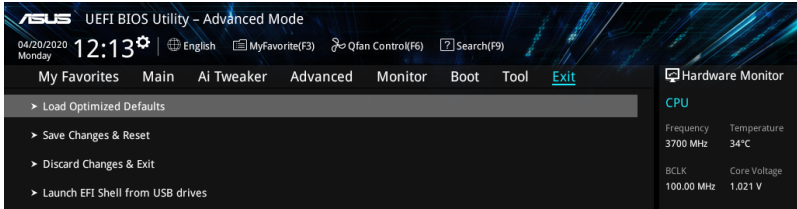
Load Optimized Defaults

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 (Shell.efi) from one of the available filesystem devices.

4.11   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.

4.11.1   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.

4.11.2   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 the USB port.

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

3.	Press <Tab> 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 <Tab> 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.
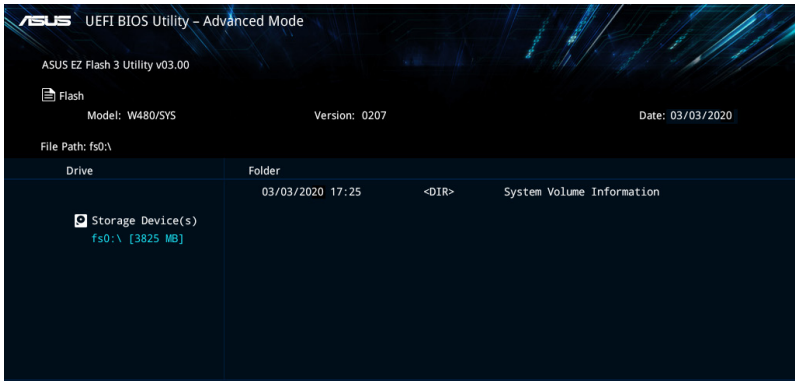
4.11.3   ASUS CrashFree BIOS 3

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!

RAID Configuration

5

This chapter provides instructions for setting up, creating, and configuring RAID sets using the available utilities.

5.1 RAID configurations

The motherboard supports Intel® Rapid Storage Technology enterprise Option ROM Utility with RAID 0, RAID 1, RAID 10, and RAID 5 support.

If you want to install a Windows® operating system to a hard disk drive included in a RAID set, you have to create a RAID driver disk and load the RAID driver during OS installation. Refer to section **Creating a RAID driver disk** for details.

5.1.1 RAID definitions

RAID 0 (Data striping) optimizes two identical hard disk drives to read and write data in parallel, interleaved stacks. Two hard disks perform the same work as a single drive but at a sustained data transfer rate, double that of a single disk alone, thus improving data access and storage. Use of two new identical hard disk drives is required for this setup.

RAID 1 (Data mirroring) copies and maintains an identical image of data from one drive to a second drive. If one drive fails, the disk array management software directs all applications to the surviving drive as it contains a complete copy of the data in the other drive. This RAID configuration provides data protection and increases fault tolerance to the entire system. Use two new drives or use an existing drive and a new drive for this setup. The new drive must be of the same size or larger than the existing drive.

RAID 5 stripes both data and parity information across three or more hard disk drives. Among the advantages of RAID 5 configuration include better HDD performance, fault tolerance, and higher storage capacity. The RAID 5 configuration is best suited for transaction processing, relational database applications, enterprise resource planning, and other business systems. Use a minimum of three identical hard disk drives for this setup.

RAID 10 is data striping and data mirroring combined without parity (redundancy data) having to be calculated and written. With the RAID 10 configuration you get all the benefits of both RAID 0 and RAID 1 configurations. Use four new hard disk drives or use an existing drive and three new drives for this setup.

5.1.2   Installing storage devices

The motherboard supports Serial ATA hard disk drives and PCIE SSD storage devices. For optimal performance, install identical drives of the same model and capacity when creating a disk array.

Refer to Chapter 2 for details on installing storage devices to your motherboard.

5.1.3   Intel® Rapid Storage Technology in UEFI BIOS

To enter the Intel® Rapid Storage Technology in UEFI BIOS:

1.   Enter the BIOS Setup during POST.

2.   Go to the **Advanced** menu **> PCH Storage Configuration**, then press <Enter>.

3.   Set the **SATA Mode Selection** item to **[Intel RST Premium With Intel Optane System Acceleration(RAID)]**.

4.   Go to the **Boot** menu > **CSM (Compatibility Support Module)** > **Launch CSM**, then set the item to **[Disabled]**.

5.   Save your changes and exit the BIOS Setup, then enter the BIOS Setup again.

6.   Go to the **Advanced** menu **> Intel(R) Rapid Storage Technology** then press <Enter> to display the Intel® Rapid Storage Technology menu.

Refer to Chapter 4 for details on entering and navigating through the BIOS Setup.

Due to chipset limitation, when SATA ports are set to RAID mode, all SATA ports run at RAID mode together.
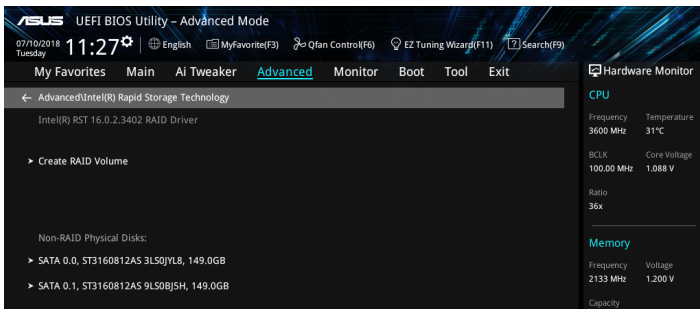
Creating a RAID set

To create a RAID set:

1. From the Intel® Rapid Storage Technology menu, select **Create RAID Volume** and press <Enter>. The following screen appears:
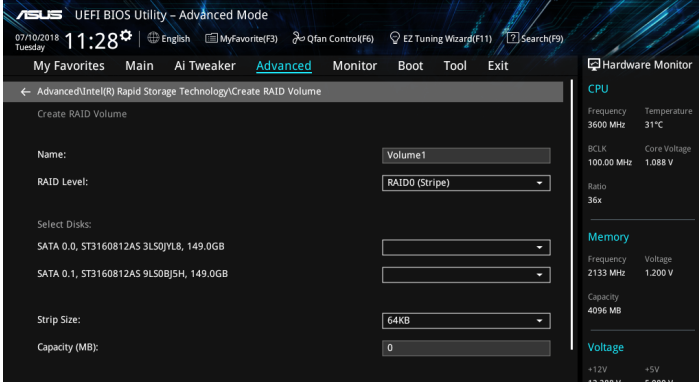
2. When the **Name** item is selected, enter a name for the RAID set and press <Enter>.

3. When the **RAID Level** item is selected, press <Enter> to select the RAID level to create, and then press <Enter>.

4. Under **Select Disks**, press <Enter> and select **X** for the disks you want to include in the RAID set.
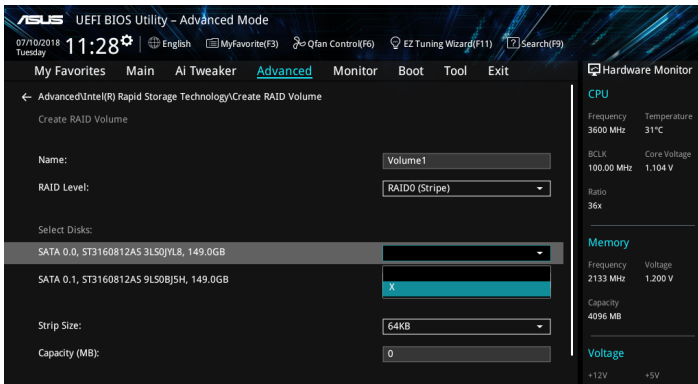
5. When the **Strip Size** item is selected, press <Enter> to select strip size for the RAID array (for RAID 0, 10 and 5 only), and then press <Enter>. The available strip size values range from 4 KB to 128 KB. The following are typical values:

- RAID 0: 128 KB

- RAID 10: 64 KB

- RAID 5: 64 KB

We recommend a lower strip size for server systems, and a higher strip size for multimedia computer systems used mainly for audio and video editing.
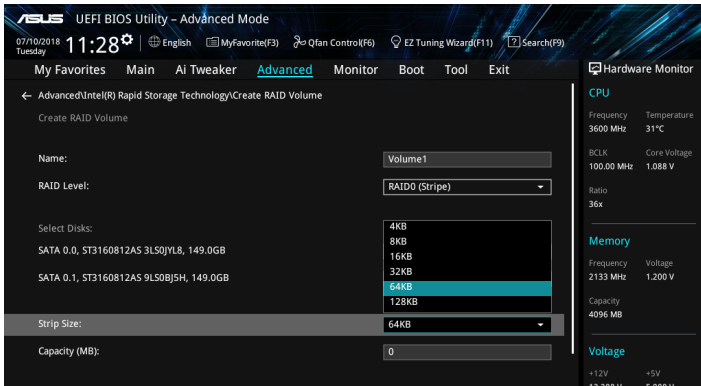
6. When the **Capacity (MB)** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

7. When the **Create Volume** item is selected, press <Enter> to create the RAID volume and return to the Intel® Rapid Storage Technology menu.
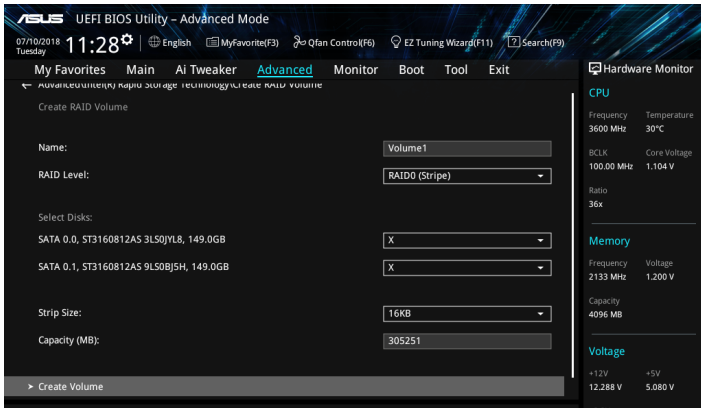
Deleting a RAID set

> Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

To delete a RAID set:

1. From the Intel® Rapid Storage Technology menu, select the RAID volume you want to delete and press <Enter>. The following screen appears:
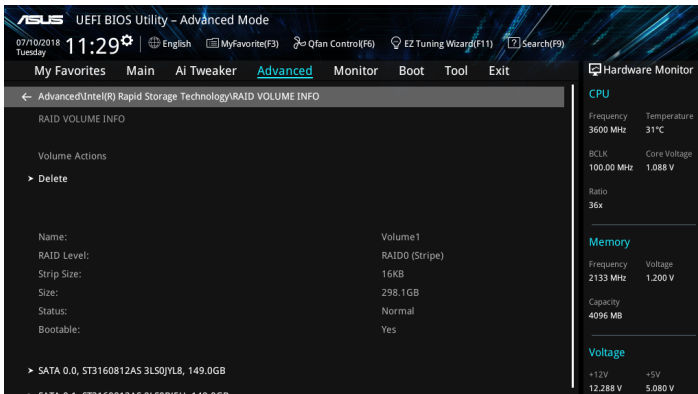
2. When the **Delete** item is selected, press <Enter>, then select **Yes** to delete the RAID volume and return to the Intel® Rapid Storage Technology menu, or select **No** to cancel.
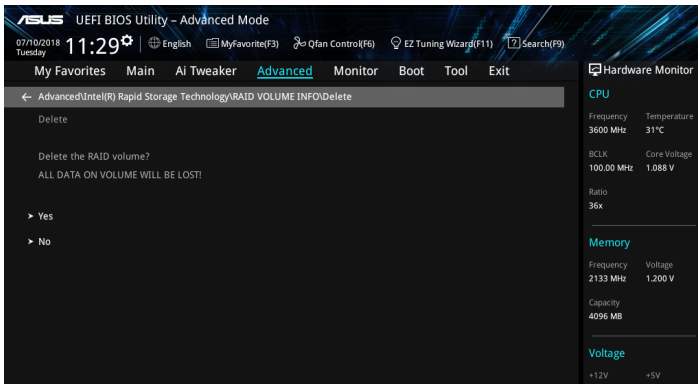
5.1.4   Intel® Rapid Storage Technology Option ROM utility

To enter the Intel® Rapid Storage Technology Option ROM utility:

1.   Enter the BIOS Setup during POST.

2.   Go to the **Boot** menu > **CSM (Compatibility Support Module)** > **Launch CSM**, then set the item to **[Enabled]**.

3.   Save your changes and exit the BIOS Setup, then during POST, press <Ctrl> + <I> to display the utility main menu.

```
         Intel(R) Rapid Storage Technology - Option - v10.5.1.1070
         Copyright(C) 2003-14 Intel Corporation. All Rights Reserved.

============================[ MAIN MENU ]============================

      1.  Create RAID Volume          4.  Recovery Volume Options
      2.  Delete RAID Volume          5.  Acceleration Options
      3.  Reset Disks to Non-RAID     6.  Exit


====================[ DISK/VOLUME INFORMATION ]=====================
   RAID Volumes:
   None defined.

   Physical Devices:
   Port   Device Model    Serial #       Size       Type/Status(Vol ID)
   0      ST3160812AS     9LS0HJA4       149.0GB    Non-RAID Disk
   1      ST3160812AS     9LS0F4HL       149.0GB    Non-RAID Disk
   2      ST3160812AS     3LS0JYL8       149.0GB    Non-RAID Disk
   3      ST3160812AS     9LS0BJ5H       149.0GB    Non-RAID Disk



 [↑↓]-Select              [ESC]-Exit         [ENTER]-Select Menu
```

The navigation keys at the bottom of the screen allow you to move through the menus and select the menu options.

The RAID BIOS setup screens shown in this section are for reference only and may not exactly match the items on your screen.

The utility supports maximum four hard disk drives for RAID configuration.

Creating a RAID set

To create a RAID set:

1. From the utility main menu, select **1. Create RAID Volume** and press <Enter>. The following screen appears:

```
         Intel(R) Rapid Storage Technology - Option - v10.5.1.1070
         Copyright(C) 2003-14 Intel Corporation. All Rights Reserved.

                         ┌═════════ [CREATE VOLUME MENU] ═════════┐
                                    Name:    Volume 0
                              RAID Level:
                                   Disks:
                              Strip Size:
                                Capacity:
                                    Sync:
                                       Create volume


                         ┌════════════════ [HELP] ════════════════┐


           Enter a unique volume name that has no special characters
           and is 16 characters or less.



 [↑↓]-Select                  [ESC]-Exit            [ENTER]-Select Menu
```
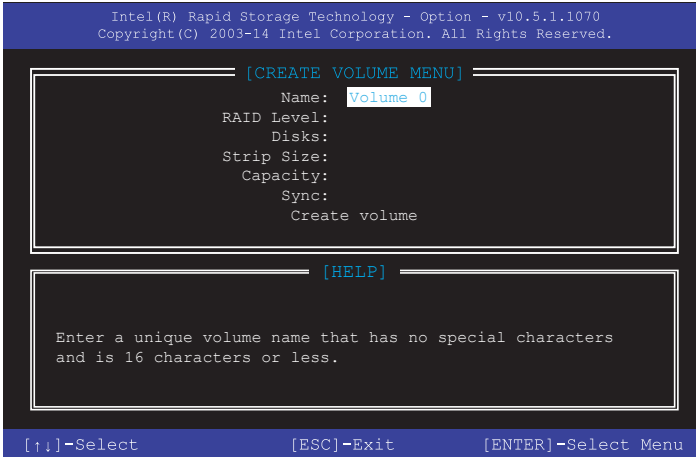
2. Enter a name for the RAID set and press <Enter>.

3. When the RAID Level item is selected, press the up/down arrow key to select a RAID level to create, and then press <Enter>.

4. When the Disks item is selected, press <Enter> to select the hard disk drives you want to include in the RAID set. The SELECT DISKS screen appears:

```
                         ┌═══════════ [SELECT DISKS] ═══════════┐

           Port    Device Model    Serial #      Size      Status
           0       ST3160812AS     9LS0HJA4      149.0GB   Non-RAID Disk
           1       ST3160812AS     9LS0F4HL      149.0GB   Non-RAID Disk
           2       ST3160812AS     3LS0JYL8      149.0GB   Non-RAID Disk
           3       ST3160812AS     9LS0BJ5H      149.0GB   Non-RAID Disk


                Select 2 to 6 to use in creating the volume.


           └ [↑↓]-Prev/Next  [SPACE]-SelectDisk  [ENTER]-Done ═══════┘
```
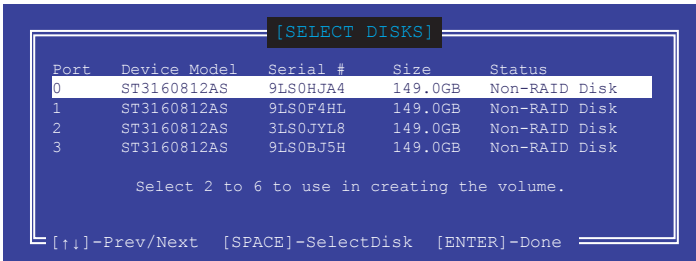
5. Use the up/down arrow key to select a drive, and then press <Space> to select. A small triangle marks the selected drive. Press <Enter> after completing your selection.

6. Use the up/down arrow key to select the strip size for the RAID array (for RAID 0, 10 and 5 only), and then press <Enter>. The available strip size values range from 4 KB to 128 KB. The following are typical values:

   - RAID 0: 128 KB

   - RAID 10: 64 KB

   - RAID 5: 64 KB

   We recommend a lower strip size for server systems, and a higher strip size for multimedia computer systems used mainly for audio and video editing.

7. When the **Capacity** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

8. When the **Create Volume** item is selected, press <Enter>. The following warning message appears:

```
WARNING:  ALL DATA ON SELECTED DISKS WILL BE LOST.
Are you sure you want to create this volume? (Y/N)
```

9. Press <Y> to create the RAID volume and return to the main menu, or <N> to go back to the CREATE VOLUME menu.

Deleting a RAID set

⚠ Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

To delete a RAID set:

1. From the utility main menu, select **2. Delete RAID Volume** and press <Enter>. The following screen appears:

```
                          ═══[DELETE VOLUME MENU]═══
    Name         Level        Drives   Capacity     Status      Bootable
    Volume0      RAID0 (Stripe)  2       298.0GB     Normal        Yes



                              ═══[HELP]═══

          Deleting a volume will reset the disks to non-RAID.

                WARNING:  ALL DISK DATA WILL BE DELETED.
                (This does not apply to Recovery volumes)



         [↑↓]-Select   [ESC]-Previous Menu   [DEL]-Delete Volume
```
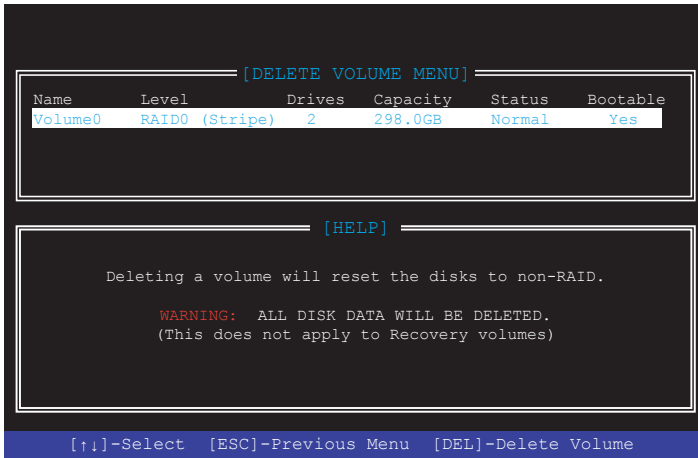
2. Use the up/down arrow key to select the RAID set you want to delete, and then press <Delete>. The following warning message appears:

```
                ═══[DELETE VOLUME VERIFICATION]═══
             ALL DATA IN THE VOLUME WILL BE LOST!
          (This does not apply to Recovery volumes)

        Are you sure you want to delete "Volume0"? (Y/N):
```
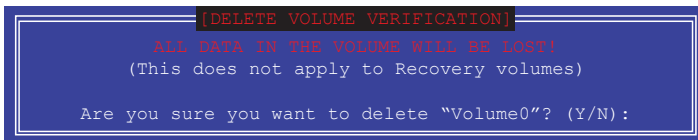
3. Press <Y> to delete the RAID set and return to the utility main menu, or press <N> to return to the DELETE VOLUME menu.

Exiting the Intel® Rapid Storage Technology Option ROM utility

To exit the utility:

1.   From the utility main menu, select **6. Exit**, then press <Enter>. The following warning
     message appears:

```
                              [CONFIRM EXIT]
              Are you sure you want to exit? (Y/N):
```
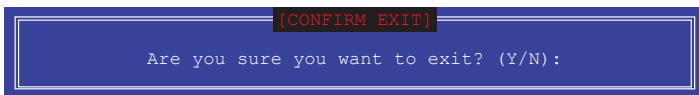
2.   Press <Y> to exit or press <N> to return to the utility main menu.

5.2   Creating a RAID driver disk

5.2.1   Creating a RAID driver disk in Windows®

To install the RAID driver for Windows® OS:

1.   During the OS installation, click **Load Driver** to allow you to select the installation
     media containing the RAID driver.

2.   Insert the USB flash drive with RAID driver into the USB port or the support DVD into
     the optical drive, and then click **Browse**.

3.   Click the name of the device you've inserted, go to **Drivers** > **RAID**, and then select
     the RAID driver for the corresponding OS version. Click **OK**.

4.   Follow the succeeding screen instructions to complete the installation.

Before loading the RAID driver from a USB flash drive, you have to use another computer
to copy the RAID driver from the support DVD to the USB flash drive.

To set up a Windows® UEFI operating system under RAID mode, ensure to load the UEFI
driver for your optical drive.

Appendix

A

W480/SYS block diagram

Appendix
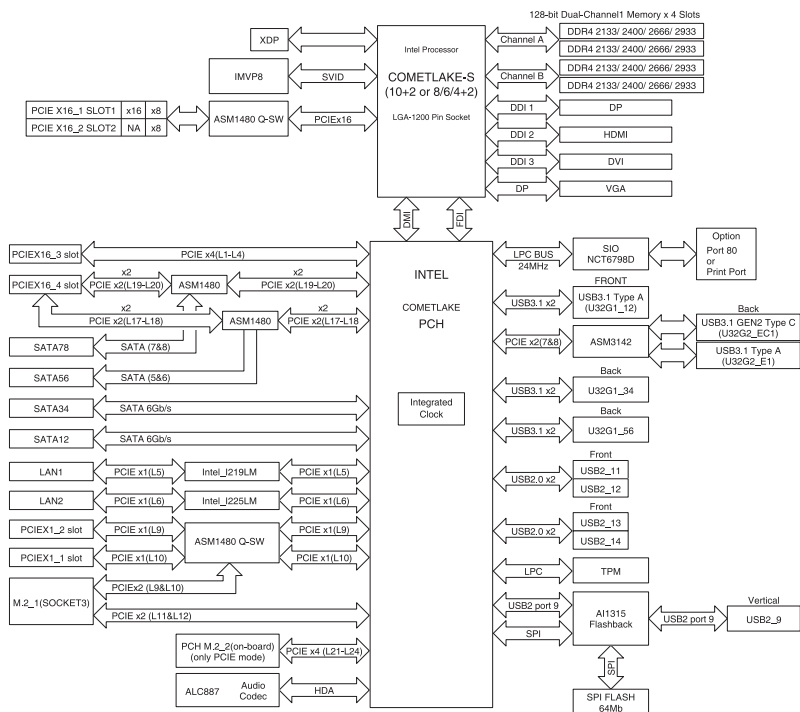
Q-Code table

Code	Description
00	Not used
02	microcode
03	CACHE_ENABLED
04	PCH initialization
06	CPU_EARLY_INIT
10	PEI Core is started
11 – 14	Pre-memory CPU initialization is started
15 – 18	Pre-memory System Agent initialization is started
19 – 1C	Pre-memory PCH initialization is started
2B – 2F	Memory initialization
30	Reserved for ASL (see ASL Status Codes section below)
31	Memory Installed
32 – 36	CPU post-memory initialization
37 – 3A	Post-Memory System Agent initialization is started
3B – 3E	Post-Memory PCH initialization is started
4F	DXE IPL is started
50 – 53	Memory initialization error. Invalid memory type or incompatible memory speed
4F	DXE IPL is started
54	Unspecified memory initialization error
55	Memory not installed
56	Invalid CPU type or Speed
57	CPU mismatch
58	CPU self test failed or possible CPU cache error
59	CPU micro-code is not found or micro-code update is failed
5A	Internal CPU error
5B	Reset PPI is not available
5C – 5F	Reserved for future AMI error codes
E0	S3 Resume is stared (S3 Resume PPI is called by the DXE IPL)
E1	S3 Boot Script execution
E2	Video repost
E3	OS S3 wake vector call
E4 – E7	Reserved for future AMI progress codes
E8	S3 Resume Failed
E9	S3 Resume PPI not Found
EA	S3 Resume Boot Script Error
EB	S3 OS Wake Error
EC – EF	Reserved for future AMI error codes
F0	Recovery condition triggered by firmware (Auto recovery)
F1	Recovery condition triggered by user (Forced recovery)
F2	Recovery process started
F3	Recovery firmware image is found

Code	Description
F4	Recovery firmware image is loaded
F5 – F7	Reserved for future AMI progress codes
F8	Recovery PPI is not available
F9	Recovery capsule is not found
FB – FF	Reserved for future AMI error codes
60	DXE Core is started
61	NVRAM initialization
62	Installation of the PCH Runtime Services
63 – 67	CPU DXE initialization is started
68	PCI host bridge initialization
69	System Agent DXE initialization is started
6A	System Agent DXE SMM initialization is started
6B – 6F	System Agent DXE initialization (System Agent module specific)
70	PCH DXE initialization is started
71	PCH DXE SMM initialization is started
72	PCH devices initialization
73 – 77	PCH DXE Initialization (PCH module specific)
78	ACPI module initialization
79	CSM initialization
7A – 7F	Reserved for future AMI DXE codes
90	Boot Device Selection (BDS) phase is started
91	Driver connecting is started
92	PCI Bus initialization is started
93	PCI Bus Hot Plug Controller Initialization
94	PCI Bus Enumeration
95	PCI Bus Request Resources
96	PCI Bus Assign Resources
97	Console Output devices connect
98	Console input devices connect
99	Super IO Initialization
9A	USB initialization is started
9B	USB Reset
9C	USB Detect
9D	USB Enable
9E – 9F	Reserved for future AMI codes
A0	IDE initialization is started
A1	IDE Reset
A2	IDE Detect
A3	IDE Enable
A4	SCSI initialization is started

(continued on the next page)

Code	Description
A5	SCSI Reset
A6	SCSI Detect
A7	SCSI Enable
A8	Setup Verifying Password
A9	Start of Setup
AA	Reserved for ASL (see ASL Status Codes section below)
AB	Setup Input Wait
AC	Reserved for ASL (see ASL Status Codes section below)
AD	Ready To Boot event
AE	Legacy Boot event
AF	Exit Boot Services event
B0	Runtime Set Virtual Address MAP Begin
B1	Runtime Set Virtual Address MAP End
B2	Legacy Option ROM Initialization
B3	System Reset
B4	USB hot plug
B5	PCI bus hot plug
B6	Clean-up of NVRAM
B7	Configuration Reset (reset of NVRAM settings)
B8– BF	Reserved for future AMI codes
D0	CPU initialization error
D1	System Agent initialization error
D2	PCH initialization error
D3	Some of the Architectural Protocols are not available
D4	PCI resource allocation error. Out of Resources
D5	No Space for Legacy Option ROM
D6	No Console Output Devices are found
D7	No Console Input Devices are found
D8	Invalid password
D9	Error loading Boot Option (LoadImage returned error)
DA	Boot Option is failed (StartImage returned error)
DB	Flash update is failed
DC	Reset protocol is not available

ACPI/ASL Checkpoints (under OS)

Code	Description
03	System is entering S3 sleep state
04	System is entering S4 sleep state
05	System is entering S5 sleep state
30	System is waking up from the S3 sleep state
40	System is waking up from the S4 sleep state
AC	System has transitioned into ACPI mode. Interrupt controller is in PIC mode.
AA	System has transitioned into ACPI mode. Interrupt controller is in APIC mode.

Notices

Federal Communications Commission Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

• This device may not cause harmful interference.

• This device must accept any interference received including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The use of shielded cables for connection of the monitor to the graphics card is required to assure compliance with FCC regulations. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Compliance Statement of Innovation, Science and Economic Development Canada (ISED)

This device complies with Innovation, Science and Economic Development Canada licence exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAN ICES-3(A)/NMB-3(A)

Déclaration de conformité de Innovation, Sciences et Développement économique Canada (ISED)

Le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-3(A)/NMB-3(A)

Australia statement notice

From 1 January 2012 updated warranties apply to all ASUS products, consistent with the Australian Consumer Law. For the latest product warranty details please visit https://www.asus.com/support/. Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

If you require assistance please call ASUS Customer Service 1300 2787 88 or visit us at https://www.asus.com/support/.

DO NOT throw the motherboard in municipal waste. This product has been designed to enable proper reuse of parts and recycling. This symbol of the crossed out wheeled bin indicates that the product (electrical and electronic equipment) should not be placed in municipal waste. Check local regulations for disposal of electronic products.

DO NOT throw the mercury-containing button cell battery in municipal waste. This symbol of the crossed out wheeled bin indicates that the battery should not be placed in municipal waste.

Japan statement notice

This product cannot be directly connected to the Internet (including public wireless LAN) of a telecom carrier (mobile network companies, landline network companies, Internet providers, etc.). When connecting this product to the Internet, be sure to connect it through a router or switch.

Declaration of compliance for product environmental regulation

ASUS follows the green design concept to design and manufacture our products, and makes sure that each stage of the product life cycle of ASUS product is in line with global environmental regulations. In addition, ASUS disclose the relevant information based on regulation requirements.

Please refer to http://csr.asus.com/Compliance.htm for information disclosure based on regulation requirements ASUS is complied with:

EU REACH and Article 33

Complying with the REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) regulatory framework, we publish the chemical substances in our products at ASUS REACH website at http://csr.asus.com/english/REACH.htm.

EU RoHS

This product complies with the EU RoHS Directive. For more details, see http://csr.asus.com/english/article.aspx?id=35

Japan JIS-C-0950 Material Declarations

Information on Japan RoHS (JIS-C-0950) chemical disclosures is available on http://csr.asus.com/english/article.aspx?id=19

India RoHS

This product complies with the "India E-Waste (Management) Rules, 2016" and prohibits use of lead, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) in concentrations exceeding 0.1% by weight in homogenous materials and 0.01% by weight in homogenous materials for cadmium, except for the exemptions listed in Schedule II of the Rule.

Vietnam RoHS

ASUS products sold in Vietnam, on or after September 23, 2011,meet the requirements of the Vietnam Circular 30/2011/TT-BCT.

Các sản phẩm ASUS bán tại Việt Nam, vào ngày 23 tháng 9 năm2011 trở về sau, đều phải đáp ứng các yêu cầu của Thông tư 30/2011/TT-BCT của Việt Nam.

Turkey RoHS

AEEE Yönetmeliğine Uygundur

ASUS Recycling/Takeback Services

ASUS recycling and takeback programs come from our commitment to the highest standards for protecting our environment. We believe in providing solutions for you to be able to responsibly recycle our products, batteries, other components as well as the packaging materials. Please go to http://csr.asus.com/english/Takeback.htm for detailed recycling information in different regions.

Ecodesign Directive

European Union announced a framework for the setting of ecodesign requirements for energy-related products (2009/125/EC). Specific Implementing Measures are aimed at improving environmental performance of specific products or across multiple product types. ASUS provides product information on the CSR website. The further information could be found at https://csr.asus.com/english/article.aspx?id=1555.

ENERGY STAR Qualified Product

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping us all save money and protect the environment through energy efficient products and practices.

All ASUS products with the ENERGY STAR logo comply with the ENERGY STAR standard, and the power management feature is enabled by default. The monitor is automatically set to sleep within 10 minutes of user inactivity; the computer is automatically set to sleep within 30 minutes of user inactivity. To wake your computer, click the mouse, press any key on the keyboard, or press the power button.

Please visit http://www.energystar.gov/powermanagement for detail information on power management and its benefits to the environment. In addition, please visit http://www.energystar.gov for detail information on the ENERGY STAR joint program.

> Energy Star is NOT supported on FreeDOS and Linux-based operating systems.

ASUS contact information

ASUSTeK COMPUTER INC.

Address   1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Telephone   +886-2-2894-3447
Fax   +886-2-2890-7798
Web site   https://www.asus.com

Technical Support

Telephone   +86-21-38429911
Online Support   https://www.asus.com/support/Product/ContactUs/Services/
                       questionform/?lang=en

ASUSTeK COMPUTER INC. (Taiwan)

Address   1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Telephone   +886-2-2894-3447
Fax   +886-2-2890-7798
Web site   https://www.asus.com/tw/

Technical Support

Telephone   +886-2-2894-3447 (0800-093-456)
Online Support   https://www.asus.com/support/Product/ContactUs/Services/
                       questionform/?lang=zh-tw

ASUSTeK COMPUTER INC. (China)

Address   No. 5077, Jindu Road, Minhang District, Shanghai, China
Telephone   +86-21-5442-1616
Fax   +86-21-5442-0099
Web site   https://www.asus.com.cn

Technical Support

Telephone   +86-20-2804-7506 (400-620-6655)
Online Support   https://www.asus.com/support/Product/ContactUs/Services/
                       questionform/?lang=zh-cn

ASUS contact information

ASUS COMPUTER INTERNATIONAL (America)

Address   48720 Kato Rd., Fremont, CA 94538, USA
Fax   +1-510-608-4555
Web site   https://www.asus.com/us/

Technical Support

Support fax   +1-812-284-0883
General support   +1-812-282-2787
Online support   https://www.asus.com/support/Product/ContactUs/Services/
                             questionform/?lang=en-us

ASUS COMPUTER GmbH (Germany and Austria)

Address   Harkort Str. 21-23, 40880 Ratingen, Germany
Web site   https://www.asus.com/de/

Technical Support

Telephone (DE)   +49-2102-5789557
Telephone (AT)   +43-1360-2775461
Online support   https://www.asus.com/support/Product/ContactUs/Services/
                             questionform/?lang=de-de

ASUS Czech Service s.r.o. (Europe)

Address   Na Rovince 887, 720 00 Ostrava – Hrabová,
                             Czech Republic
Telephone   +420-596766888
Web site   https://www.asus.com/cz/

Technical Support

Telephone   +420-596-766-891
Fax   +420-596-766-329
E-mail   advance.rma.eu@asus.com
Online Support   https://www.asus.com/support/Product/ContactUs/Services/
                             questionform/?lang=cs-cz

ASUS contact information

ASUS Holland BV (The Netherlands)

Address	Marconistraat 2, 7825GD EMMEN, The Netherlands
Web site	https://www.asus.com/nl/

Technical Support

Telephone	+31-(0)591-5-70292
Fax	+31-(0)591-666853
E-mail	advance.rma.eu@asus.com
Online Support	https://www.asus.com/support/Product/ContactUs/Services/questionform/?lang=nl-nl

ASUS Polska Sp. z o.o. (Poland)

Address	Ul. Postępu 6, 02-676 Warszawa, Poland
Web site	https://www.asus.com/pl/

Technical Support

Telephone	+48-225718033
Online Support	https://www.asus.com/support/Product/ContactUs/Services/questionform/?lang=pl-pl

ASK-Service (Russia and CIS)

Address	г.Москва, ул. Орджоникидзе, д.10, Россия
Telephone	(495) 640-32-75
Web site	https://www.asus.com/ru/

Technical Support

Telephone	008-800-100-ASUS (008-800-100-2787)
Online Support	https://www.asus.com/support/Product/ContactUs/Services/questionform/?lang=ru-ru