ESC700 G3

Workstation
User Guide

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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 B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with manufacturer's instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

> 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(B)/NMB-3(B)

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(B)/NMB-3(B)

REACH

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

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.

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.

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/.

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, 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 add a device.

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

Operation Safety

- Any mechanical operation on this server must be conducted by certified or experienced engineers.

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

- Before using the server, ensure 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.

6   **Chapter 6: Driver Installation**

    This chapter provides instructions for installing the necessary drivers for different system components.

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.

1. **ASUS Server Web-based Management (ASWM) user guide**

   This manual tells how to set up and use the proprietary ASUS server management utility.

2. **ASUS websites**

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

Product Introduction

1

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	ESC700 G3
Accessories	1 x ESC700 G3 Support CD 1 x AC Power Cable
Optional Items	DVD-ROM/DVD-RW Smart card reader

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.
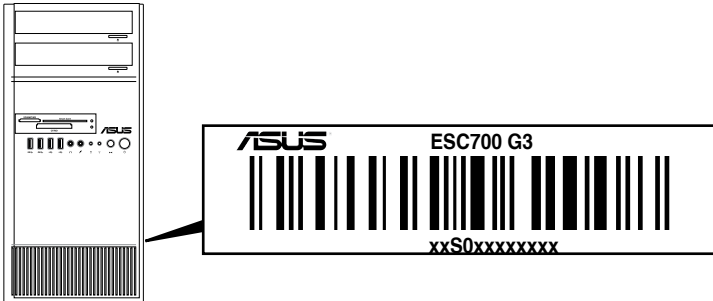
1.3   ESC700 G3 specifications summary

The ASUS ESC700 G3 is a workstation featuring the ASUS X99-WS/SYS server board.

CPU	LGA2011-v3 socket for the Next Generation Intel® Core™ i7/Xeon® E5-2600/1600 v3 processors
Chipset	Intel® X99 Express Chipset
Memory	8 x DIMM DDR4 max at 128 GB 2133 MHz, non-ECC unbuffered memory (When installing Intel® Socket 2011-v3 Core™ i7 processors)
	8 x DIMM DDR4 max at 128 GB 2133 / 1866 MHz, ECC unbuffered, Register memory (When installing Intel® Xeon™ E5-1600 v3 / 2600 v3 processors)
	Quad channel memory architecture
Expansion slots	**40-LANE CPU**
	5 x PCI Express 3.0/2.0 x16 slots (single at x16, dual at x16/x16, triple at x16/x16/x8, quintuple at x8/x8/x8/x8/x8 mode)
	28-LANE CPU
	5 x PCI Express 3.0/2.0 x16 slots (single at x16, dual at x16/x8, quad at x8/x8/x8/x4 mode)*
	* The PCIe 3.0/2.0 x16_4 slot will not work if you install a 28-LANE CPU.
Storage	**Intel® X99 Express Chipset with RAID 0, 1, 5, 10 and Intel® Rapid Storage Technology 13 support**
	- 8 x SATA 6.0 Gb/s ports (4 x right angle connectors from controller 1, 4 x vertical connectors from controller 2)
	- 1 x SATA Express port (gray at bottom, compatible with 2 x SATA 6.0 Gb/s ports)
	- 1 x M.2 Socket 3 with M Key, 2260/2280 storage devices support (SATA/PCIE mode)*
	* M.2 Socket shares bandwidth with SATA Express.
LAN	2 x Intel® I210-AT Gigabit LAN controllers
USB	**Intel® X99 Express Chipset**
	- 6 x USB 3.0/2.0 (4 ports at front panel, 2 ports at rear panel)
	- 6 x USB 2.0/1.1 ports (4 ports at mid-board, 2 ports at back panel)
Rear Panel I/O Ports	1 x BIOS Flashback button
	2 x USB 3.0 ports (blue)
	2 x USB 2.0 ports (1 port supports USB BIOS Flashback)
	1 x Optical S/PDIF Out port
	2 x Intel® LAN (RJ45) ports
	8-channel Audio I/O jacks
Internal I/O Connectors	2 x 19-pin USB 3.0/2.0 connectors support additional 4 USB ports
	2 x USB 2.0/1.1 connectors support additional 4 USB ports
	1 x M.2 Socket 3 (for M Key, type 2260/2280 devices)
	1 x SATA Express connector (gray)
	8 x SATA 6.0 Gb/s connectors (4 x gray, 4 x black)

(continued on the next page)

ESC700 G3 specifications summary

Internal I/O Connectors	1 x 4-pin CPU Fan connector for both 3-pin (DC Mode) and 4-pin (PWM Mode) CPU coolers control with auto detection support
	1 x 4-pin CPU OPT Fan connector
	4 x 4-pin Chassis Fan connectors for both 3-pin (DC Mode) and 4-pin (PWM Mode) fan control
	1 x Front panel audio connector(AAFP)
	1 x S/PDIF Out header
	1 x TPM connector
	1 x 24-pin EATX Power connector
	2 x 8-pin EATX 12V Power connectors
	1 x 6-pin EATX 12V_1 Power connector
	1 x MemOK! button
	1 x Clear CMOS button
	1 x 3-pin Chassis intrusion (CHASSIS) connector
	1 x DRCT (DirectKey) connector
	1 x TPU switch (advanced two-stage adjustments)
	1 x EPU switch
	1 x EZ XMP switch
	1 x Power-on button
	1 x Reset button
	1 x System Panel
	1 x SMBus headers
Dimension (HH x WW x DD)	423 mm x 190 mm x 435 mm
Net Weight Kg (CPU, DRAM & HDD excluded)	11 Kg
Power Supply	700W 80Plus Single Power Supply, Gold
Power Rating	Input: 100-240Vac, 10-5A, 50/60Hz Class1
Environment	Operating temperature: 10ºC – 35ºC
	Non operating temperature: -40ºC – 70ºC
	Non operating humidity: 20% – 90% (Non condensing)

Specifications are subject to change without notice.

1.4   Front panel features

The ESC700 G3 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.
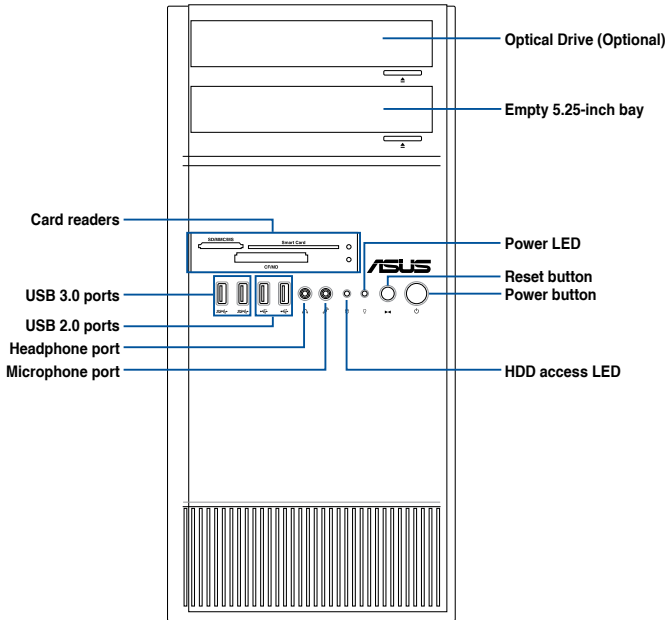
Refer to the Front panel LEDs section for the LED descriptions.

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

700W Gold Single power supply

USB 2.0 ports

USB BIOS flashback button

Gigabit LAN port 1

Gigabit LAN port 2

120 mm x 120 mm system fan vents

USB 3.0 ports

Audio ports

PCI-E latch

Expansion slots
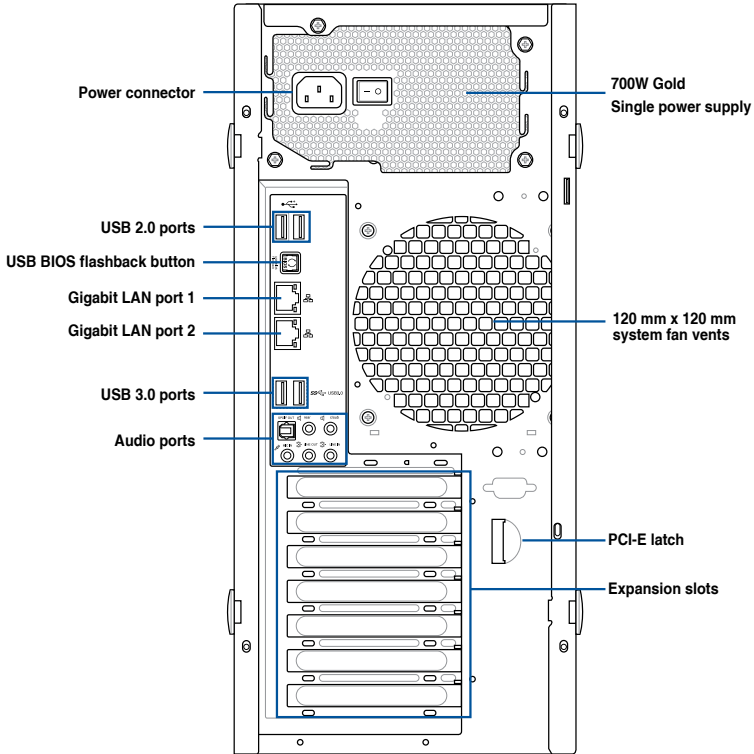
1.6   Internal features

The ASUS ESC700 G3 Pedestal server system includes the basic components as shown:
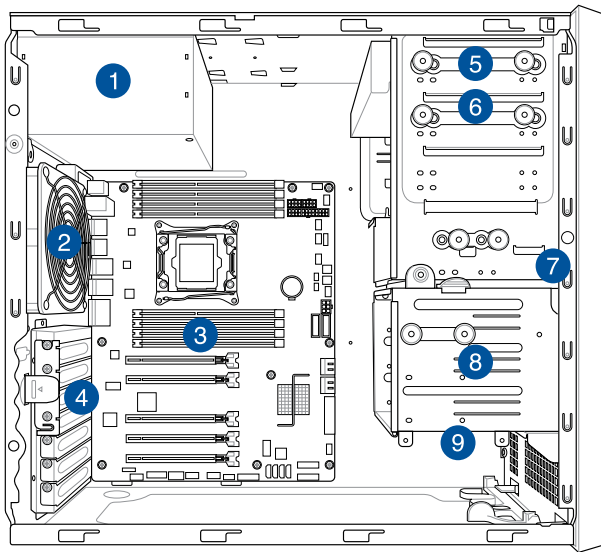
1.   Power supply unit

2.   120 mm x 120 mm system fan

3.   ASUS X99-WS/SYS Server Board

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 HDD bays

9.   1 x 2.5-inch Internal HDD/SSD 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
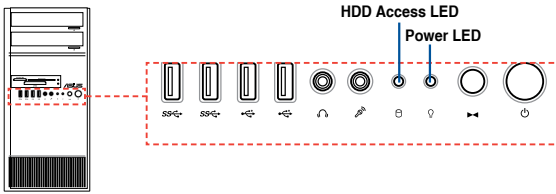
LED	Icon	Display status	Description
Power LED		ON	System power ON
HDD Access LED		OFF Blinking	No activity Read/write data into the HDD

1.7.2 Rear panel LEDs
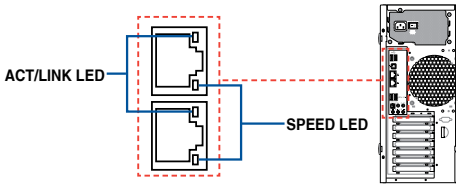
ACT/LINK LED		SPEED LED	
Status	**Description**	**Status**	**Description**
OFF	No link	OFF	10 Mbps connection
GREEN	Linked	ORANGE	100 Mbps connection
BLINKING	Data activity	GREEN	1 Gbps connection

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 barebone server 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
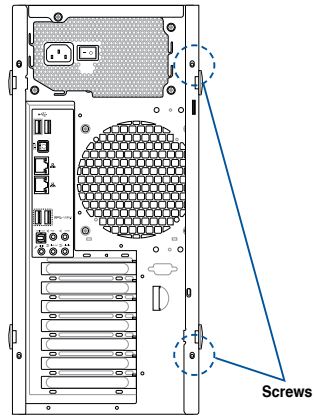
2. Press the side cover locks outward.

Side cover locks
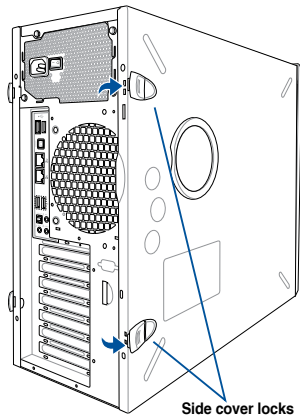
3. Slightly pull the side cover toward the rear just enough to detach it from the chassis.
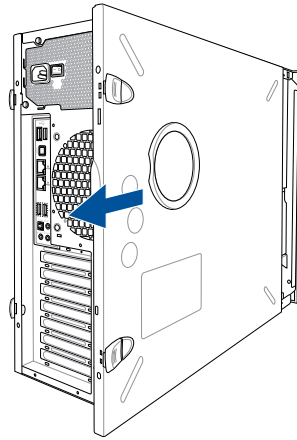
4. Remove the cover and set it aside.
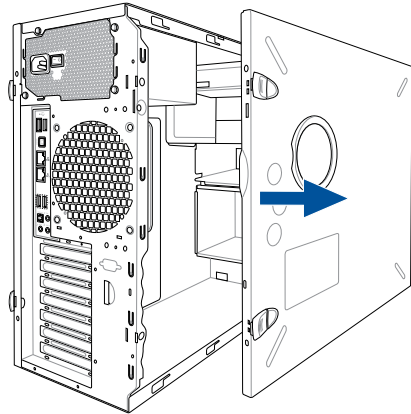
2.2   CPU installation

The motherboard comes with a surface mount LGA2011-v3 socket designed for Intel® Core™ i7 processors.

- 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 LGA2011-v3 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.
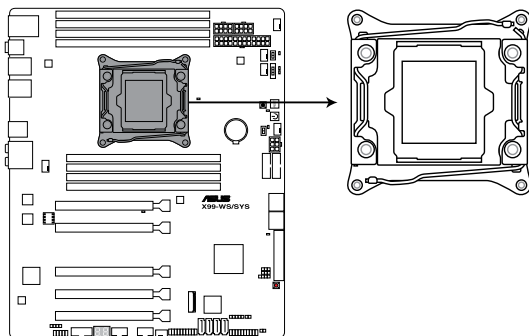
X99-WS/SYS CPU LGA2011-v3 Socket

Before installing the CPU, ensure that the socket box is facing toward you and the load lever is on your right.

Triangle mark

Triangle mark
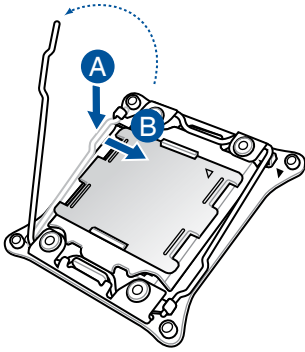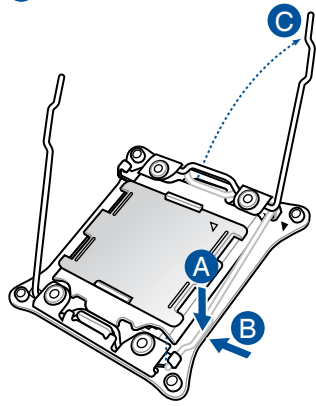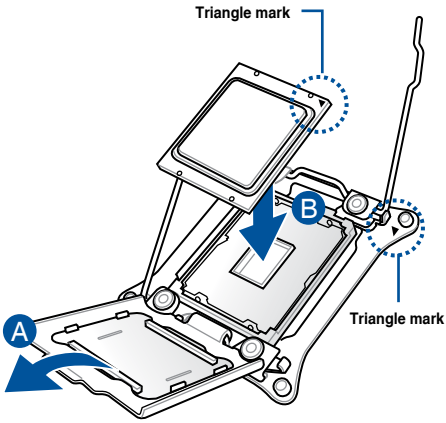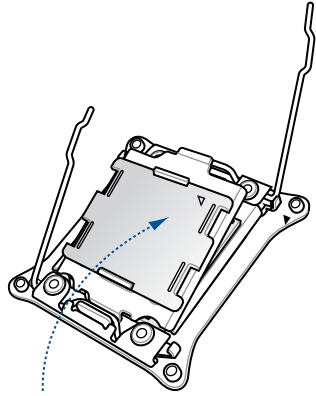
5
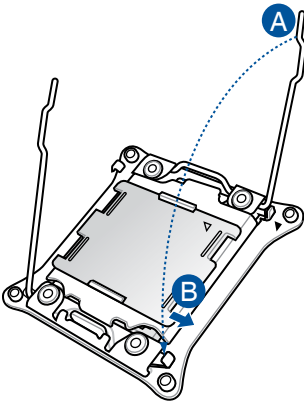
6
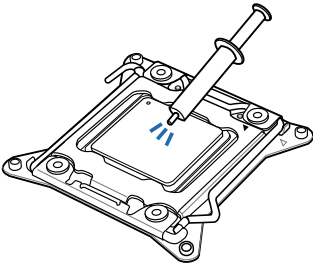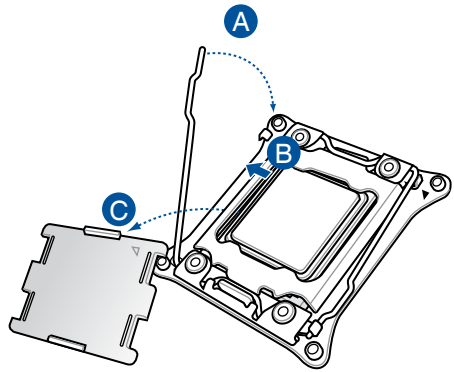
Apply the Thermal Interface Material to the CPU heatsink and CPU before you install the heatsink and fan, if necessary.

2.3   CPU heatsink and fan assembly installation

To install the CPU heatsink and fan assembly
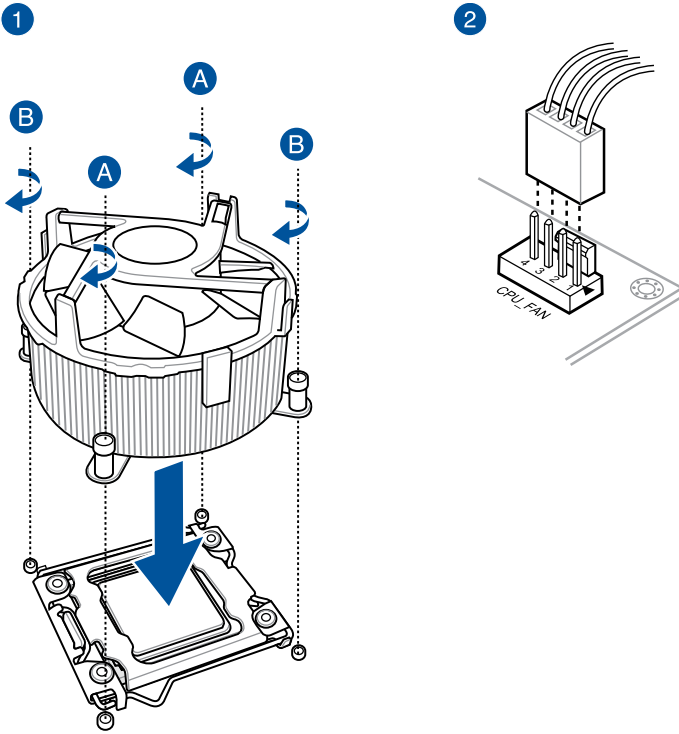
2.4   System memory

The motherboard comes with eight DDR 4 (Double Data Rate 4) Quad 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.

DIMM_C1
DIMM_C2
DIMM_D1
DIMM_D2

DIMM_B2
DIMM_B1
DIMM_A2
DIMM_A1
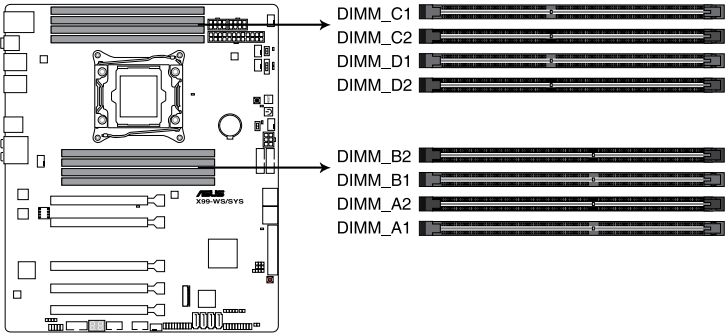
X99-WS/SYS 288-pin DDR4 DIMM socket

Recommended memory configurations

DIMM_D1

DIMM_B1
DIMM_D1

DIMM_A1
DIMM_B1
DIMM_D1
DIMM_C1

DIMM_A1
DIMM_B1
DIMM_B2
DIMM_D2
DIMM_D1
DIMM_C1

DIMM_A1
DIMM_A2
DIMM_B1
DIMM_B2
DIMM_D2
DIMM_D1
DIMM_C2
DIMM_C1
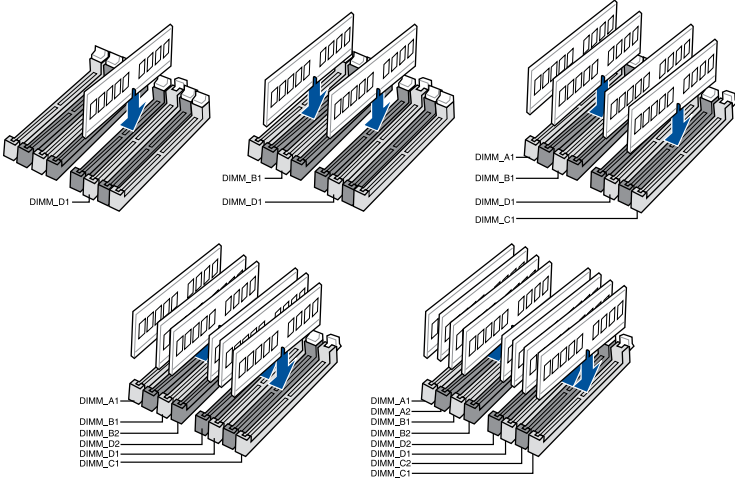
Memory configurations

You may install 2 GB, 4 GB and 8 GB unbuffered and non-ECC DDR4 DIMMs into the DIMM sockets.

- You may install varying memory sizes in Channel A, Channel B, Channel C, and Channel D. 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.

- According to Intel® CPU spec, DIMM voltage below 1.65 V is recommended to protect the CPU.

- Due to the memory address limitation on 32-bit Windows® OS, when you install 4GB or more memory on the motherboard, the actual usable memory for the OS can be about 3GB or less. For effective use of memory, we recommend that you do any of the following:

  a) Use a maximum of 3GB system memory if you are using a 32-bit Windows® OS.

  b) Install a 64-bit Windows® OS when you want to install 4 GB or more on the motherboard.

  c) For more details, refer to the Microsoft® support site at http://support.microsoft.com/kb/929605/en-us.

- 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. To operate at the vendor-marked or at a higher frequency, refer to section **4.5 Ai Tweaker menu** for manual memory frequency adjustment.

- For system stability, use a more efficient memory cooling system to support a full memory load (8 DIMMs) or overclocking condition.

- Memory modules with memory frequency higher than 2133MHz and their corresponding timing or the loaded XMP profile is not the JEDEC memory standard. The stability and compatibility of the memory modules depend on the CPU's capabilities and other installed devices.

- 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.

- ASUS exclusively provides hyper DIMM support function.

- Hyper DIMM support is subject to the physical characteristics of individual CPUs. Load the X.M.P. or D.O.C.P. settings in the BIOS for the hyper DIMM support.

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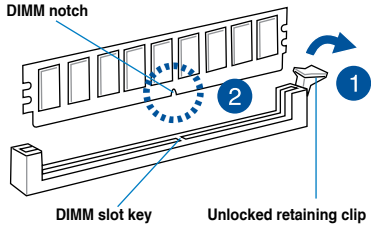
A DIMM is keyed with a notch so that it fits in only one direction. DO NOT force a DIMM into a socket in the wrong direction to avoid damaging the DIMM.

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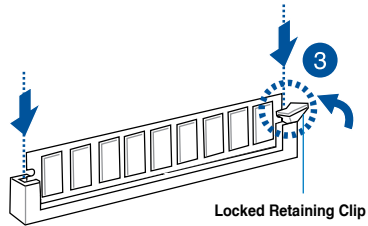
Always insert the DIMM into the socket vertically to prevent DIMM notch damage.

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

- Refer to the user guide 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.
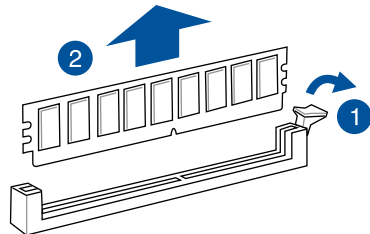
Support the DIMM lightly with your fingers when pressing the retaining clips. The DIMM might get damaged when it flips out with extra force.

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 secures the front panel cover to the chassis.

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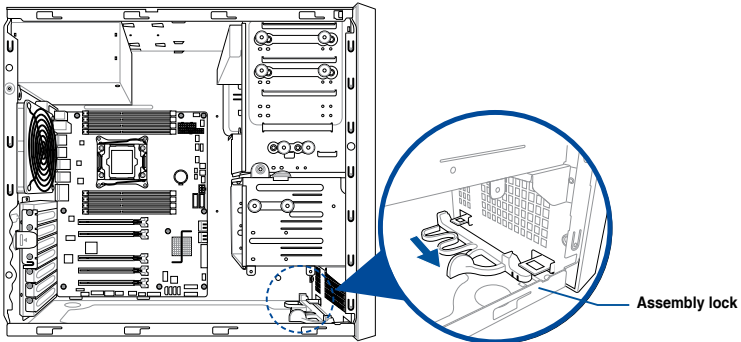
2. Remove the front panel assembly from the chassis and set it aside.

Front panel assembly
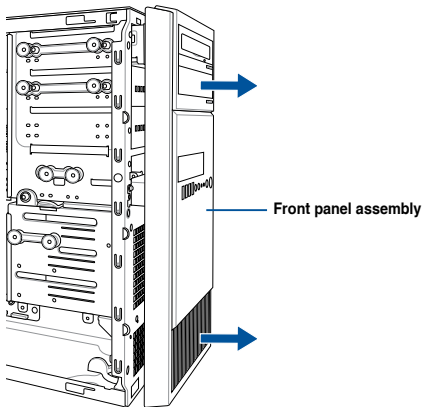
2.6   5.25-inch drives

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.
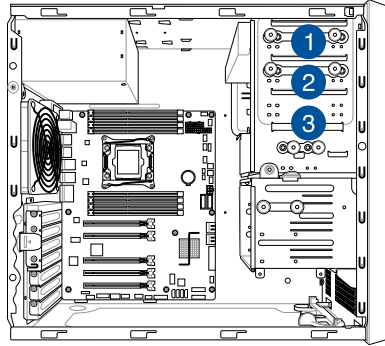
Installing a 5.25-inch drive

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
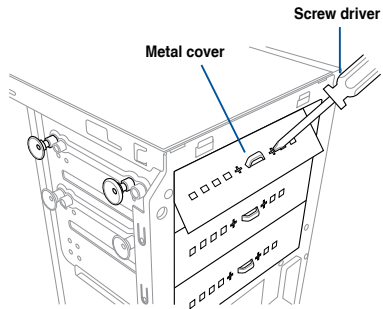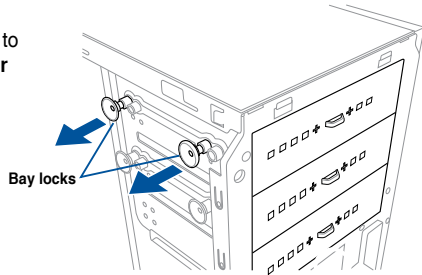
4.   Prepare the 5.25-inch drive.

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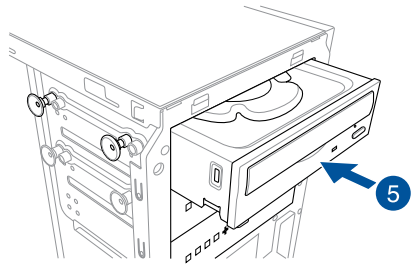
6.   Push the bay locks to secure the drive in
      place.

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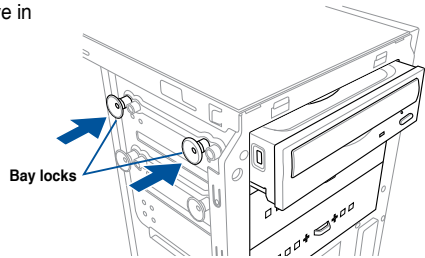
7.   Connect the SATA cable to the SATA
      connector of the drive.

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**
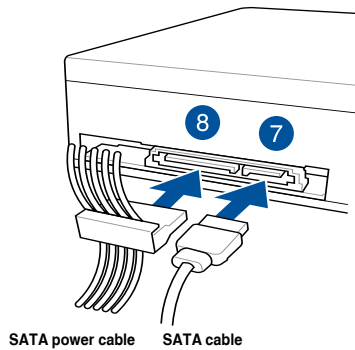
2.7 Hard disk drives (HDD)

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 the it up (A), then swing the HDD cage outwards (B) until it clicks in place.
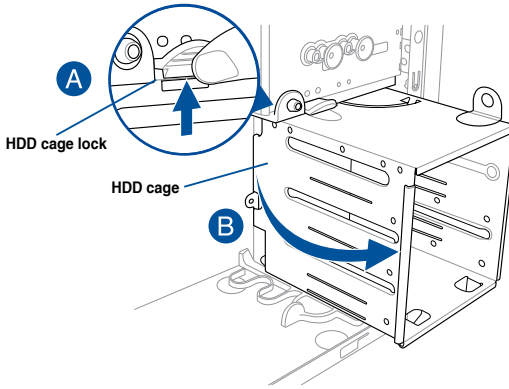
4. Align and insert the 3.5-inch HDD into the drive bay ensuring that the screw holes on the HDD matches the screw holes on the HDD cage.
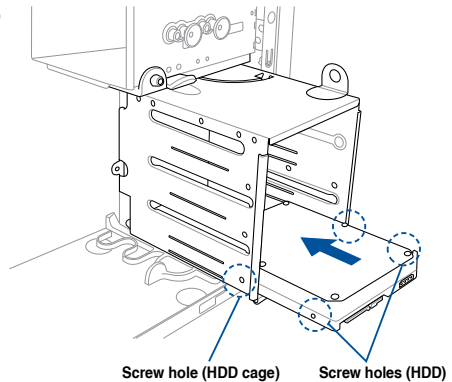
5. Secure the 3.5-inch HDD to the HDD cage using the bundled set of screws.
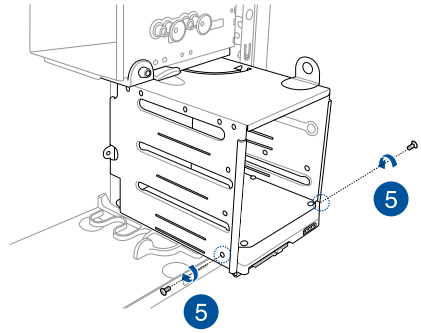
6. Swing the HDD cage inwards until it clicks back into place.

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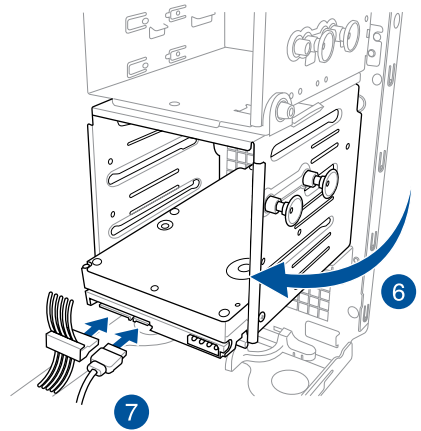
Installing 2.5-inch HDD/SSD

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.
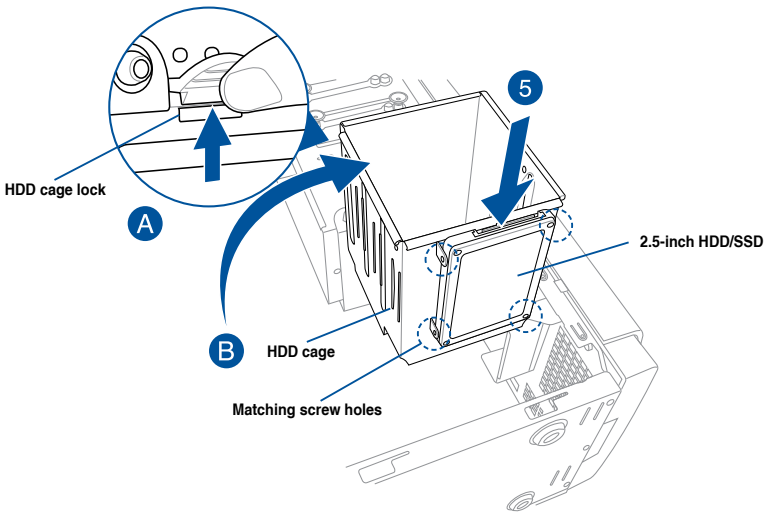
6.	Secure the 2.5-inch HDD/SSD to the HDD cage using the bundled set of screws.
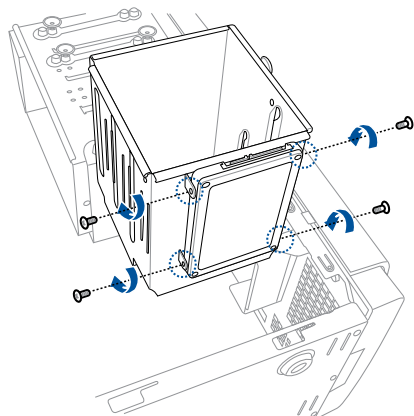
7.	Swing the HDD cage inwards until it clicks back into place.
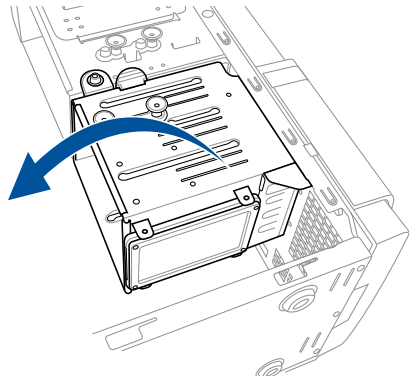
8.	Connect a SATA cable and a SATA power cable to the 2.5-inch HDD/SSD.
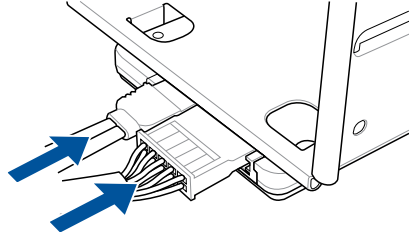
2.8 Expansion slots

⚠️ Unplug the power cord before adding or removing expansion cards. Failure to do so may cause you physical injury and damage motherboard components.
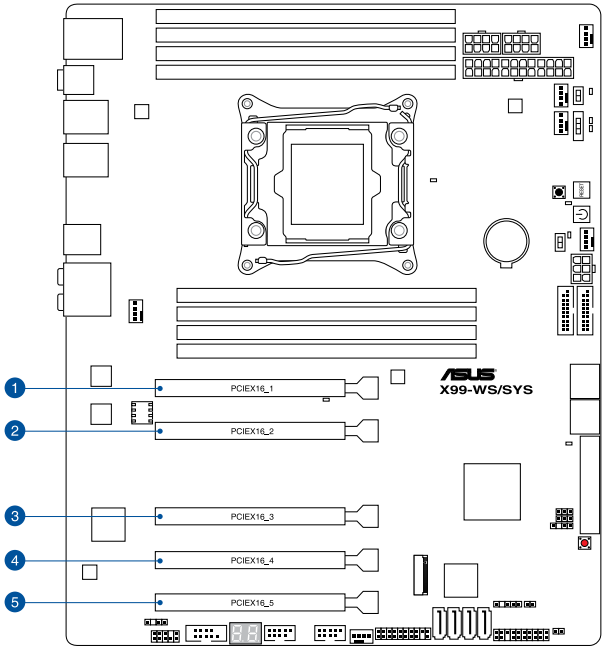
Slot No.	Slot Description	
	40-LANE	**28-LANE**
1	PCIe 3.0/2.0 x16_1 slot	PCIe 3.0/2.0 x16_1 slot
2	PCIe 3.0/2.0 x16_2 slot	PCIe 3.0/2.0 x16_2 slot
3	PCIe 3.0/2.0 x16_3 slot	PCIe 3.0/2.0 x16_3 slot
4	PCIe 3.0/2.0 x16_4 slot	PCIe 3.0/2.0 x16_4 slot*
5	PCIe 3.0/2.0 x16_5 slot	PCIe 3.0/2.0 x16_5 slot

*This slot may not work if a 28-LANE CPU is installed.

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 PCI-E latch (A), hold it by its edge then lift it towards the rear (B).
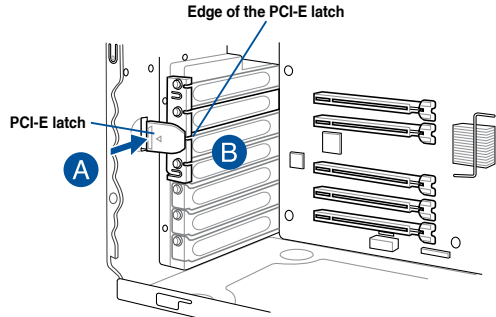
3.   Remove the screw (A) that secures the metal bracket to the chassis then remove the metal bracket (B).
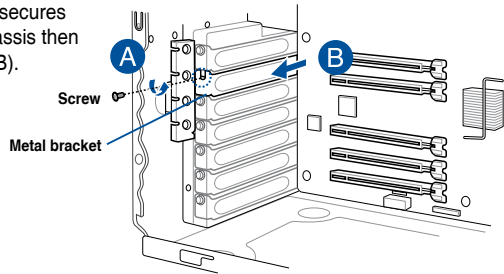
4. Align and insert the expansion card into the PCI-E slot.

Expansion card

PCI-E slot
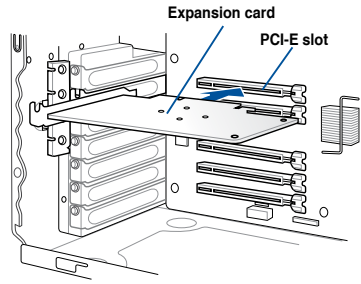
5. Lift the PCI-E latch inwards until it clicks into place securing the expansion card to the chassis.

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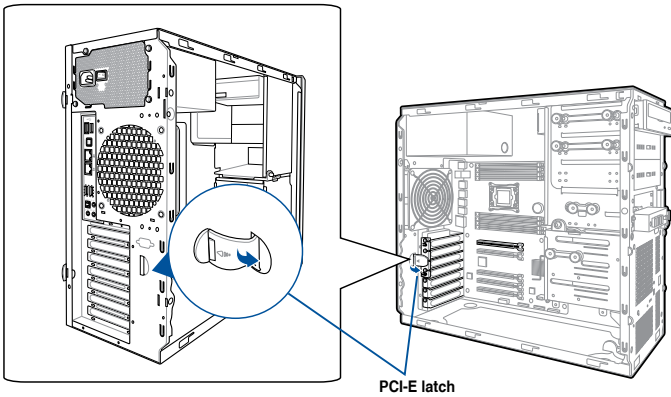
6. (Optional) Replace the screw of the metal bracket.
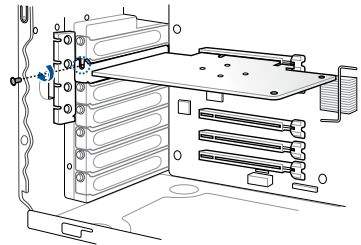
2.8.2　Configuring an expansion card

40-LANE CPU VGA configuration

40-LANE CPU	PCI Express 3.0 operating mode				
VGA configuration	PCIe 3.0/2.0 x16_1	PCIe 3.0/2.0 x16_2	PCIe 3.0/2.0 x16_3	PCIe 3.0/2.0 x16_4	PCIe 3.0/2.0 x16_5
Single VGA/PCIe card	N/A	x16	N/A	N/A	N/A
Dual VGA/PCIe cards	N/A	x16	x16	N/A	N/A
Triple VGA/PCIe cards	N/A	x16	x16	N/A	x8
Quintuple VGA/ PCIe cards	x8	x8	x8	x8	x8

28-LANE CPU VGA configuration

28-LANE CPU	PCI Express 3.0 operating mode				
VGA configuration	PCIe 3.0/2.0 x16_1	PCIe 3.0/2.0 x16_2	PCIe 3.0/2.0 x16_3	PCIe 3.0/2.0 x16_4	PCIe 3.0/2.0 x16_5
Single VGA/PCIe card	N/A	x16	N/A	N/A	N/A
Dual VGA/PCIe cards	N/A	x16	x8	N/A	N/A
Quintuple VGA/ PCIe cards	x8	x8	x8	N/A	x4

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

- Connect a chassis fan to the motherboard connector labeled REAR_FAN1 or FRNT_ FAN1-3 when using multiple graphics cards for better thermal environment.

IRQ assignments for this motherboard

	A	B	C	D	E	F	G	H
PCIe x16_1	shared	–	–	–	–	–	–	–
PCIe x16_2	shared	–	–	–	–	–	–	–
PCIe x16_3	shared	–	–	–	–	–	–	–
PCIe x16_4	shared	–	–	–	–	–	–	–
PCIe x16_5	shared	–	–		–	–	–	–
SMBUS Controller	–	–	shared	–	–	–	–	–
Intel® SATA Controller 1	–	shared	–	–	–	–	–	–
Intel® SATA Controller 2	shared	–	–	–	–	–	–	–
Intel® LAN1 (i210)	–	–	shared	–	–	–	–	–
Intel® LAN2 (i210)	–	–	–	shared	–	–	–	–
Intel® xHCI	–	–	–	–	–	–	–	shared
Intel® EHCI 1	–	–	–	–	–	shared	–	–
Intel® EHCI 2	–	–	shared	–	–	–	–	–
HD Audio	–	–	–	–	–	–	shared	–

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 REAR_FAN1 connector on the motherboard.
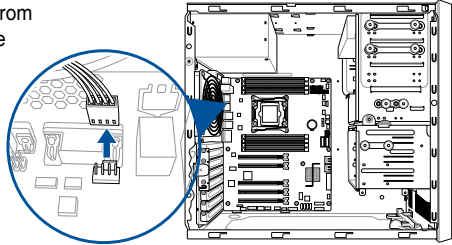
2.   Remove the four system fan screws at the rear panel. Keep the screws for later use.

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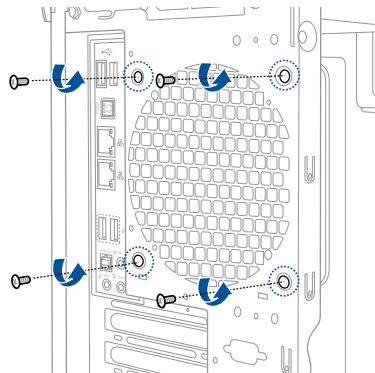
3.   Remove the system fan.

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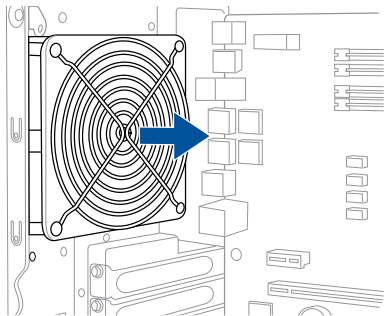
2.10 BIOS update utility

USB BIOS Flashback

USB BIOS Flashback allows you to easily update the BIOS without entering the existing BIOS or operating system. Simply insert a USB storage device to the USB port (the USB port hole marked in green on the I/O shield) then press the USB BIOS Flashback button for three seconds to automatically update the BIOS.

To use USB BIOS Flashback:

1. Download the latest BIOS from the support site at http://support.asus.com and save it to as 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.

2. Insert the USB storage device to the USB Flashback port.

> Refer to section **2.11.1 Rear I/O connection** for the location of the USB port that supports USB BIOS Flashback.

3. Shut down your computer.

4. Press the BIOS Flashback button for three seconds until the Flashback LED blinks three times, indicating that the BIOS Flashback function is working.

USB BIOS Flashback port   **BIOS Flashback button**
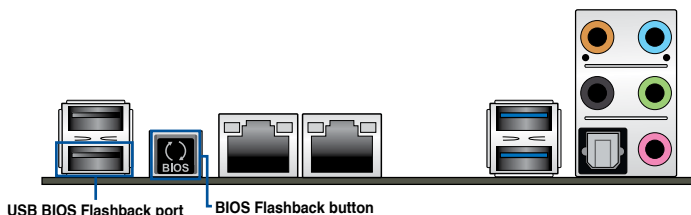
5. Wait until the light goes out, indicating that the BIOS updating process is completed.

> For more BIOS update utilities in BIOS setup, refer to the section **4.11 Updating BIOS** in Chapter 4.

> *   Do not unplug portable disk, power system, or press the CLR_CMOS button while BIOS update is ongoing, otherwise update will be interrupted. In case of interruption, please follow the steps again.
>
> *   If the light flashes for five seconds and turns into a solid light, this means that the BIOS Flashback is not operating properly. This may be caused by improper installation of the USB storage device and filename/file format error. If this scenario happens, please restart the system to turn off the light.
>
> *   Updating BIOS may have risks. If the BIOS program is damaged during the process and results to the system's failure to boot up, please contact your local ASUS Service Center.

2.11   Motherboard rear and audio connection

2.11.1   Rear I/O connection
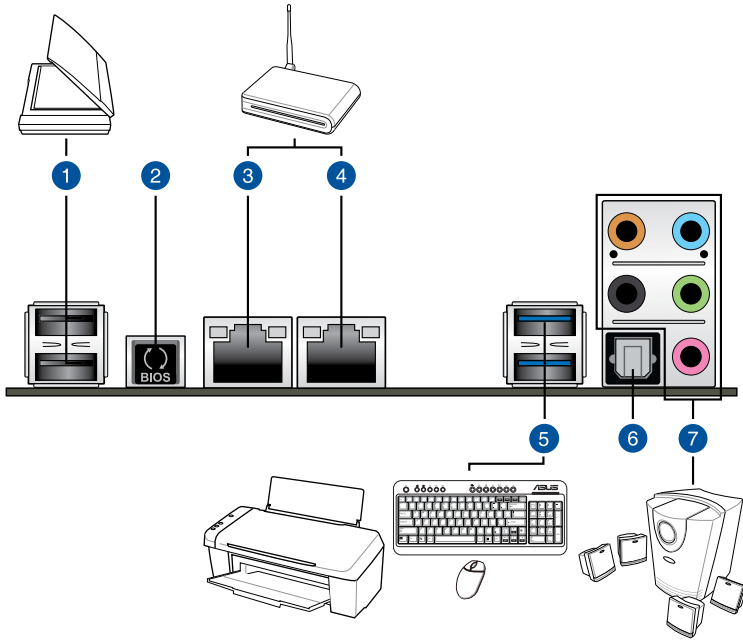
Rear panel connectors			
1.	USB 2.0 ports 78 (lower port supports USB BIOS Flashback)	5.	USB 3.0 ports 56
2.	USB BIOS Flashback button	6.	Optical S/PDIF Out port
3.	Intel® LAN port (LAN2)*	7.	Audio I/O ports**
4.	Intel® LAN port (LAN1)*		

* and **:   Refer to the tables on the next page for the LAN port LEDs and audio port definitions.

- The plugged USB 3.0 device may run on xHCI mode or EHCI mode, depending on the operating system's setting.

- USB 3.0 devices can only be used as data storage only.

- We strongly recommend that you connect USB 3.0 devices to USB 3.0 ports for faster and better performance for your USB 3.0 devices.

- Due to the design of the Intel® X99 series chipset, all USB devices connected to the USB 2.0 and USB 3.0 ports are controlled by the xHCI controller. Some legacy USB devices must update their firmware for better compatibility.

* 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		

ACT/LINK LED   SPEED LED

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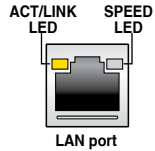
You can disable the LAN controllers in BIOS. Due to hardware design, the LAN1 port's LEDs may continue to blink even when disabled.

** Audio 2, 4, 6, or 8-channel configuration

Port	Headset 2-channel	4-channel	6-channel	8-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/Subwoofer	Center/Subwoofer
Black	–	Rear Speaker Out	Rear Speaker Out	Rear Speaker Out

2.11.2   Audio I/O connection

Audio I/O ports

orange
black

light blue
lime
pink
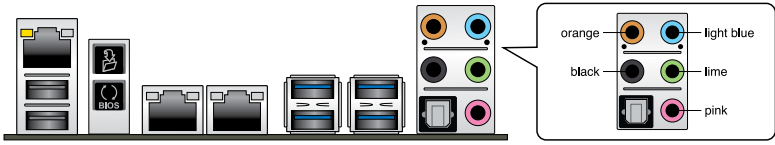
Connect to Headphone and Mic

Connect to Stereo Speakers

AUDIO INPUTS
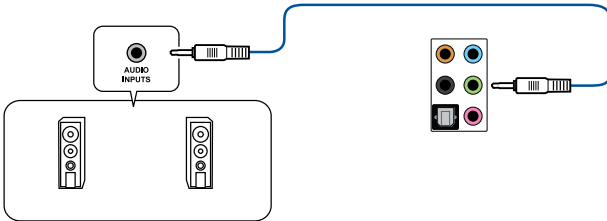
Connect to 2.1 channel Speakers
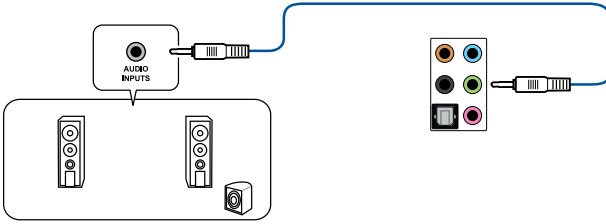
Connect to 4.1 channel Speakers
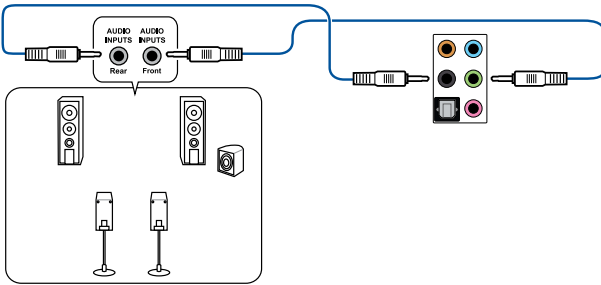
Connect to 5.1 channel Speakers
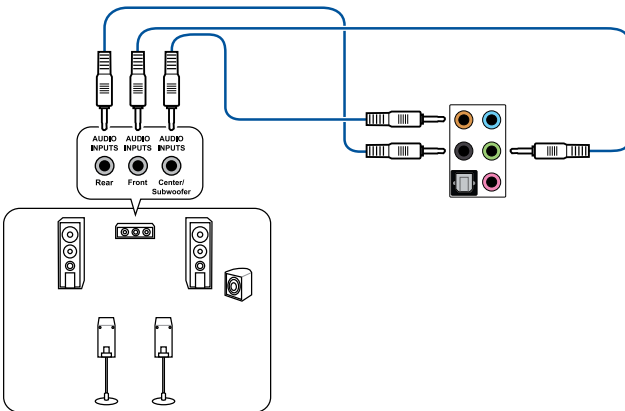
Connect to 7.1 channel Speakers
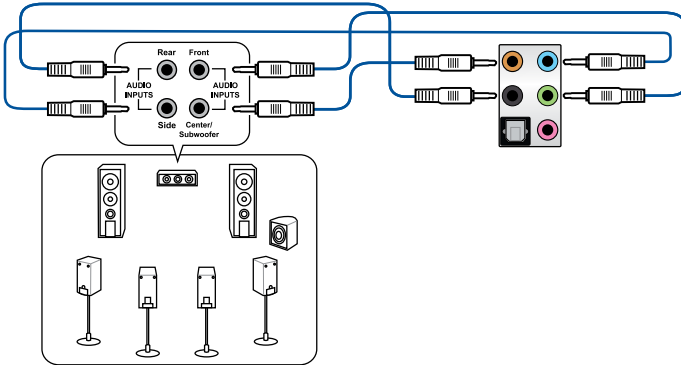
When the DTS UltraPC II function is enabled, ensure to connect the rear speaker to the light blue port.

3

Motherboard Information

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

3.1   Motherboard layout
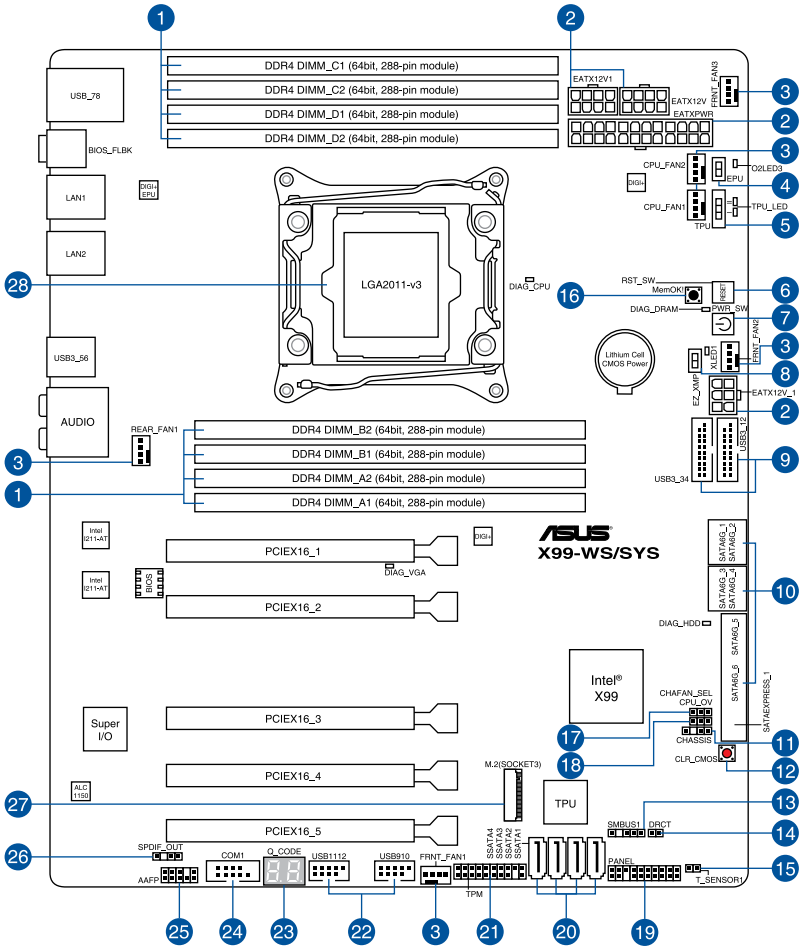
Refer to **3.5 Internal connectors** and **1.5 Rear panel features** for more information about rear panel connectors and internal connectors.

Layout contents

Connectors/Jumpers/Buttons and switches/Slots	Page
1. DDR4 DIMM slots	2-8
2. ATX power connectors (24-pin EATXPWR; 8-pin EATX12V; 8-pin EATX12V1; 6-pin EATX12V_1)	3-23
3. CPU and chassis fan connectors (4-pin CPU_FAN1-2, 4-pin REAR_FAN1, 4-pin FRNT_FAN1-3)	3-22
4. EPU switch	3-7
5. TPU switch	3-6
6. Reset button	3-4
7. Power-on button	3-4
8. EZ XMP switch	3-8
9. USB 3.0 connectors (20-1 pin USB3_12, USB3_34)	3-20
10. Intel® X99 Serial ATA 6 Gb/s connectors (7-pin SATA6G_12, SATA 6G_34, SATA 6G_5, SATA 6G_6, SATAEXPRESS_1)	3-17
11. Chassis intrusion connector (4-1 pin CHASSIS)	3-27
12. Clear CMOS button (CLR_CMOS)	3-8
13. System Management Bus (SMBUS) connector (5-1 pin SMBUS1)	3-18
14. DirectKey connector (2-pin DRCT)	3-25
15. T_Sensor connector (2-pin T_SENSOR1)	3-26
16. MemOK! button	3-5
17. Chassis Fan control setting jumper (3-pin CHAFAN_SEL)	3-9
18. CPU Over Voltage jumper (3-pin CPU_OV)	3-9
19. System panel connector (20-1 pin PANEL)	3-24
20. Serial ATA 3.0 6 Gb/s connectors (7-pin SSATA_1-4 [gray])	3-18
21. TPM connector (20-1 pin TPM)	3-25
22. USB 2.0 connectors (10-1 pin USB910; US1112)	3-21
23. Q-Code Leds	3-12
24. Serial port connector (10-1 pin COM1)	3-16
25. Front panel audio connector (10-1 pin AAFP)	3-19
26. Digital audio connector (4-1 pin SPDIF_OUT)	3-16
27. M.2 connector (SOCKET 3)	3-26
28. LGA2011-v3 CPU socket	2-4

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.

PWR_SW
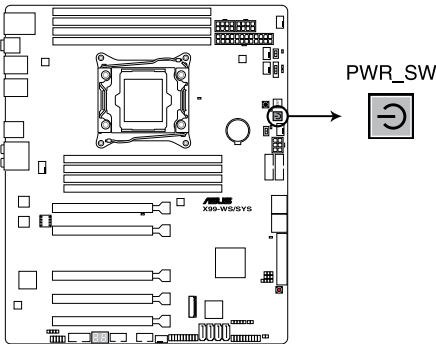
X99-WS/SYS Power on button

2.   **Reset button**

Press the reset button to reboot the system.

RST_SW
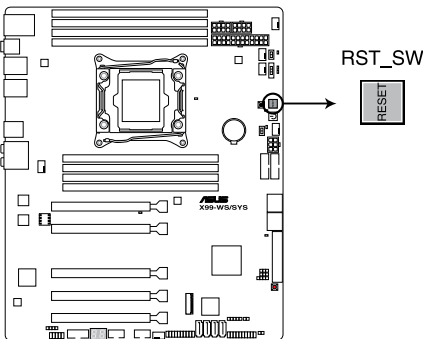
X99-WS/SYS Reset button

3.   **MemOK! button**

Installing DIMMs that are not compatible with the motherboard may cause system boot failure, and the DIAG_DRAM LED near the MemOK! button lights continuously. Press and hold the MemOK! button until the DIAG_DRAM LED starts blinking to begin automatic memory compatibility tuning for successful boot.
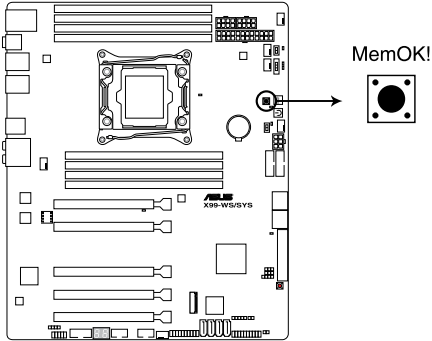
X99-WS/SYS MemOK! button

- Refer to section **3.4 Onboard LEDs** for the exact location of the DIAG_DRAM LED.

- The DIAG_DRAM LED also lights up when the DIMM is not properly installed. Turn off the system and reinstall the DIMM before using the MemOK! function.

- The MemOK! button does not function under Windows® OS environment.

- During the tuning process, the system loads and tests failsafe memory settings. It takes about 30 seconds for the system to test one set of failsafe settings. If the test fails, the system reboots and test the next set of failsafe settings. The blinking speed of the DIAG_DRAM LED increases, indicating different test processes.

- Due to memory tuning requirement, the system automatically reboots when each timing set is tested. If the installed DIMMs still fail to boot after the whole tuning process, the DIAG_DRAM LED lights continuously. Replace the DIMMs with ones recommended in the Memory QVL (Qualified Vendors Lists) in this user manual or at www.asus.com.

- If you turn off the computer and replace DIMMs during the tuning process, the system continues memory tuning after turning on the computer. To stop memory tuning, turn off the computer and unplug the power cord for about 5–10 seconds.

- If your system fails to boot up due to BIOS overclocking, press the MemOK! button to boot and load the BIOS default settings. A message will appear during POST reminding you that the BIOS has been restored to its default settings.

- We recommend that you download and update to the latest BIOS version from www.asus.com after using the MemOK! function.

4.   TPU switch

With its two-level adjustment functions, the TPU allows you to automatically adjusts the CPU ratio and clock speed for an optimal system performance.

- • Enable this switch when the system is powered off.

- • When the TPU switch is set to Enabled (TPU_I: CPU Ratio Boost), the system automatically adjusts the CPU ratio for an enhanced performance.

- • When the TPU switch is set to Enabled (TPU_II: CPU BCLK and Ratio Boost), the system automatically adjusts the base clock rate (BCLK) and the CPU ratio for a more enhanced performance.

TPU

TPU_I

TPU_II

Disabled
(Default)

Enabled
(CPU Ratio Boost)

Enabled
(CPU BCLK
and
Ratio Boost)

X99-WS/SYS TPU switch
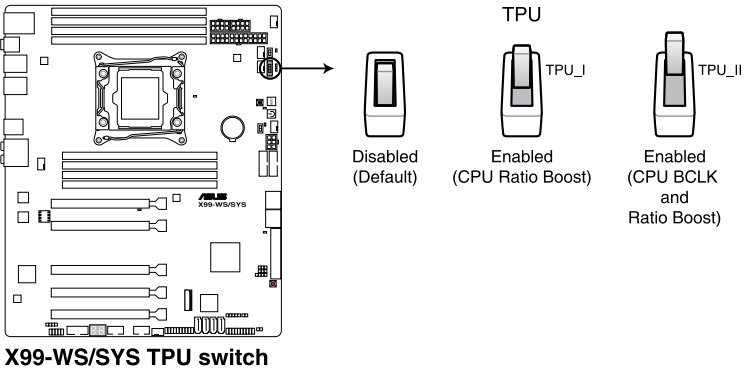
- • The TPU LEDs (TPU_LED) near the TPU switch light up when you set the TPU switch to TPU_I mode or TPU_II mode. Refer to section **3.4 Onboard LEDs** for the exact location of the TPU LEDs.

- • If you enable this switch under Windows® OS environment, the TPU function will be activated after the next system bootup.

5. EPU switch

Enable this switch to automatically detect the current PC loadings and intelligently moderate the power consumption.

Enable this switch when the system is powered off.

EPU

Disabled   Enabled
(Default)
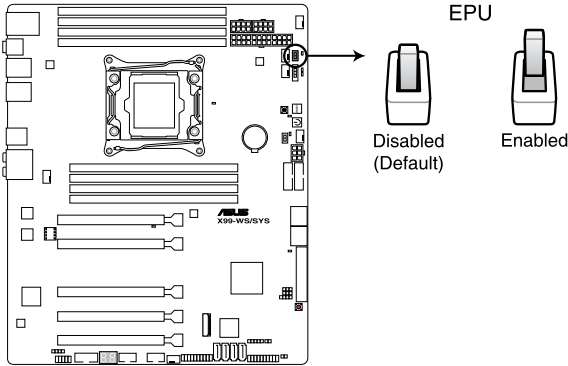
X99-WS/SYS EPU switch

- The EPU LED (O2LED3) near the EPU switch lights up when you enable the EPU switch. Refer to section **3.4 Onboard LEDs** for the exact location of the EPU LED.

- If you enable this switch under Windows® OS environment, the EPU function will be activated after the next system bootup.

- You may change the EPU settings in BIOS setup program and enable the EPU function at the same time. However, the system will use the last setting you have made.

6. Clear CMOS button (CLR_CMOS)

Press this button to clear the BIOS setup information only when the systems hangs due to overclocking.
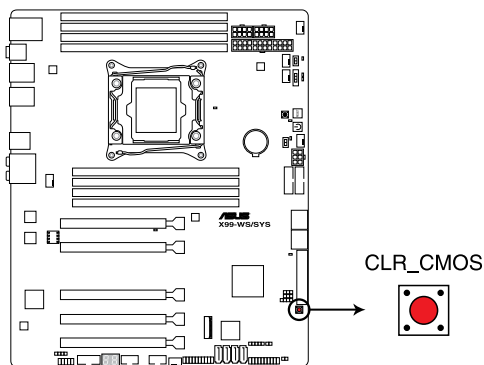
CLR_CMOS

X99-WS/SYS CLR_CMOS button

7. EZ XMP switch

Enable this switch to overclock the installed DIMMs, allowing you to enhance the DIMM's speed and performance.

EZ_XMP

Disabled (Default)   Enabled
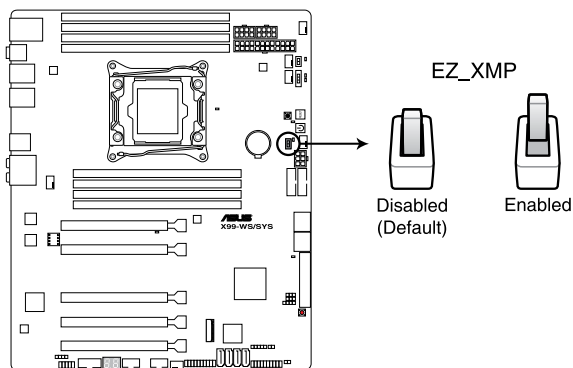
X99-WS/SYS EZ_XMP switch

The EZ XMP LED (XLED1) lights up when you enable the EZ XMP switch. For the location of the EZ XMP LED, refer to section **3.4 Onboard LEDs**.

3.3 Jumpers

1. **CPU Over Voltage jumper (3-pin CPU_OV)**

    The CPU Over Voltage jumper allows you to set a higher CPU voltage for a flexible overclocking system, depending on the type of the installed CPU. To gain more CPU voltage setting, insert the jumper to pins 2-3. To go back to its default CPU voltage setting, insert the jumper to pins 1-2.

CPU_OV

1 2   2 3

Disable   Enable
(default setting)
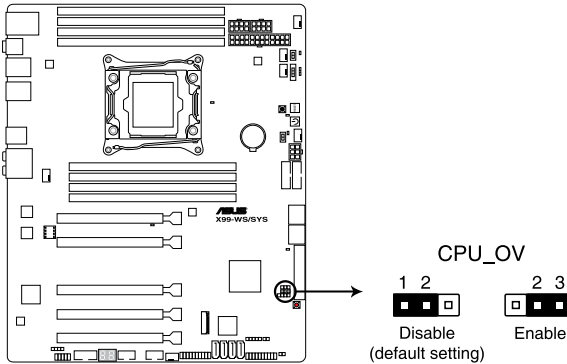
X99-WS/SYS CPU_OV setting

2. **Chassis Fan control setting jumper (3-pin CHAFAN_SEL)**

    These jumpers allow you to switch fan pin selection. The CHAFAN_SEL jumper is for the front fans and rear fans control. Set pins 1-2 to let the BIOS control the settings of the chassis fans. Set pins 2-3 to control the settings of the 4-pin PWM fans.

CHAFAN_SEL

1 2   2 3

Chosen   4Pin
By BIOS   PWM FAN
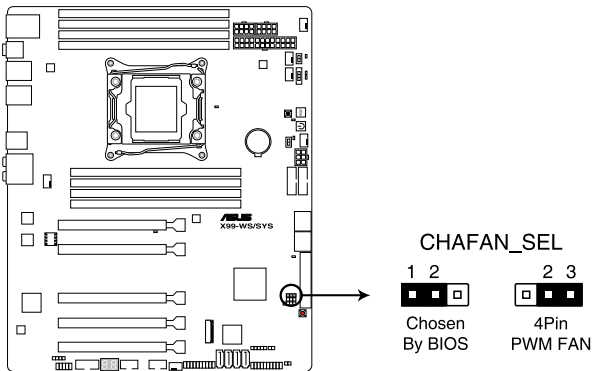
X99-WS/SYS CHAFAN setting

3.4 Onboard LEDs

1. **Diagnosis LEDs (DIAG_VGA, DIAG_HDD, DIAG_DRAM, DIAG_CPU)**

   The Diagnosis LEDs provide the status of these key components during POST (Power-On-Self Test): CPU, memory modules, VGA card, and hard disk drives. If an error is found, the critical component's LED stays lit up until the problem is solved.
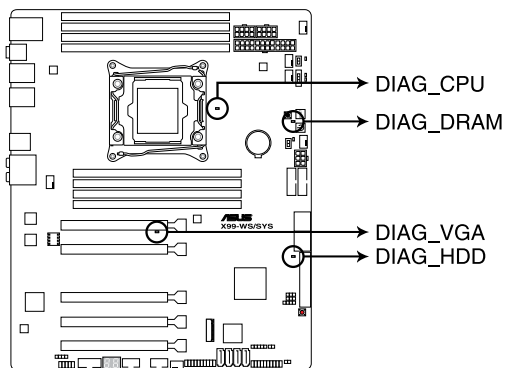
X99-WS/SYS Diagnosis LED

2. **TPU LED (TPU_LED)**

   The TPU LED lights up when the TPU switch is enabled.
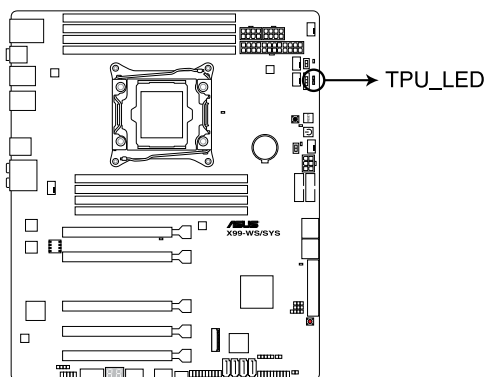
X99-WS/SYS TPU LEDs

3. EPU LED (O2LED3)

The EPU LED lights up when the EPU switch is enabled.
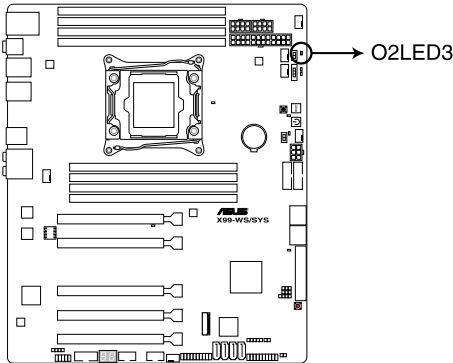
X99-WS/SYS EPU LED

4. EZ XMP LED (XLED1)

This LED lights up when you enable the EZ XMP switch.
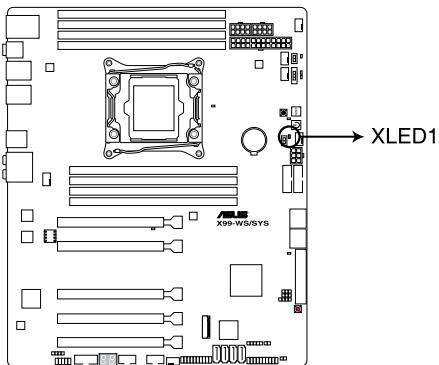
X99-WS/SYS XLED1

5. Q-Code LEDs

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.

X99-WS/SYS Q-Code LED
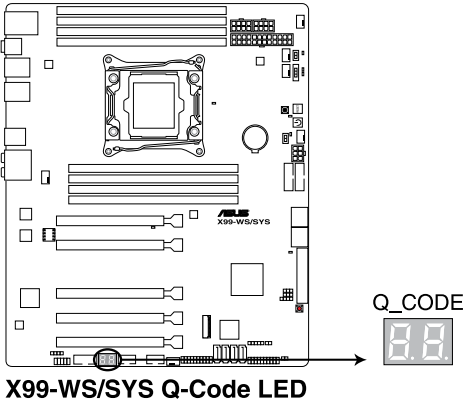
Q-Code table

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
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

(continued on the next page)

Code	Description
FA	Invalid recovery capsule
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
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

(continued on the next page)

Code	Description
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.

3.5 Internal connectors

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

This connector is for the serial (COM) port. Connect the serial port module cable to one of these connectors, then install the module to a slot opening at the back of the system chassis.
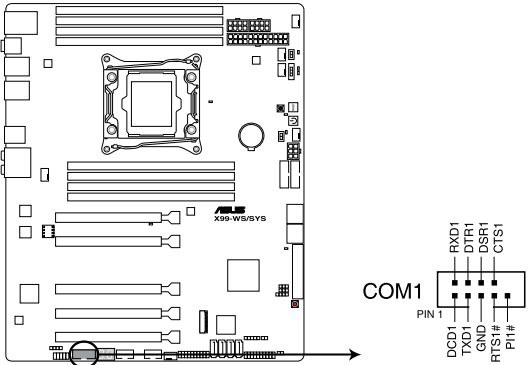
X99-WS/SYS Serial port connector

COM1

2.   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.

SPDIF_OUT
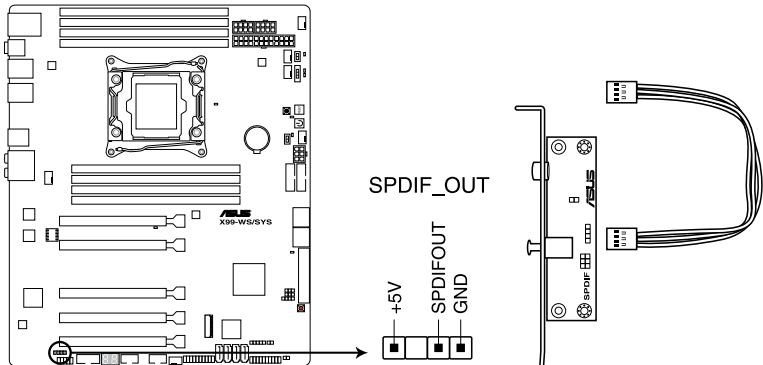
X99-WS/SYS Digital audio connector

The S/PDIF module is purchased separately.

3. Intel® X99 Serial ATA 6 Gb/s connectors (7-pin SATA6G_12, SATA6G_34, SATA6G_56/SATAEXPRESS_1)

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 through the onboard Intel® X99 chipset.
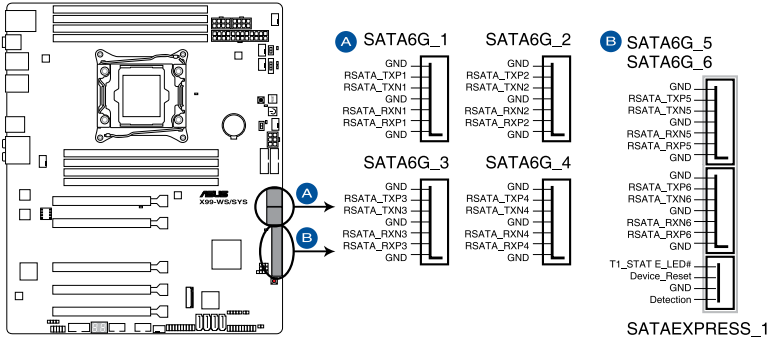
X99-WS/SYS Intel® SATA 6 Gb/s connectors
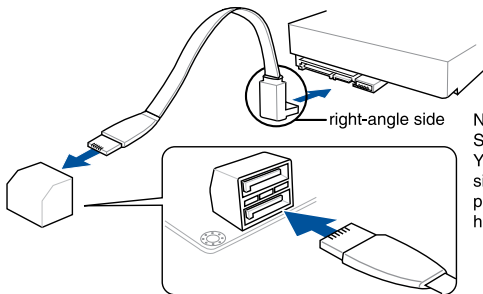
right-angle side

NOTE: Connect the right-angle side of SATA signal cable to SATA device. You may also connect the right-angle side of SATA cable to the onboard SATA port to avoid mechanical conflict with huge graphics cards.

- 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 **[RAID Mode]**. Refer to section **4.6.3 PCH Storage Configuration** for details.

- Before creating a RAID set, refer to the manual bundled in the motherboard support DVD.

- The SATAEXPRESS_1 connector can support one SATA Express device or two SATA devices.

- Due to chipset behavior, the SATA6G_78 and SATA6G_910 ports (black) do not support Intel® Rapid Storage Technology and RAID configuration.

4. **Serial ATA 3.0 6 Gb/s connectors (7-pin SSATA_1-4 [gray])**

These connectors are for the Serial ATA signal cables for Serial ATA hard disk drives that allows up to 6 Gbps of data transfer rate.

If you installed Serial ATA hard disk drives, you can use a software RAID solution to create a RAID 0, RAID 1, RAID 5, or a RAID 10 configuration. For more information on the SATA RAID solutions supported on this motherboard, refer to the RAID Configuration chapter of this user guide.

X99-WS/SYS SSATA connectors
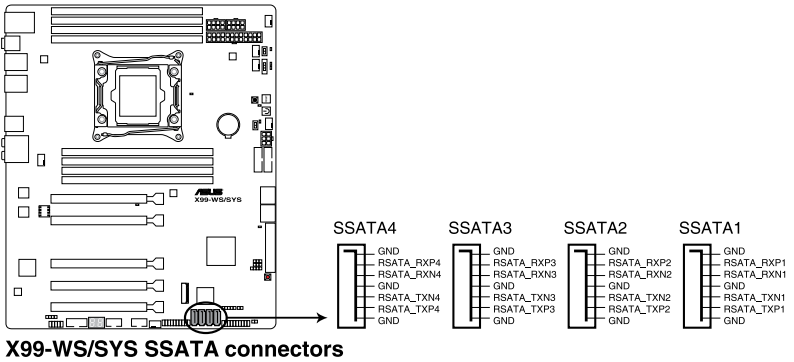
5. **System Management Bus (SMBUS) connector (5-1 pin SMBUS1)**

This connector controls the system and power management-related tasks. This connector processes the messages to and from devices rather than tripping the individual control lines.

X99-WS/SYS SMBUS connector
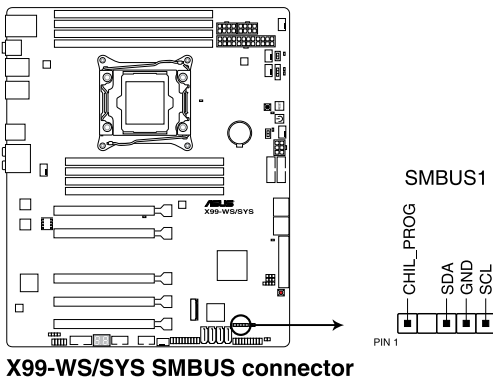
6. Front panel audio connector (10-1 pin AAFP)

This connector is for a chassis-mounted front panel audio I/O module that supports either HD Audio or legacy AC`97 audio standard. Connect one end of the front panel audio I/O module cable to this connector.

X99-WS/SYS Analog front panel connector
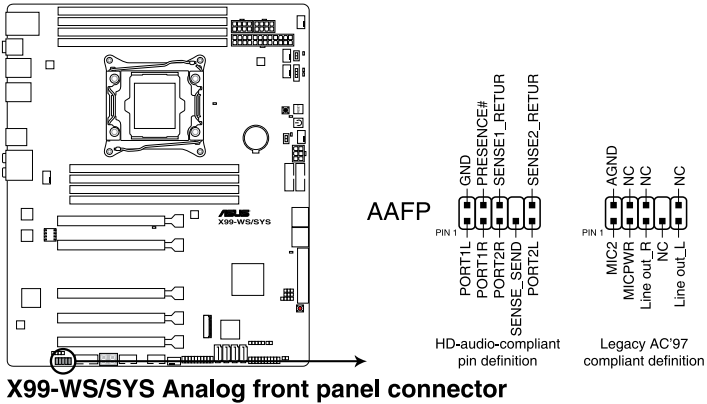
- We recommend that you connect a high-definition front panel audio module to this connector to avail of the motherboard's high-definition audio capability.

- If you want to connect a high-definition or an AC'97 front panel audio module to this connector, set the Front Panel Type item in the BIOS setup to **[HD Audio]** or **[AC97]**.

7. **USB 3.0 connectors (20-1 pin USB3_12, USB3_34)**

These connectors allow you to connect a USB 3.0 module for additional USB 3.0 front or rear panel ports. With an installed USB 3.0 module, you can enjoy all the benefits of USB 3.0 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.
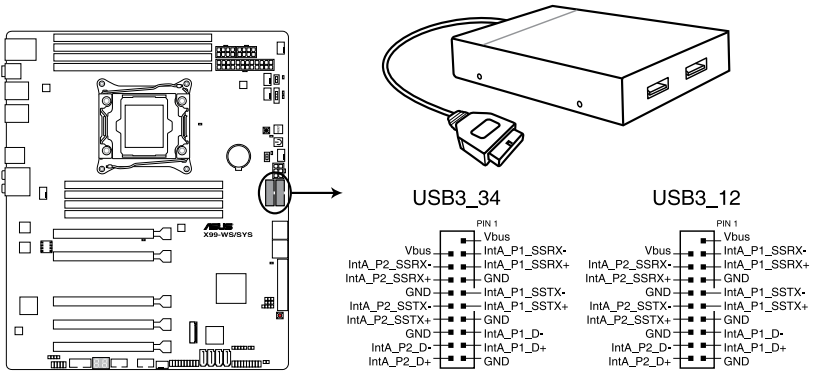
X99-WS/SYS USB3.0 connectors

The USB 3.0 module is purchased separately.

- Ensure to install the related driver to fully use the USB 3.0 ports under Windows® 7.

- The plugged USB 3.0 device may run on xHCI or EHCI mode depending on the operating system's setting.

- These USB 3.0 ports support native UASP transfer standard in Windows® 8 / Windows® 8.1 and Turbo Mode when using USB 3.0 Boost feature.

8. **USB 2.0 connectors (10-1 pin USB910; US1112)**

These connectors are for USB 2.0 ports. Connect the USB module cable to any of these connectors, then install the module to a slot opening at the back of the system chassis. These USB connectors comply with USB 2.0 specification that supports up to 48 Mb/s connection speed.
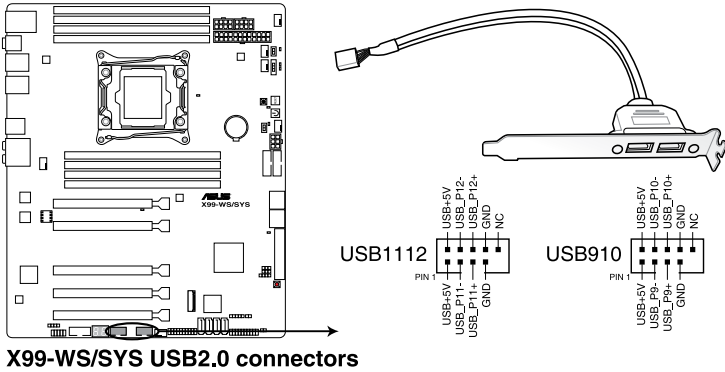
X99-WS/SYS USB2.0 connectors

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

You can connect the front panel USB cable to the ASUS Q-Connector (USB) first, and then install the Q-Connector (USB) to the USB connector onboard if your chassis supports front panel USB ports.

The USB 2.0 module is purchased separately.

9. **CPU and chassis fan connectors (4-pin CPU_FAN1-2; 4-pin REAR_FAN1; 4-pin FRNT_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.

⚠️
- 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.

A FRNT_FAN3

CHA FAN PWM
CHA FAN IN
CHA FAN PWR
GND

B CPU_FAN2

CPU FAN PWM
CPU FAN IN
CPU FAN PWR
GND

C CPU_FAN1

CPU FAN PWM
CPU FAN IN
CPU FAN PWR
GND

D FRNT_FAN2

CHA FAN PWM
CHA FAN IN
CHA FAN PWR
GND

E REAR_FAN1

CHA FAN PWM
CHA FAN IN
CHA FAN PWR
GND

F FRNT_FAN1

GND
CHA FAN PWR
CHA FAN IN
CHA FAN PWM

X99-WS/SYS Fan connectors
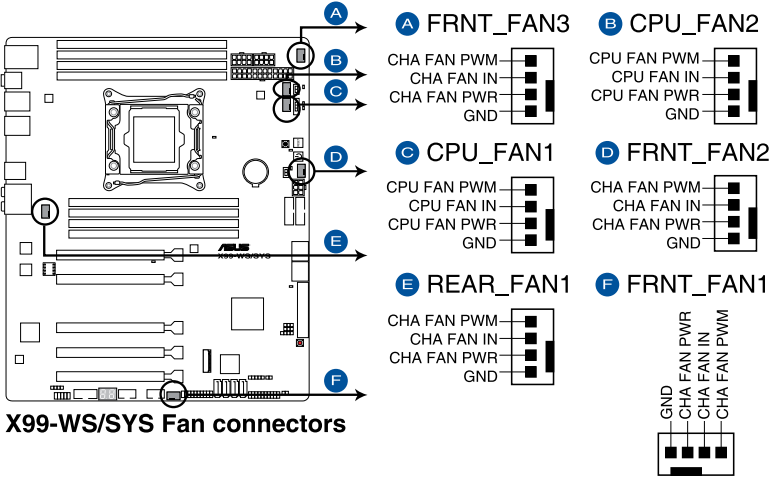
📝 The CPU_FAN1-2 connectors support the CPU fan of maximum 1A (12 W) fan power.

10. ATX power connectors (24-pin EATXPWR12V; 8-pin EATX12V; 8-pin EATX12V1; 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.
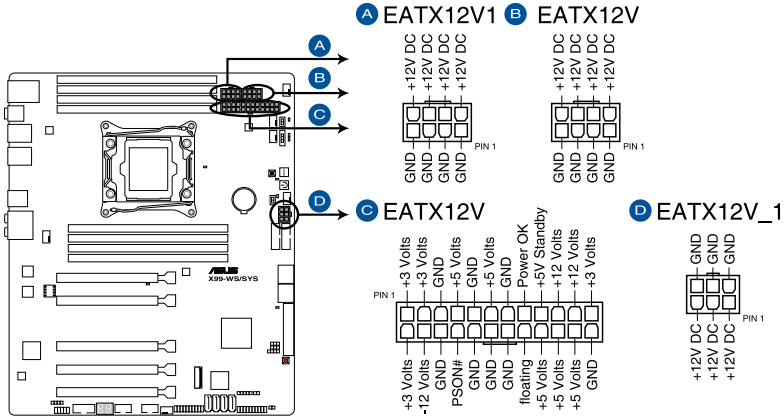
X99-WS/SYS ATX power connectors

- 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 4-pin/8-pin EATX12 V 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.

- If you are uncertain about the minimum power supply requirement for your system, refer to the Recommended Power Supply Wattage Calculator at http://support.asus. com/PowerSupplyCalculator/PSCalculator.aspx?SLanguage=en-us for details.

11. System panel connector (20-1 pin PANEL)

This connector supports several chassis-mounted functions.

X99-WS/SYS System panel connector
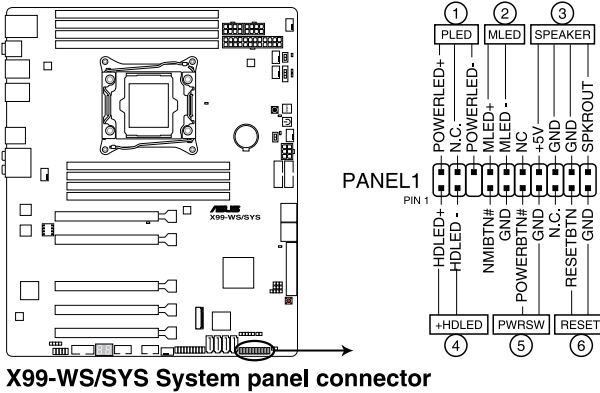
- **System power LED (2-pin PLED)**

  This 2-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.

12.   TPM connector (20-1 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.

X99-WS/SYS TPM connector
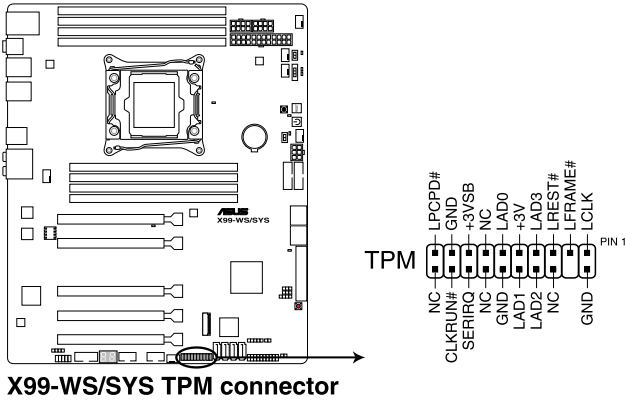
The TPM module is purchased separately.

13.   DirectKey connector (2-pin DRCT)

This connector is for the chassis-mounted button that supports the DirectKey function. Connect the button cable that supports DirectKey, from the chassis to this connector on the motherboard.

X99-WS/SYS DRCT connector
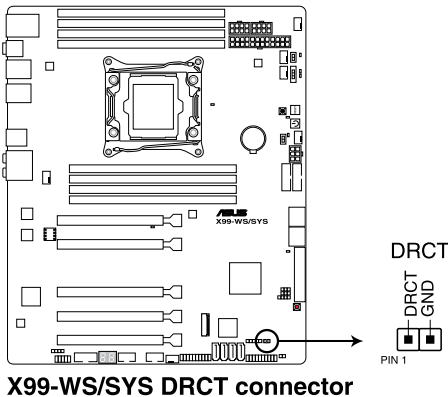
Ensure that your chassis comes with the extra button cable that supports the DirectKey feature. Refer to the technical documentation that came with the chassis for details.

14. M.2 socket 3

This socket allows you to install an M.2 (NGFF) SSD module.

M.2(SOCKET3)

X99-WS/SYS M.2(SOCKET3)
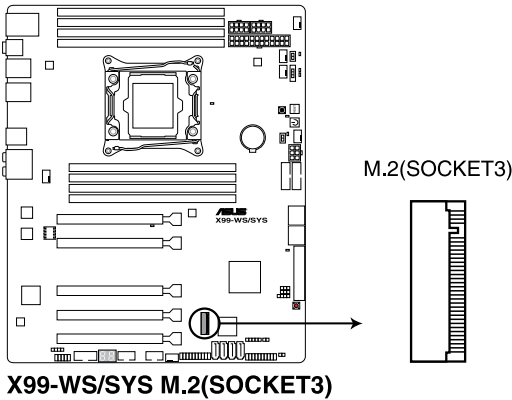
- This socket supports M Key and type 2260/2280 storage devices.

- This socket supports PCIe and SATA modes.

15. T_Sensor connector (2-pin T_SENSOR1)

This connector is for the thermistor cable that allows you to monitor the temperature of your motherboard's critical components and connected devices.

T_SENSOR1

PIN 1

SENSOR IN

GND

X99-WS/SYS T_SENSOR connector
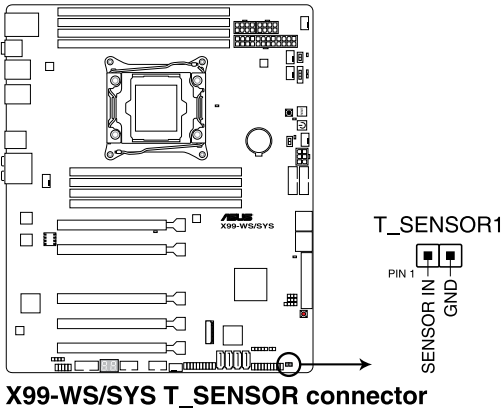
The thermistor cable is purchased separately.

16. Chassis intrusion connector (4-1 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.

By default, the pin labeled "Chassis Signal" and "Ground" are shorted with a jumper cap. Remove the jumper caps and enable the related options in BIOS if you intend to use the chassis intrusion detection feature.
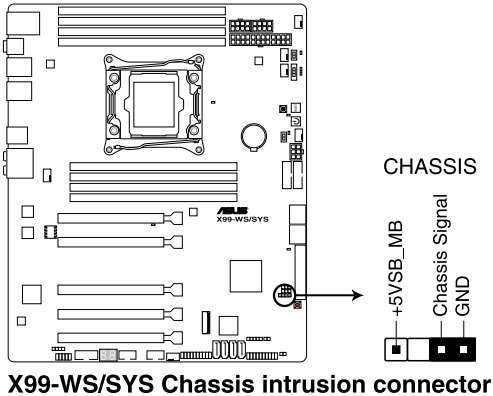
X99-WS/SYS Chassis intrusion connector

A message appears when you connect the sensor or switch at the first time or when you reconnect the sensor or switch to this connector. Reset the system to exit the message.

BIOS Setup

4

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, rename it as **X99WSS.CAP** for this motherboard.

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> during the Power-On Self Test (POST). If you do not press <Delete>, 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 **4.10 Exit menu** for details.
>
> • If the system fails to boot after changing any BIOS setting, try to clear the CMOS and reset the motherboard to the default value. See section **3.2 Onboard buttons and switches** for information on how to erase the RTC RAM via the Clear CMOS button.
>
> • The BIOS setup program does not support Bluetooth devices.

4.2.1   Advanced Mode

The Advanced Mode provides advanced options for experienced end-users to configure the BIOS settings. The figure below shows an example of the Advanced Mode. Refer to the following sections for the detailed configurations.

EZ Tuning Wizard

Quick Note

MyFavorite

Hot Keys

Language

Menu bar

Sub-menu item

Item description

Configuration fields

Scroll bar

Menu items

Shows the last modified items

Displays the CPU/motherboard temperature,
CPU and memory voltage output

Menu bar

The menu bar on top of the screen has the following main items:

My Favorites	For saving the frequently-used system settings and configuration.
Main	For changing the basic system configuration
Ai Tweaker	For changing the overclocking settings
Advanced	For changing the advanced system settings
Monitor	For displaying the system temperature, power status, and changing the fan settings.
Boot	For changing the system boot configuration
Tool	For configuring options for special functions
Exit	For selecting the exit options and loading default settings

Menu items

The highlighted item on the menu bar displays the specific items for that menu. For example, selecting **Main** shows the Main menu items.

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

Submenu items

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

Language

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

MyFavorites (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 **4.3 My Favorites** for more information.

EZ Tuning Wizard (F11)

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

Refer to section **4.2.2 EZ Tuning Wizard** for more information.

Quick Note (F9)

This button above the menu bar allows you to key in notes of the activities that you have done in BIOS.

> • The Quick Note function does not support the following keyboard functions: delete, cut, copy and paste.
>
> • You can only use the alphanumeric characters to enter your notes.

Hot keys

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

Scroll bar

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

General help

At the top right corner 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.
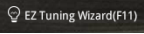
4.2.2 EZ Tuning Wizard

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

System OC setup   **RAID setup**
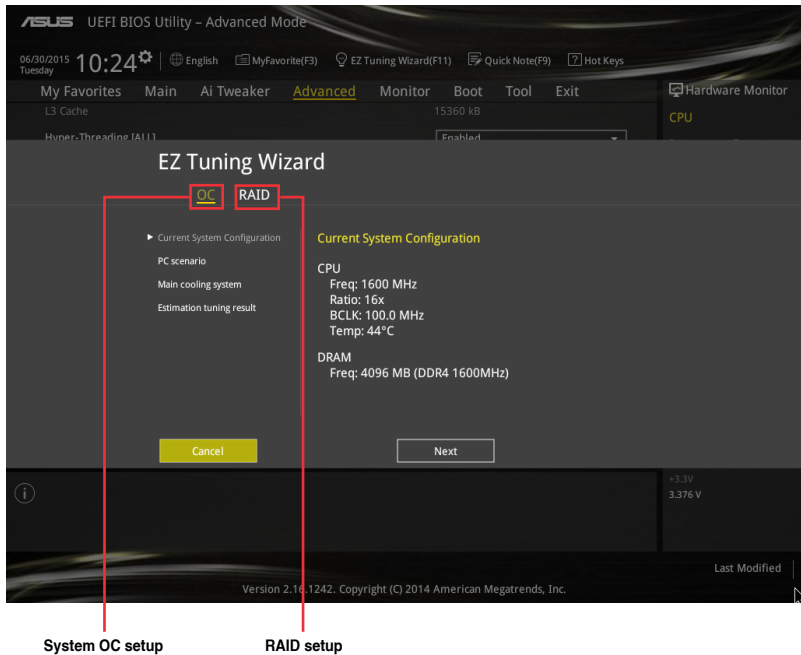
Tuning your system settings

To tune your settings:

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

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

3. Select the CPU fan type (**Box cooler**, **Tower cooler**, or **Water cooler**) that you installed then click **Next**.
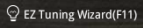
> If you are not sure of the CPU fan type, click **I'm not sure**. The system automatically detects the CPU fan type.

4. Click **Next** then click **Yes** to confirm auto-tuning.

Creating RAID

To create RAID:

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

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

> - Ensure that your HDDs have no existing RAID volumes.
> - Ensure to connect your HDDs to Intel® SATA connectors.

3. Select the type of storage for your RAID **Easy Backup** or **Super Speed**, then click **Next**.

   a. For Easy Backup, click **Next** then select from **Easy Backup (RAID1)** or **Easy Backup (RAID10)**.

   > You can only select Easy Backup (RAID 10) if you connect four (4) HDDs.
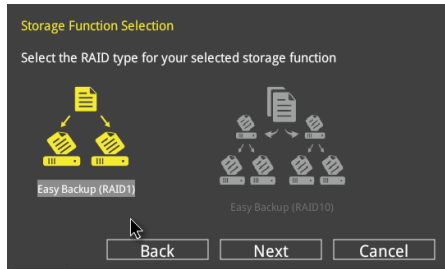
   b. For Easy Backup, click **Next** then select from **Super Speed (RAID0)** or **Super Speed (RAID5)**.
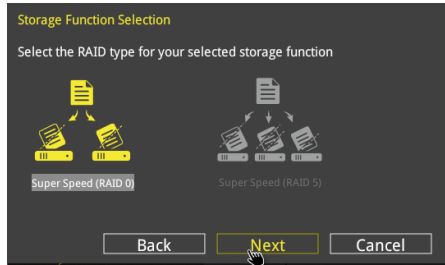
4. After selecting the type of RAID, click **Next** then click **Yes** to continue the RAID setup.

5. After the RAID setup is done, click **Yes** to exit the setup then click **OK** to reset your system.
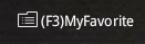
4.3   My Favorites

MyFavorites is your personal space where you can easily save and access your favorite BIOS items.
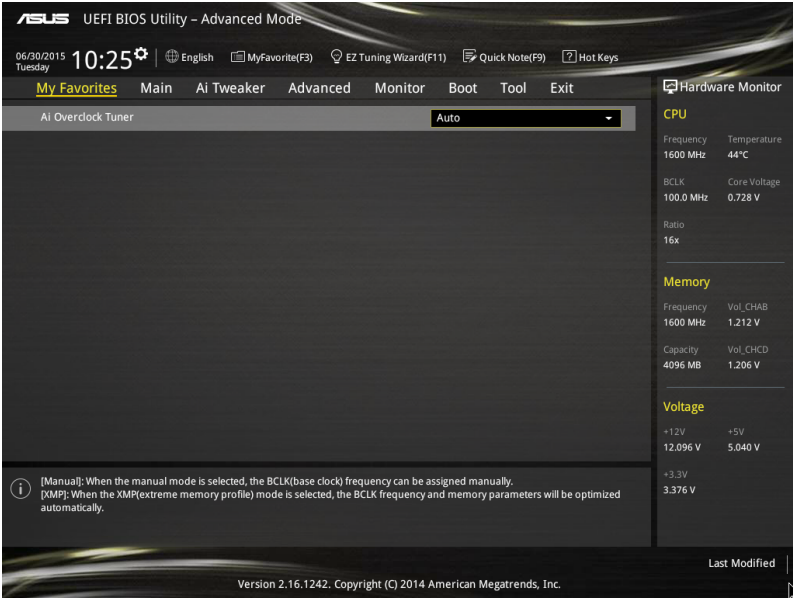
Adding items to My Favorites

To add BIOS items:

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

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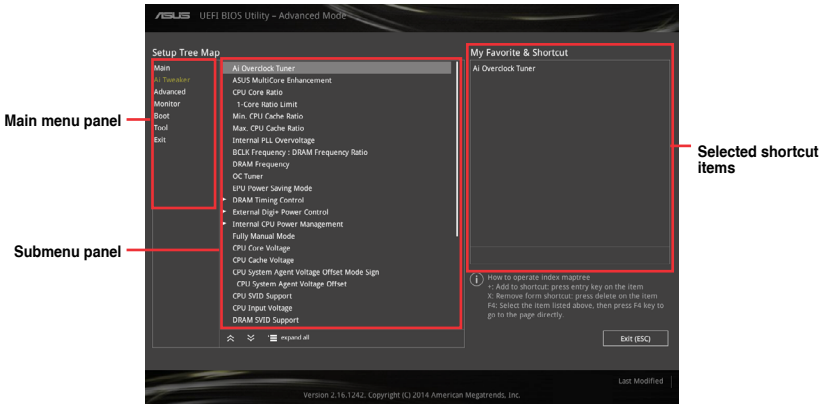
3.   Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and tap or click ➕ or press <Enter> on your keyboard.

> 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 section **3.2 Onboard buttons and switches** for information on how to erase the RTC RAM via the Clear CMOS button.

- 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.   Confirm the password when prompted.

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.   Confirm the password when prompted.

To clear the administrator password, follow the same steps as in changing an administrator password, but press <Enter> when prompted to create/confirm the password. After you clear the password, the **Administrator Password** item on top of the screen shows **Not Installed**.

User Password

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

To set a user password:

1.   Select the **User Password** item and press <Enter>.

2.   From the **Create New Password** box, key in a password, then press <Enter>.

3.   Confirm the password when prompted.

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.   Confirm the password when prompted.

To clear the user password, follow the same steps as in changing a user password, but press <Enter> when prompted to create/confirm the password. After you clear the password, the **User Password** item on top of the screen shows **Not Installed**.

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 CPU and DIMM model you installed on the motherboard.

Scroll down to display other BIOS items.

Ai Overclock Tuner [Auto]

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

[Auto]   Loads the optimal settings for the system.

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

The following item appears only when you set the Ai Overclocking Tuner to **[Manual]**.

CPU Strap [Auto]

This item allows you to select a strap close to your target BCLK (base clock) for an extreme overclocking, or leave it at **[Auto]** for the BIOS to upgrade.
Configuration options: [Auto] [100MHz] [125MHz] [166MHz] [250MHz]

Source Clock Tuner [Auto]

This item allows you to select the source clock based on the assigned CPU strap for a better overclocking capability.

Configuration options: [8Ohm dbl] [7Ohm dbl] [6Ohm dbl] [5Ohm dbl] [4Ohm dbl] [3Ohm dbl] [2Ohm dbl]

PLL Selection [Auto]

This item is set to LC PLL by default for better stability. Select SB PLL when the BCLK (base clock) frequency is far away from 100 MHz. This may affect the function of other devices that need precise clock jitters.
Configuration options: [Auto] [LC PLL] [SB PLL]

Filter PLL [Auto]

Set this item to high BCLK (base clock) mode when using a very high BCLK to improve overclocking capability.
Configuration options: [Auto] [Low BCLK mode] [High BCLK mode]

BCLK Frequency [Auto]

This item allows you to set the BCLK (base clock) frequency to enhance the system performance. Use the <+> or <-> keys to adjust the value. The values range from 80.0 MHz to 300.0 MHz.

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

Initial BCLK Frequency [Auto]

This item allows you to start overclocking the system from the initial BCLK (base clock) frequency to the assigned BCLK frequency. Use the <+> or <-> keys to adjust the value. The value ranges depend on the value you set on BCLK Frequency.

ASUS MultiCore Enhancement [Auto]

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

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

CPU Core Ratio [Sync All Cores]

This item allows you to set the CPU core ratio limit per core or synchronize automatically to all cores.
Configuration options: [Auto] [Sync All Cores] [Per Core]

1-Core Ratio Limit [Auto]

Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 1-Core Limit value that must be higher than or equal to the 2-Core Ratio Limit.

2-Core Ratio Limit [Auto]
Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 2-Core Limit value that must be higher than or equal to the 3-Core Ratio Limit.

If you assign a value for 2-Core Ratio Limit, do not set the 1-Core Ratio Limit to **[Auto]**.

3-Core Ratio Limit [Auto]
Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 3-Core Limit value that must be higher than or equal to the 4-Core Ratio Limit.

If you assign a value for 3-Core Ratio Limit, do not set the 1-Core Ratio Limit and 2-Core Ratio Limit to **[Auto]**.

4-Core Ratio Limit [Auto]
Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 4-Core Limit value that must be higher than or equal to the 5-Core Ratio Limit.

If you assign a value for 4-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, and 3-Core Ratio to **[Auto]**.

5-Core Ratio Limit [Auto]
Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 5-Core Limit value that must be higher than or equal to the 6-Core Ratio Limit.

If you assign a value for 5-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio, and 4-Core Ratio to **[Auto]**.

6-Core Ratio Limit [Auto]
Select **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 6-Core Limit value.

If you assign a value for 6-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio, 4-Core Ratio, and 5-Core Ratio to **[Auto]**.

Min. CPU Cache Ratio [Auto]

This item allows you to set the minimum possible ratio on the Uncore part of the processor. Use the <+> or <-> keys to adjust the value. The values depend on the CPU installed.

Max. CPU Cache Ratio [Auto]

This item allows you to set the maximum possible ratio on the Uncore part of the processor. Use the <+> or <-> keys to adjust the value. The values depend on the CPU installed.

Internal PLL Overvoltage [Auto]

This item allows you to enable the internal PLL Overvoltage for K-SKU CPUs to get the extreme overclocking capability.

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

BCLK Frequency: DRAM Frequency Ratio [Auto]

This item allows you to set the base clock frequency of the DRAM frequency ratio.

[Auto]   The DRAM ratio is set to its optimized settings.

[100:100]   The DRAM ratio is set to 100:100.

[100:133]   The DRAM ratio is set to 100:133.

DRAM Frequency [Auto]

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: [DDR4-800MHz] [DDR4-1000MHz] [DDR4-1067MHz] [DDR4-1200MHz] [DDR4-1333MHz] [DDR4-1400MHz] [DDR4-1600MHz] [DDR4-1800MHz] [DDR4-1866MHz] [DDR4-2000MHz] [DDR4-2133MHz] [DDR4-2200MHz] [DDR4-2400MHz] [DDR4-2600MHz] [DDR4-2666MHz] [DDR4-2800MHz] [DDR4-2933MHz] [DDR4-3000MHz] [DDR4-3200MHz] [DDR4-3400MHz] [DDR4-3467MHz] [DDR4-3600MHz] [DDR4-3733MHz] [DDR4-3800MHz] [DDR4-4000MHz]

OC Tuner [Keep Current Settings]

This item allows you to automatically overclock the CPU and DRAM frequencies and voltage for an enhanced system performance. It also accelerates the CPU graphics performance to the extreme depending on the CPU graphics loading.

Configuration options: [Keep Current Settings] [Ratio Tuning] [BCLK + Ratio Tuning]

> Ensure that you installed an efficient CPU fan for CPU and graphics loading before selecting either **[BCLK First]** or **[Ratio First]**. To keep the current overclocking tuner status, select **[Keep Current Settings]**.

EPU Power Saving Mode [Disabled]

The ASUS EPU (Energy Processing Unit) sets the CPU in its minimum power consumption settings. Enable this item to set lower CPU VCCIN and Vcore voltages and achieve the best energy saving condition.

Configuration options: [Disabled] [Enabled]

DRAM Timing Control

The subitems in this menu allow you to set the DRAM timing control features. Use the <+> or <-> keys to adjust the value. 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 [Auto]
Configuration options: [Auto] [1] – [31]

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

DRAM RAS# PRE Time [Auto]
Configuration options: [Auto] [1] – [31]

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

DRAM Command Rate [Auto]
Configuration options: [Auto] [Timing T1] – [Timing T3]

Secondary Timings

DRAM RAS# to RAS# Delay [Auto]
Configuration options: [Auto] [1] – [7]

DRAM RAS# to RAS# Delay L [Auto]
Configuration options: [Auto] [1] – [7]

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

DRAM Refresh Interval [Auto]
Configuration options: [Auto] [1] – [32767]

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

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

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

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

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

DRAM CKE Minimum Pulse Width [Auto]
Configuration options: [Auto] [4] – [8]

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

Third Timings

tRRDR [Auto]
Configuration options: [Auto] [1] - [7]

tRRDD [Auto]
Configuration options: [Auto] [1] - [7]

tWWDR [Auto]
Configuration options: [Auto] [1] - [7]

tWWDD [Auto]
Configuration options: [Auto] [1] - [7]

tRWDR [Auto]
Configuration options: [Auto] [1] - [7]

tWRDR [Auto]
Configuration options: [Auto] [1] - [7]

tWRDD [Auto]
Configuration options: [Auto] [1] - [7]

tRWSR [Auto]
Configuration options: [Auto] [1] - [7]

tCCD [Auto]
Configuration options: [Auto] [1] - [7]

tUWRDR [Auto]
Configuration options: [Auto] [1] - [3]

tRWDR2 [Auto]
Configuration options: [Auto] [0] - [31]

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

tRWSR2 [Auto]
Configuration options: [Auto] [0] - [31]

tWRDD2 [Auto]
Configuration options: [Auto] [0] - [31]

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

tCCD_L [Auto]
Configuration options: [Auto] [1] – [3]

RTL IOL control

> ***DRAM RTL INIT Value [Auto]***
> Configuration options: [Auto] [1] - [127]
> ***DRAM RTL (CHA D0 R0) [Auto]***
> Configuration options: [Auto] [1] - [127]

DRAM RTL (CHA D0 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHA D1 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHA D1 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHB D0 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHB D0 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHB D1 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHB D1 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHC D0 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHC D0 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHC D1 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHC D1 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHD D0 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHD D0 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHD D1 R0) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM RTL (CHD D1 R1) [Auto]
Configuration options: [Auto] [1] - [127]

DRAM IO-L (CHA D0 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHA D0 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHA D1 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHA D1 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHB D0 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHB D0 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHB D1 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHB D1 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHC D0 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHC D0 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHC D1 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHC D1 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHD D0 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHD D0 R1) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHD D1 R0) [Auto]
Configuration options: [Auto] [1] - [255]

DRAM IO-L (CHD D1 R1) [Auto]
Configuration options: [Auto] [1] - [255]

IO control

MC Vref(CHA) [Auto]
Configuration options: [Auto] [50] - [99.911]

MC Vref(CHB) [Auto]
Configuration options: [Auto] [50] - [99.911]

MC Vref(CHC) [Auto]
Configuration options: [Auto] [50] - [99.911]

MC Vref(CHD) [Auto]
Configuration options: [Auto] [50] - [99.911]

DRAM Vref (CHA) [Auto]
Configuration options: [Auto] [60] - [99]

DRAM Vref (CHB) [Auto]
Configuration options: [Auto] [60] - [99]

DRAM Vref (CHC) [Auto]
Configuration options: [Auto] [60] - [99]

DRAM Vref (CHD) [Auto]
Configuration options: [Auto] [60] - [99]

CTL Vref (CHAB) Sign [+]
Configuration options: [+] [-]

CTL Vref (CHAB) [Auto]
Configuration options: [Auto] [0.00] - [0.20]

CTL Vref (CHCD) Sign [+]
Configuration options: [+] [-]

CTL Vref (CHCD) [Auto]
Configuration options: [Auto] [0.00] - [0.20]

Receiver DQ Pre-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Receiver DQ De-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Transmitter DQ Pre-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Receiver DQS Pre-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Receiver DQS De-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Transmitter DQS Pre-emphasis [Auto]
Configuration options: [Auto] [0.90] - [1.60]

Receiver CMD Pre-emphasis [Auto]
Configuration options: [Auto] [0.80] - [1.60]

Receiver CMD De-emphasis [Auto]
Configuration options: [Auto] [0.80] - [1.60]

Transmitter CMD De-emphasis [Auto]
Configuration options: [Auto] [0.80] - [1.60]

Receiver CLK Pre-emphasis [Auto]
Configuration options: [Auto] [1.00] - [2.00]

Receiver CLK De-emphasis [Auto]
Configuration options: [Auto] [1.00] - [2.00]

Transmitter CLK Pre-emphasis [Auto]
Configuration options: [Auto] [1.00] - [2.00]

Receiver CTL Pre-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

Receiver CTL De-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

Transmitter CTL Pre-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

Receiver ODT Pre-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

Receiver ODT De-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

Transmitter ODT De-emphasis [Auto]
Configuration options: [Auto] [1.00] - [1.60]

MISC

DRAM Eventual Voltage (CHA/CHB/CHC/CHD) [Auto]

Use <+> or <-> to adjust the eventual voltages of the DIMM slots. The values range from 0.8 V to 1.9 V with a 0.10 V increment.

DRAM CLK Period [Auto]

This item allows you to set a DRAM clock period.
Configuration options: [Auto] [1] – [19]

Memory optimize Control [Auto]

This item allows you to optimize the memory control.
Configuration options: [Auto] [Enabled] [Disabled]

Enhanced Training (CHA/CHB/CHC/CHD) [Auto]

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

MemTest [Auto]

This item allows you to enable or disable the memory testing.
Configuration options: [Auto] [Enabled] [Disabled]

Attempt Fast Boot [Auto]

This item allows the portion of the memory reference code to be skipped when possible to increase boot speed.
Configuration options: [Auto] [Enabled] [Disabled]

Attempt Fast Cold Boot [Auto]

This item allows the portion of the memory reference code to be skipped when possible to increase boot speed.
Configuration options: [Auto] [Enabled] [Disabled]

DRAM Training [Auto]

This item allows the system to set the training channel status of the installed DRAMs.
Configuration options: [Auto] [Ignore] [Enabled]

DRAM SPD Write [Disabled]

This item allows you to enable/disable the DRAM SPD write for memory SMBus programming.
Configuration options: [Enabled] [Disabled]

External Digi+ Power Control

CPU Input Boot Voltage [Auto]

This item allows you to set a higher CPU input boot voltage for better overclocking capability. Use the <+> or <-> keys to adjust the value. The values range from 0.80 V to 2.7 V with an interval of 10 V.

CPU Load-line Calibration [Auto]

Load-line is defined by Intel® specification and affects CPU power voltage. The CPU working voltage decreases proportionally to CPU loading. Higher load-line calibration could get higher voltage and good overclocking performance, but increases the CPU and VRM thermal conditions. Select from levels 1 to 9 to adjust the CPU power voltage from 0% to 125%.
Configuration options [Auto] [Level 1] - [Level 9]

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

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

CPU VRM Switching Frequency [Auto]

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

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

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

Fixed CPU VRM Switching Frequency (KHz) [300]
This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> keys to adjust the value. The values range from 300 KHz to 600 KHz with an interval of 50 KHz.

VRM Spread Spectrum [Disabled]

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

Active Frequency Mode [Disabled]

This item allows to enhance the power saving condition of your system.
Configuration options: [Disabled] [Enabled]

CPU Power Phase Control [Auto]

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

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

The following item appears only when you set the CPU Power Phase Control to **[Power Phase Response]**.

Power Phase Response [Fast]
This item allows you to set a faster phase response for the CPU to increase system performance or to slower phase response to decrease DRAM power efficiency.

Configuration options: [Ultra Fast] [Fast] [Medium] [Regular]

CPU Power Duty Control [T.Probe]

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

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

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

CPU Current Capability [Auto]

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

CPU Power Thermal Control [120]

A higher temperature brings a wider CPU power thermal range and extends the overclocking tolerance to enlarge the overclocking potential. Use the <+> or <-> keys to adjust the value. The values depend on the CPU installed.

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

DRAM AB/CD Current Capability [100%]

This item adjusts the total power range for DRAM overclocking. Set a higher value to provide a wider total power range and extends the overclocking frequency range simultaneously.
Configuration options: [100%] [110%] [120%] [130%]

DRAM AB/CD Switching Frequency [Auto]

This item affects the overclocking range and system stability. Set this item to **[Manual]** to manually set a fixed DRAM switching frequency for an increased overclocking range or enhanced system stability.

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

Fixed DRAM AB/CD Switching Frequency (KHz) [500]
This item allows you to set a higher frequency for an increased overclocking range or a lower frequency for an enhanced system stability. Use the <+> or <-> keys to adjust the value. The values range from 300 KHz to 550 KHz with an interval of 50 KHz.

DRAM Power Phase Control [CHA-CHB/CHC-CHD] [Standard]

This item allows you to set the DRAM power phase control.

Standard   The phase control is based on the CPU command.
Optimized   Set to the ASUS optimized phase tuning profile.
Extreme   Set to the full phase mode.

Internal CPU Power Management

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

Enhanced Intel SpeedStep Technology [Enabled]

This item allows the operating system to dynamically adjust the processor voltage and cores frequency which decreases the average power consumption the average heat production.
Configuration options: [Enabled] [Disabled]

Turbo Mode [Enabled]

This item allows you to enable your core processor's speed to run faster than the base operating frequency when it is below operating power, current and temperature specification limit.
Configuration options: [Disabled] [Enabled]

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

Turbo Mode Parameters
Long Duration Package Power Limit [Auto]
Allows you to limit the Turbo Ratio's time duration that exceeds the TDP (Thermal Design Power) for maximum performance. Use the <+> or <-> keys to adjust the value. The values range from 1 W t0 4095 W.

Package Power Time Window [Auto]
Also known as Power Limit 1, this item allows you to maintain the time window for Turbo Ratio over TDP (Thermal Design Power). Use the <+> or <-> keys to adjust the value. The values range from 1 to 127 in seconds.

Short Duration Package Power Limit [Auto]
Also known as Power Limit 2, this item allows you to provide rapid protection when the package power exceeds the Power Limit 1. Use the <+> or <-> keys to adjust the value. The values range from 1 W t0 4095 W.

CPU Integrated VR Current Limit [Auto]
Allows you to set a higher current limit to prevent frequency and power throttling when overclocking. Use the <+> or <-> keys to adjust the value. The values range from 0.125 to 1023.875 with a 0.125 interval.

CPU Internal Power Fault Control

CPU Integrated VR Fault Management [Auto]

Disable this item to prevent tripping the Fully Integrated Voltage Regulator when doing over-voltage. We recommend you to disable this item when overclocking.
Configuration options: [Auto] [Disabled] [Enabled]

CPU Internal Power Configuration

CPU Integrated VR Efficiency Management [Auto]

This item allows you to improve the power rating when the CPU is in low power state, or make the FIVR (fully integrated voltage regulator work in high performance at all times.
Configuration options: [Auto] [High Performance] [Balanced]

Extreme Over-voltage [Disabled]

Disable this item to protect the CPU from damage by over-voltage or enable to choose a high voltage for overclocking.

Configuration options: [Disabled] [Enabled]

> You can only enable this item if you enable the CPU OverVoltage jumper on your motherboard. Refer to section **3.1 Motherboard layout** for the location of the CPU Overvoltage jumper.

Fully Manual Mode [Disabled]

Set this item to [Enabled] to support voltage control via ROG Connect and OC Panel.

Configuration options: [Disabled] [Enabled]

> The following items appear only when you set Fully Manual Mode item to **[Disabled]**.

CPU System Agent Voltage Offset Mode Sign [+]

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

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

CPU System Agent Voltage Offset [Auto]

This item allows you to set the amount of voltage fed to the system agent of the processor including its PCIE controller and power control unit (PCU). Setting a high system agent voltage may enhance the overclocking capability. Use the <+> or <-> key to adjust the value. The values range from 0.001 V to 0.999 V at 0.001 V increment.

CPU Core Voltage [Auto]

This item allows you to configure the amount of Voltage fed to the CPU cores. Increase the voltage when configuring a high CPU core frequency.

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

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

CPU Core Voltage Override [Auto]

This item allows you to configure the CPU core voltage. Use<+> or <-> key to adjust the value. The values range from 0.001V to 1.920 V at 0.001 V increment.

> The following items appear only when you set the CPU Core Voltage 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 [Auto]

This item allows you to configure the CPU core voltage offset value. Use<+> or <-> key to adjust the value. The values range from 0.001 V to 0.999V at 0.001 V increment.

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

Additional Turbo Mode CPU Core Voltage [Auto]

This item allows you to set the amount of voltage fed to the CPU cores when running in turbo mode. Increase the voltage when configuring a high CPU core frequency. The voltage you set is affected by the offset value. Use the <+> or <-> keys to adjust the value. The values range from 0.001 V to 1.920 V with a 0.001 V interval.

Total Adaptive Mode CPU Core Voltage [Auto]

This item sums up the voltages of the CPU Core Voltage offset and Additional Turbo Mode CPU Core Voltage options.

CPU Cache Voltage [Auto]

This item allows you to configure the amount of voltage fed to the CPU uncores including it is cache. Increase the voltage when configuring a high CPU cache frequency.

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

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

CPU Cache Voltage Override [Auto]

This item allows you to configure the CPU cache voltage. Use<+> or <-> key to adjust the value. The values range from 0.001 V to 1.920 V at 0.001 V increment.

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

Offset Mode Sign [+]

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

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

CPU Cache Voltage Offset [Auto]

This item allows you to configure the CPU cache voltage offset value. Use<+> or <-> key to adjust the value. The values range from 0.001 V to 0.999 V at 0.001 V increment.

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

Additional Turbo Mode CPU Cache Voltage [Auto]

This item allows you to set the amount of voltage fed to the CPU cores when running in turbo mode. Increase the voltage when configuring a high CPU core frequency. The voltage you set is affected by the offset value. Use the <+> or <-> keys to adjust the value. The values range from 0.001 V to 1.920 V with a 0.001 V interval.

Total Adaptive Mode CPU Cache Voltage [Auto]

This item sums up the voltages of the CPU Cache Voltage offset and Additional Turbo Mode CPU Cache Voltage options.

CPU SVID Support [Auto]

Set this item to [Enabled] when overclocking. Disabling this item prevents the CPU from communicating with the external voltage regulator.

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

> The following items appear only when you set the CPU Core Voltage to **[Enabled]**.

SVID Voltage Override[Auto]

This item allows you to set a VCCIN for the CPU during initial part of POST. Use the <+> or <-> key to adjust the value. The values range from 0.001 V to 2.440 V at 0.001 V increment.

CPU Input Voltage [Auto]

This item allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> or <-> key to adjust the value. The values range from 0.80 V to 2.70 V at 0.010 V increment.

DRAM SVID Support [Auto]

Set this item to [Disabled] to stop the CPU from communicating with the external voltage regulator. Disable this item when you overclock your system.

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

DRAM Voltage (CHA/CHB, CHC/CHD) [Auto]

This item allows you to set the voltage for the system memory. Use the <+> or <-> key to adjust the value. The values range from 0.80 V to 1.90 V at 0.010 V increment.

> According to Intel® CPU specifications, DIMMs with voltage requirement over 1.65 V may damage the CPU permanently. We recommend that you install the DIMMs with the voltage requirement below 1.65 V.

PCH Core Voltage [Auto]

This item allows you to configure the core voltage for the PCH (platform controller hub). Use the <+> or <-> key to adjust the value. The values range from 0.70 V to 1.80 V at 0.00625 V increment.

PCH I/O Voltage [Auto]

This item allows you to configure the I/O voltage for the PCH (platform controller hub). Use the <+> or <-> key to adjust the value. The values range from 1.20 V to 2.20 V at 0.00625 V increment.

VCCIO CPU 1.05V Voltage [Auto]

This item allows you to set the main power supply for the CPU REF. Use the <+> or <-> key to adjust the value. The values range from 0.7000 V to 1.8000 V at 0.00625 V increment.

VCCIO PCH 1.05V Voltage [Auto]

This item allows you to set the tmain power supply for the PCH REF. Use the <+> or <-> key to adjust the value. The values range from 0.7000 V to 1.8000 V at 0.00625 V increment.

VTTDR Voltage (CHA/CHB) [Auto]

This item allows you to set the termination voltage for the DRAM on the left. Use the <+> or <-> key to adjust the value. The values range from 0.2000 V to 1.0000 V at 0.00625 V increment.

VTTDR Voltage (CHC/CHD) [Auto]

This item allows you to set the termination voltage for the DRAM on the right. Use the <+> or <-> key to adjust the value. The values range from 0.2000 V to 1.0000 V at 0.00625 V increment.

PLL Termination Voltage [Auto]

This item allows you to terminate the PLL Voltage. You can use the <+> or <-> keys to adjust the value. The values range from 0.20000 V to 3.098278 V with a 0.006602 V interval.

PLL Reference Offset Mode Sign [+]

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

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

PLL Reference Offset Value [Auto]

This item allows you to configure the PLL reference value. You can use the <+> or <-> keys to adjust the value.
Configuration options: [Auto] [1] - [20]

CPU Spread Spectrum [Auto]

This item allows you to enhance the BCLK overclocking capability or reduce the EMI (electromagnetic disturbance) generated by the BCLK. Set this item to [Enabled] for EMI reduction, or set this item to [Disabled] to enhance BCLK overclocking.

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

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 CPU Configuration

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

The items in this menu may vary based on the CPU installed.
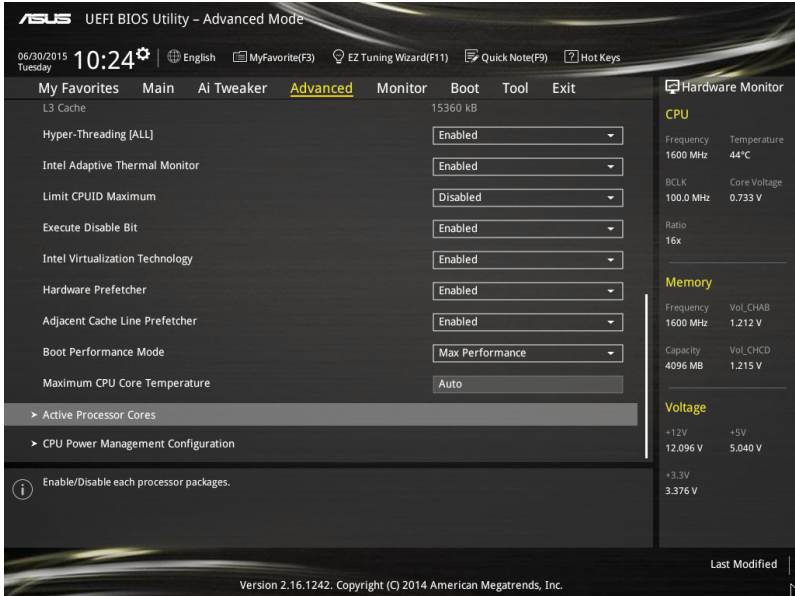
Hyper-Threading [ALL] [Enabled]

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

Configuration options: [Enabled] [Disabled]

Intel Adaptive Thermal Monitor [Enabled]

This item allows you to protect the CPU by decreasing its frequency as it reaches the thermal throttle point. The thermal monitor includes TM1 (Thermal monitor 1), TM2 (Thermal monitor 2), and EMTTM (Enhanced Multi-threaded Thermal Monitoring).

Configuration options: [Disabled] [Enabled]

Limit CPUID Maximum [Disabled]

When set to **[Enabled]**, this item allows the legacy OS to boot even without support for CPUs with extended CPUID functions.

Configuration options: [Disabled] [Enabled]

Execute Disable Bit [Enabled]

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

Configuration options: [Disabled] [Enabled]

Intel Virtualization Technology [Disabled]

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

Configuration options: [Disabled] [Enabled]

Hardware Prefetcher [Enabled]

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

Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetcher [Enabled]

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

Configuration options: [Disabled] [Enabled]

Boot Performance Mode [Max Performance]

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

Configuration options: [Max Efficient] [Turbo Performance]

Maximum CPU Core Temperature [Auto]

This item allows you to set the maximum allowable temperature for CPU cores. The CPU throttles or shuts down when it reaches its maximum temperature to prevent damaging the CPU cores.

Configuration options: [Auto] [60] - [120]

> ⚠ We recommend that you set the temperature 105° C or lower. High temperatures may damage the CPU permanently.

Active Processor Cores

The items in this menu allow you to enable/disable the cores of your CPU.

Active Processor Core (0-5) [Enabled]

Configuration options: [Enabled] [Disabled]

CPU Power Management Configuration

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

Enhanced Intel SpeedStep Technology [Enabled]

This item allows your system to adjust the CPU's voltage and cores frequency, resulting in decreased power consumption and heat production.

[Disabled]   The CPU runs at its default speed.

[Enabled]   The system controls the CPU speed.

Turbo Mode [Enabled]

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

Configuration options: [Enabled] [Disabled]

CPU states [Auto]

This item allows you to set the power saving of the CPU states.

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

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

Enhanced C1 state [Enabled]
This item allows your CPU to reduce power consumption when the system is in idle mode.

Configuration options: [Enabled] [Disabled]

CPU C3 Report [Enabled]
This item allows you to disable or enable the CPU C3 report to the operating system.

Configuration options: [Enabled] [Disabled]

CPU C6 Report [Enabled]
This item allows you to disable or enable the CPU C6 report to the operating system.

Configuration options: [Enabled] [Disabled]

Package C State limit [Auto]
This item allows you to set the a C-state support for the CPU package.
Configuration options: [Auto] [C0/C1 state] [C2 state] [C6 (non Retention) state] [C6 (Retention) state]

4.6.2 PCH Configuration
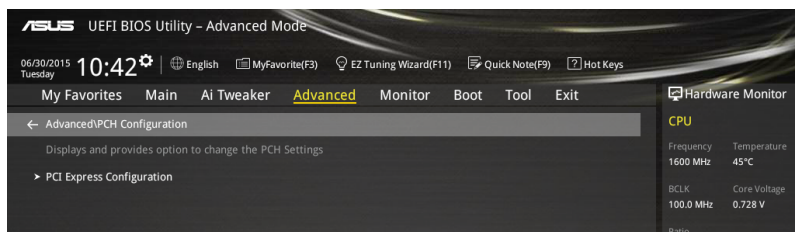
PCI Express Configuration

This item allows you to configure the PCI Express slots.

PCIe Speed [Auto]

This item allows your system to automatically select the PCI Express port speed. When set to [Gen1], the PCI-E port runs at PCI-E 1.0 speed. When set to [Gen2], the PCI-E port runs at PCI-E 2.0 speed.
Configuration options: [Auto] [Gen1] [Gen2]

4.6.3 PCH Storage Configuration

While entering Setup, the BIOS automatically detects the presence of SATA devices. The SATA Port items show **Not Present** if no SATA device is installed to the corresponding SATA port.

Scroll down to display the other BIOS items.
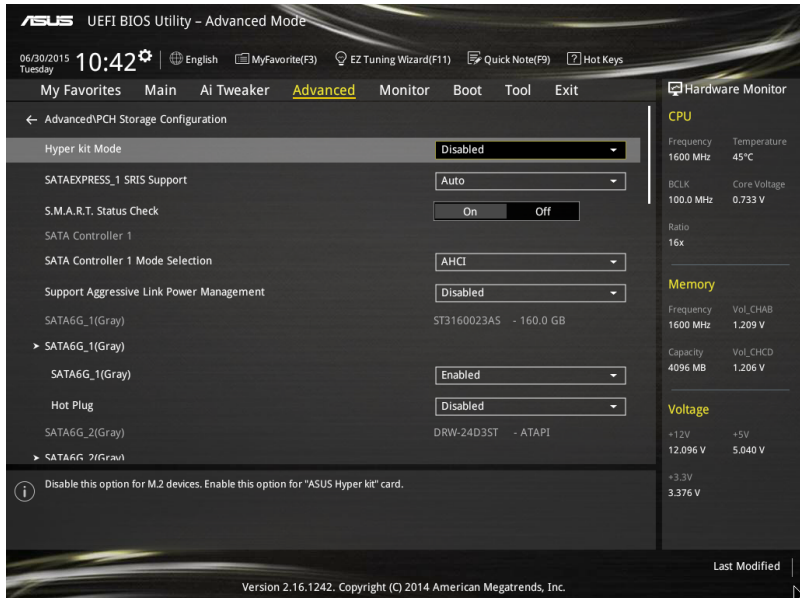
Hyper kit Mode [Disabled]

Enable this item for "ASUS Hyper kit" card, or disable this item for M.2 devices.

Configuration options: [Enabled] [Disabled]

SATAExpress_1 SRIS Support [Auto]

When set to **[Auto]**, this item allows the system to automatically adjust the SRIS (Separate Reference Clock Independent Spread Spectrum Clocking Architecture) support for connected SATA Express devices. Set this item to **[Disabled]** to activate ASUS RUNWAY SATA Express bridge card.

Configuration options: [Auto] [Disabled]

S.M.A.R.T. Status Check [On]

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]

SATA Controller 1 Mode Selection [AHCI]

This item allows you to set the SATA configuration.

[Disabled]   Disables the SATA function.

[IDE Mode]   Set to [IDE Mode] when you want to use the Serial ATA hard disk drives as
                    Parallel ATA physical storage devices.

[AHCI Mode]   Set to [AHCI Mode] 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.

[RAID Mode]   Set to [RAID Mode] when you want to create a RAID configuration from the
                    SATA hard disk drives.

> The following item appears only when you set the SATA Mode Selection to **[IDE]**.

SATA6G_1-6 (Gray)

These items display all connected devices to SATA6G ports. If some ports are not
used, these items show **[Not Installed]**.

SATA Controller 2 Mode Selection [AHCI]

This item allows you to set the SATA configuration.

[Disabled]   Disables the SATA function.

[IDE Mode]   Set to [IDE Mode] when you want to use the Serial ATA hard disk drives as
                    Parallel ATA physical storage devices.

[AHCI Mode]   Set to [AHCI Mode] 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.

> Due to Intel® chipset specification, the SATA ports from SATA controller 2 does not support
> Intel® Rapid Storage Technology including RAID configuration.

> The following item appears only when you set the SATA Mode Selection to **[IDE]**.

SATA6G_7-10 (Black)

These items display all connected devices to SATA6G ports. If some ports are not
used, these items show **[Not Installed]**.

Support Aggressive Link Power Management [Disabled]

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]

Hot Plug [Disabled] (SATA6G_1-6 (Gray) / SATA6G_7-10 (Black))

These items allow you to enable/disable SATA Hot Plug Support.

Configuration options: [Disabled] [Enabled]

4.6.4 System Agent Configuration
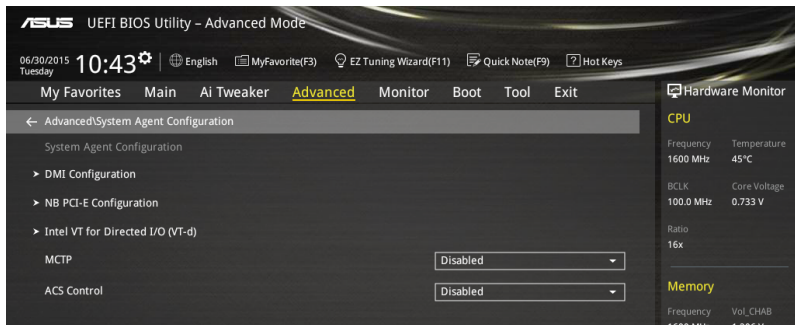
DMI Configuration

The item in this menu allows you configure the Direct Media Interface.

DMI Gen 2 [Enabled]

This item allows you to run the DMI at PCI-E 2.0 speed.
Configuration options: [Enabled] [Disabled]

NB PCI-E Configuration

The items in this menu allow you to select the operating speeds of the PCIe slots.

PCIEX16_1 Link Speed [Auto]

This item allows you to select the operating speed of the PCIEX16_1 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEX16_2 Link Speed [Auto]

This item allows you to select the operating speed of the PCIEX16_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEX16_3 Link Speed [Auto]

This item allows you to select the operating speed of the PCIEX16_3 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEX16_4 Link Speed [Auto]

This item allows you to select the operating speed of the PCIEX16_4 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEX16_5 Link Speed [Auto]

This item allows you to select the operating speed of the PCIEX16_5 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

Intel VT for Directed I/O (VT-d)

The item in this menu allows you to configure the Intel® Virtualization Technology for Directed I/O (VT-d).

Intel VT for Directed I/O (VT-d) [Disabled]

This item allows you to enable/disable the Intel® Virtualization Technology for Directed I/O (VT-d) by reporting the I/O device assignment to VMM via the DMAR ACPI Tables. Configuration options: [Enabled] [Disabled]

MCTP [Disabled]

This item allows you to enable/disable Management Component Transport Protocol.

Configuration options: [Enabled] [Disabled]

ACS Control [Disabled]

This item allows you to enable/disable ACS Control.

Configuration options: [Enabled] [Disabled]

4.6.5 USB Configuration

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

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

Intel xHCI Mode [Smart Auto]

[Auto]   The xHCI is automatically enabled and runs at USB 3.0 mode when the xHCI driver is installed in the operating system.

[Smart Auto]   Upon detection, the xHCI driver supports the USB 3.0 mode during both POST and operating system.

[Enabled]   Enables the xHCI controller.

[Disabled]   Disables the xHCI controller.

EHCI Legacy USB Support [Enabled]

[Enabled]   Your system supports the USB 2.0 devices in legacy operating systems.

[Disabled]   Your USB 2.0 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 2.0 devices at startup. If any USB 2.0 devices are detected, the xHCI legacy USB support is enabled.

xHCI Hand-off [Disabled]

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

[Disabled]   Disables the xHCI Hand-off support.

EHCI Hand-off [Disabled]

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

[Disabled]   Disables the EHCI Hand-off support.

USB Single Port Control

This item allows you to enable or disable the individual USB ports.

Refer to section **3.1 Motherboard layout** for the location of the USB ports.

4.6.6 Platform Misc Configuration

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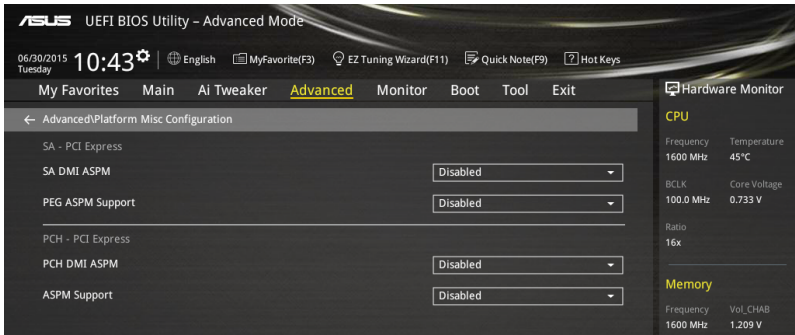
SA - PCI Express

SA SMI ASPM [Disabled]

This item allows you to enable/disable the ASPM (L1) support for the downstream devices.

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

PEG ASPM Support [Disabled]

This item allows you to enable/disable the ASPM support for the downstream devices.

Configuration options: [Disabled] [L1 only]

PCH - PCI Express

PCH DMI ASPM [Disabled]

This item allows you to enable/disable the PCH DMI ASPM Setting.

Configuration options: [Disabled] [Enabled]

ASPM Support [Disabled]

This item allows you to enable/disable the ASPM support for all downstream devices.

Configuration options: [Disabled] [L1 only]

4.6.7 Onboard Devices Configuration

Scroll down to view the other BIOS items.

HD Audio Controller [Enabled]

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

Configuration options: [Disabled] [Enabled]

> The following items appear only when you set the HD Audio Controller to **[Enabled]**.

Front Panel Type [HD Audio]

This item allows you to set the front panel audio connector (AAFP) mode to legacy AC'97 or high-definition audio depending on the audio standard that the front panel audio module supports.

[HD Audio]   Sets the front panel audio connector (AAFP) mode to high definition audio.

[AC97]   Sets the front panel audio connector (AAFP) mode to legacy AC'97.

SPDIF Out Type [SPDIF]

[SPDIF]   Sets to an SPDIF audio output.

[HDMI]   Sets to an HDMI audio output.

Intel LAN Controller (LAN1-LAN2) [Enabled]

This item allows you to enable or disable the Intel LAN1/2 controllers.

Configuration options: [Disabled] [Enabled]

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

Intel PXE OPROM (LAN1-LAN2) [Disabled]

This item allows you to enable/disable the PXE OptionRom of the Intel® LAN controller.
Configuration options: [Enabled] [Disabled]

Serial Port Configuration

The items in this menu allows you to set the parameters of the serial port.

> This items in this menu works only if a serial port connector is installed on the motherboard.

Serial Port [On]

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

Change Settings [Auto]

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]

4.6.8 APM Configuration

ErP Ready [Disabled]

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)]

Restore AC Power Loss [Power Off]

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]

Power On By PCI-E/PCI [Disabled]

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

Configuration options: [Disabled] [Enabled]

Power On By Ring [Disabled]

This item allows you to enable/disable the Power On by Ring feature of your motherboard.

Configuration options: [Disabled] [Enabled]

Power On By RTC [Disabled]

This item allows you to enable/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]

4.6.9   Network Stack Configuration
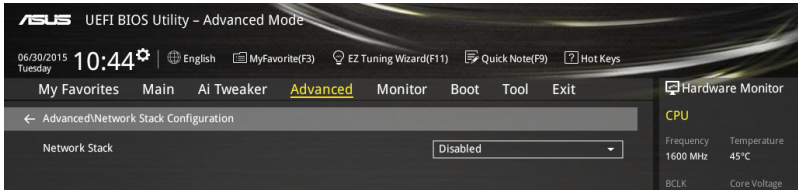
Network stack [Disabled]

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

Configuration options: [Disabled] [Enabled]

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

Ipv4/Ipv6 PXE Support [Enabled]

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

4.6.10   NVMe Configuration

This item allows you to view the NVMe controller and drive information.
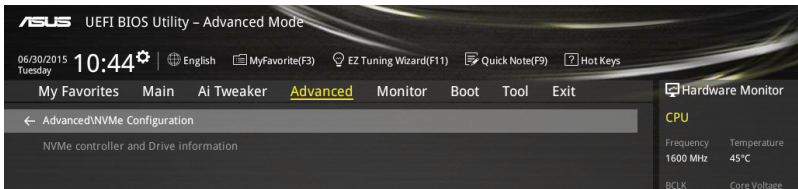
4.7 Monitor menu

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

Scroll down to display the other BIOS items.
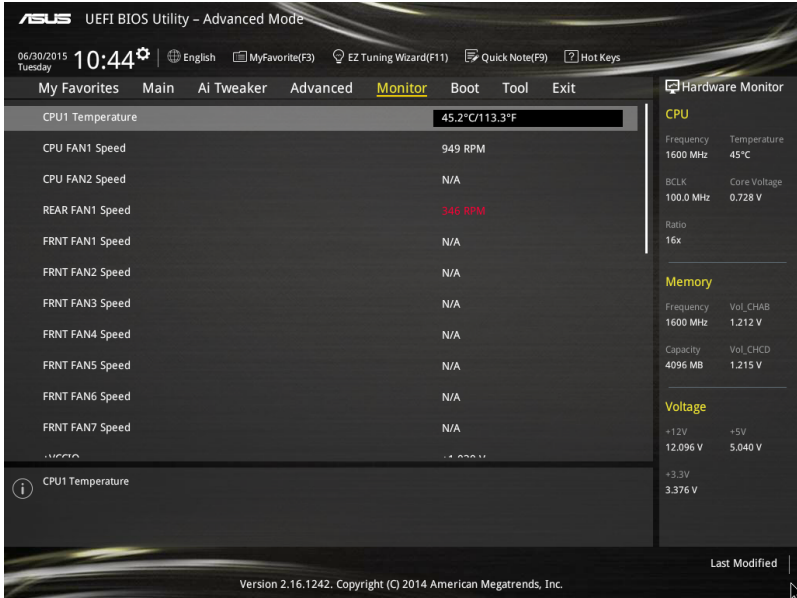
CPU1 Temperature / TR1 Temperature [xxx°C/xxx°F]

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

CPU FAN1-2 Speed [xxxx RPM] or [Ignore] / [N/A], REAR FAN1 Speed [xxxx RPM] or [Ignore], FRNT FAN1-3 Speed [xxxx RPM] or [Ignore] / [N/A]

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

+VCCIO, +VCORE1, +VDDQ_AB, +VDDQ_CD, +5VSB, +5V, +12V, +3.3V, VBAT, +3.3VSB Voltages

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

CPU FAN 1&2, REAR FAN1, FRNT FAN1, FRNT FAN2&3 modes

This item allows you to select a specific speed for your CPU and front fans.

Configuration options: [Generic Speed] [High Speed] [Full Speed] [Manual]

The following item appears only when you set the CPU FAN 1&2 and FRNT FAN1 mode to **[Manual]**.

Duty% [50]

This item allows you to set a duty cycle percentage to meet the thermal requirement for your system. Use the <+> or <-> keys to adjust the value. The values range from 0 to 100 with an interval of 5.

4.8   Boot menu

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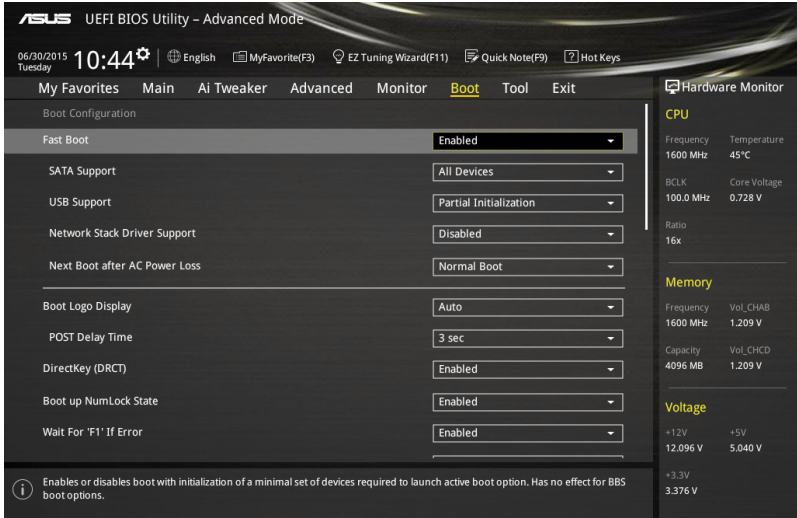
Boot Configuration

Fast Boot [Enabled]

[Disabled]   This item allows your system to go back to its normal boot speed.

[Enabled]   This item allows your system to accelerate the boot speed.

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

SATA Support [All Devices]

[All Devices]   All devices connected to SATA ports are available during POST. This process extends the POST time.

[Hard Drive Only]   Only hard drives connected to SATA ports are detected during POST.

[Boot Drive Only]   Only boot drives connected to a SATA ports are detected during POST.

USB Support [Partial Initialization]

[Disabled]   All USB devices will not be available until OS boot up for a fastest POST time.

[Full Initialization]   All USB devices will be available during POST. This process will extend the POST time.

[Partial Initialization]   For a faster POST time, only USB ports with keyboard and mouse connections will be detected.

Network Stack Driver Support [Disabled]

[Disabled]   Select to skip the network stack driver from loading during POST.
[Enabled]   Select to load the network stack driver during POST.

Next Boot after AC Power Loss [Normal Boot]

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

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

Boot Logo Display [Auto]

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

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

[Disabled]   Disables the boot logo display during POST.

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

Post Delay Time [3 sec]

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

> This feature only works when set under normal boot.

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

Post Report [5 sec]

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

DirectKey (DRCT) [Enabled]

[Disabled]   Disables the DirectKey button. The system will only power on or off when you press the DirectKey button.

[Enabled]   Allows the system to power on and go to the BIOS Setup directly when you press the Reset button. Connect the 2-pin connector of the chassis reset buton cable to the onboard DRCT header.

Bootup NumLock State [Enabled]

This item allows you to enable/disable power-on state of the NumLock.

Configuration options: [Enabled] [Disabled]

Wait For 'F1' If Error [Enabled]

This item allows your system to wait for the <F1> key to be pressed when error occurs.

Configuration options: [Disabled] [Enabled]

Option ROM Messages [Force BIOS]

This item allows you to set the display mode for Option ROM.

Configuration options: [Force BIOS] [Keep Current]

INT19 Trap Response [Immediate]

[Immediate]   Executes the trap for INT19 immediately.

[Postponed]   Executes the trap during legacy boot.

Above 4G Decoding [Disabled]

This item allows you to decode the 64-bit capable devices above 4G address space. Ensure that your system supports 64-bit PCI decoding.

Configuration options: [Disabled] [Enabled]

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]

[Auto]   The system automatically detects the bootable devices and the add-on devices.

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

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

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

Boot Device Control [UEFI and Legacy OpROM]
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 [Legacy OpROM first]
This item allows you to select the type of network devices that you want to launch.

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

Boot from Storage Devices [Legacy OpROM first]
This item allows you to select the type of storage devices that you want to launch.

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

Boot from PCI-E/PCI Expansion Devices [Legacy OpROM first]
This item allows you to select the type of PCIe/PCI expansion devices that you want to launch.

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

Secure Boot

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

OS Type [Windows UEFI Mode]

[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

This item allows you to manage the Secure Boot keys.

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

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

Save Secure Boot Keys
This item allows you to save the PK (Platform 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.

Delete PK
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]

Load PK from File
This item allows you to load the downloaded PK from a USB storage device.

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).

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

Configuration options: [Yes] [No]

Load Default KEK
This item allows you to load the downloaded KEK from a USB storage device.

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

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.

Delete the db
This item allows you to delete the db file from your system.

Configuration options: [Yes] [No]

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

Append Default db
This item allows you to load the additional db from a storage device so that more images can be loaded securely.

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.

Delete the dbx
This item allows you to delete the dbx file from your system.

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

Configuration options: [Yes] [No]

Append Default dbx
This item allows you to load the additional dbx from a storage device so that more db's images cannot be loaded.

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.
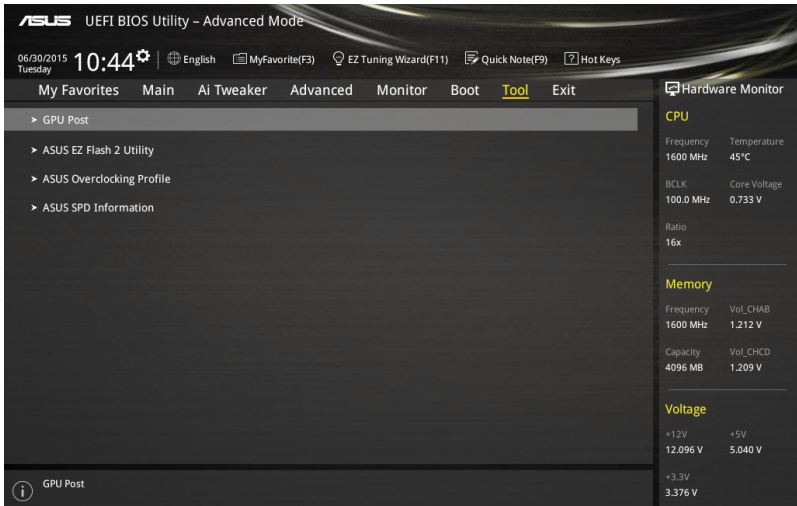
GPU Post

This item shows the installed graphics cards in your motherboard. It also shows the recommended number of graphics card to install to your motherboard for best performance.

4.9.1   ASUS EZ Flash 2 Utility

This item allows you to run ASUS EZ Flash 2. 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 **4.11.2 ASUS EZ Flash 2**.

4.9.2 ASUS Overclocking Profile

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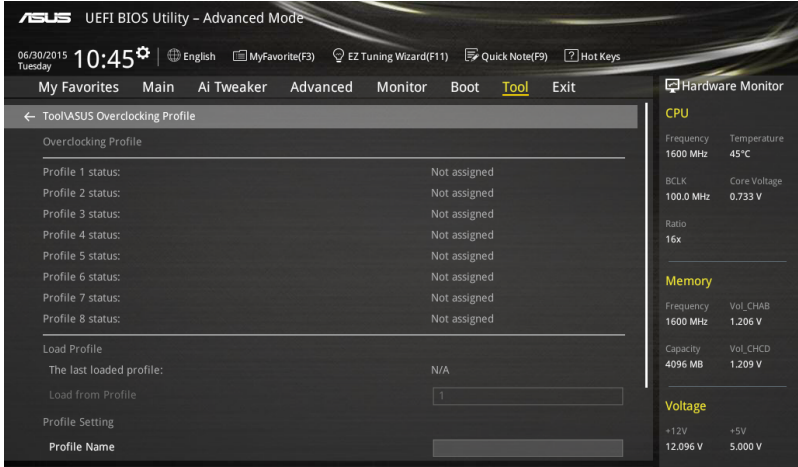
Load from Profile

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.

4.9.3 ASUS SPD Information

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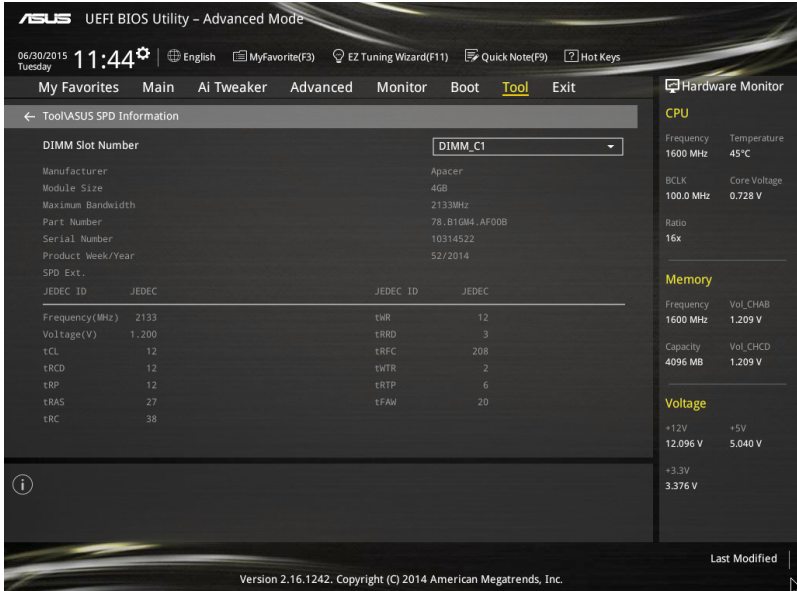
4.10 Exit menu

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.
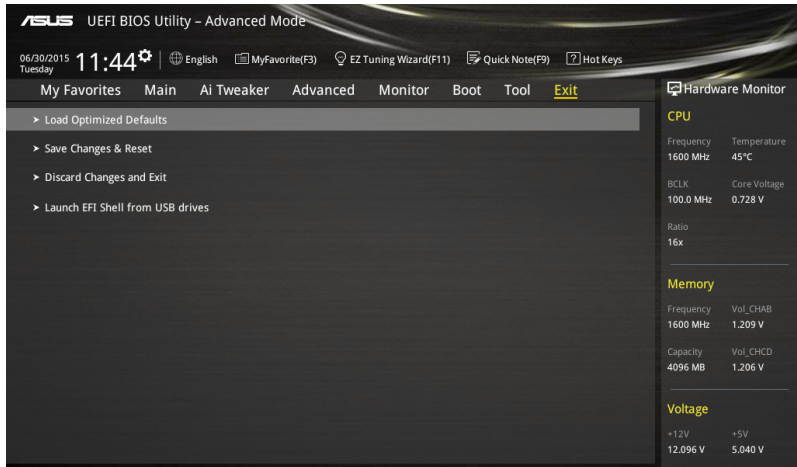
Load Optimized Defaults

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 (shellx64.efi) from one of the available file system 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 2: 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.   ASUS BIOS Updater: Updates the BIOS in DOS environment using the motherboard support DVD and a USB flash disk drive.

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. Refer to the documentation that came with the support DVD.

4.11.2   ASUS EZ Flash 2

ASUS EZ Flash 2 allows you to update the BIOS without having to use a bootable floppy disk or an OS-based utility.

Before you start using this utility, download the latest BIOS from the ASUS website at www.asus.com.

To update the BIOS using EZ Flash 2:

1.   Insert the USB flash disk 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> to enable it.
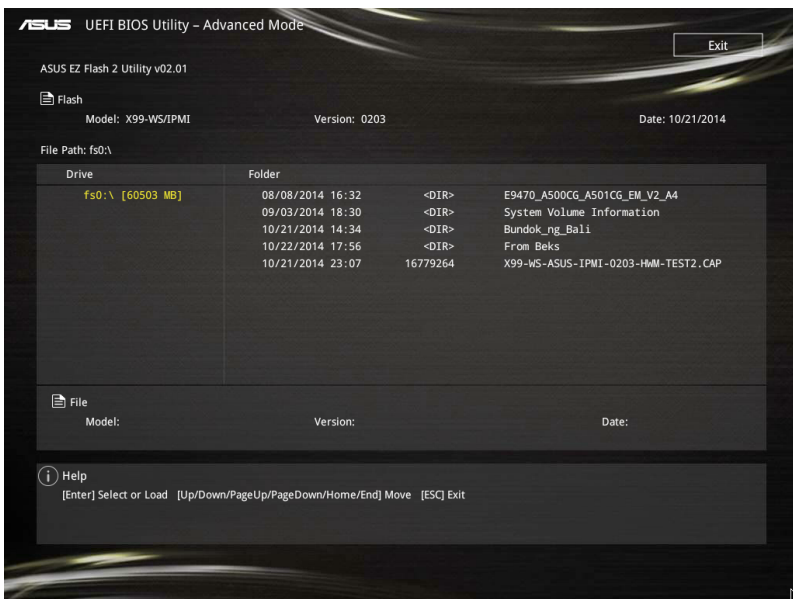
3.   Press <Tab> to switch to the Drive field.

4.   Press the Up/Down arrow keys to find the USB flash disk 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.

• This function can support devices such as a USB flash disk with FAT 32/16 format and single partition only.

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

Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the Load Optimized Defaults item under the Exit menu. See section **4.10 Exit Menu** for details.

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 http://support.asus.com 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 2 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!

4.11.4   ASUS BIOS Updater

ASUS BIOS Updater allows you to update the BIOS in DOS environment.

> The screen captures used in this section are for reference only and may not be exactly the same as actually shown on your computer screen.

Before updating BIOS

•   Prepare the motherboard support DVD and a USB flash drive.

•   Download the latest BIOS file and BIOS Updater from http://support.asus.com and save them in your USB flash drive.

> NTFS is not supported under DOS environment. Ensure that your USB flash drive is in single partition and in FAT32/16 format.

•   Turn off the computer.

•   Ensure that your computer has a DVD optical drive.

Booting the system in DOS environment

To boot the system in DOS:

1.   Insert the USB flash drive with the latest BIOS file and BIOS Updater to the USB port.

2.   Boot your computer then press <F8> to launch the select boot device screen.

3.   When the select boot device screen appears, insert the Support DVD into the optical drive then select the optical drive as the boot device.

```
    Please select boot device:

E1:  ASUS DVD-E818A6T  (4069MB)
 USB DISK 2.0 (3824MB)
UEFI: (FAT)  USB DISK 2.0 (3824MB)
Enter Setup

       ↑ and ↓ to move selection
      ENTER to select boot device
       ESC to boot using defaults
```
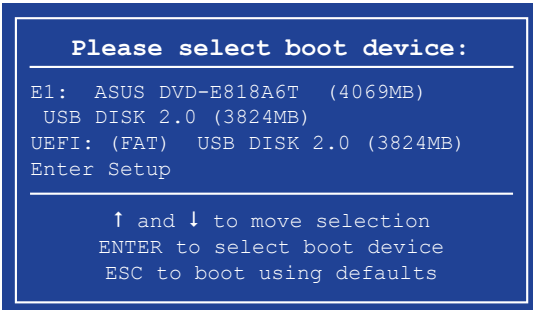
4.   When the booting message appears, press <Enter> within five (5) seconds to enter FreeDOS prompt.

```
ISOLINUX 3.20 2006-08-26 Copyright (C) 1994-2005 H. Peter Anvin
A Bootable DVD/CD is detected. Press ENTER to boot from the DVD/CD.
If no key is pressed within 5 seconds, the system will boot next priority
device automatically. boot:
```

5.   On the FreeDOS prompt, type **d:** then press <Enter> to switch the disk from Drive C (optical drive) to Drive D (USB flash drive).

```
Welcome to FreeDOS (http://www.freedos.org)!
C:/> d:
D:/>
```

Updating the BIOS file

To update the BIOS file:

1.   On the FreeDOS prompt, type **bupdater /pc /g** and press <Enter>.

```
D:/> bupdater /pc /g
```

2.   On the BIOS Updater screen, press <Tab> to switch from Files panel to Drives panel then select **D:**.

```
        ASUSTeK BIOS Updater for DOS V1.30 [2014/08/01]

    ┌─── Current ROM ───┐              ┌─── Update ROM ───┐
    BOARD: X99-WS/SYS                  BOARD: Unknown
    VER: 0210 (H :00 B :00)            VER: Unknown
    DATE: 10/30/2014                   DATE: Unknown

    PATH:  C:\

    ┌──────────┐  ┌─────────────────────────────────────────┐
    C:            FORMAN~1       <DIR>
    D:            X99-WS_SYS.CAP    8390626  2014-06-30    21:14:34
    │          │  │                                         │
    │          │  │                                         │
    └──────────┘  └─────────────────────────────────────────┘

    ┌── Note ──────────────────────────────────────────────┐
         [Enter] Select or Load    [Tab] Switch    [V] Drive Info
         [Up/Down/Home/End] Move    [Esc] Exit
    └──────────────────────────────────────────────────────┘
```

Drives panel (left)   **Files panel** (right)
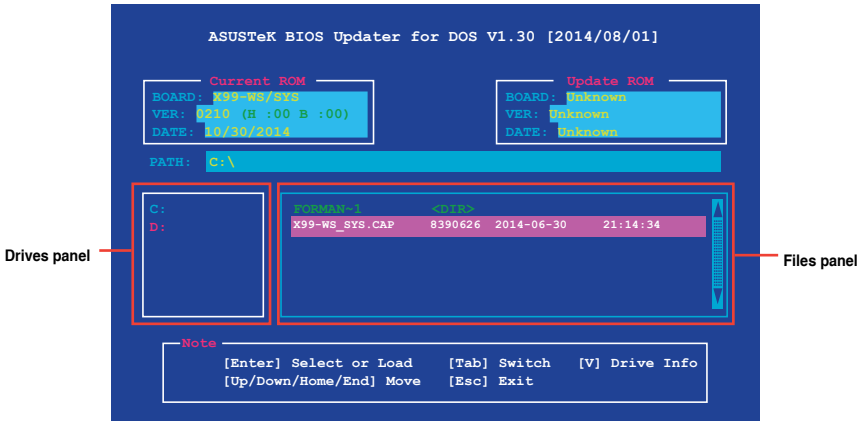
3.   Press <Tab> to switch from Drives panel to Files panel then press <Up/Down or Home/End> keys to select the BIOS file and press <Enter>.

4.   After the BIOS Updater checks the selected BIOS file, select **Yes** to confirm the BIOS update.

```
    Are you sure you want to update the BIOS?

                    Yes        No
```

✎   The BIOS Backup feature is not supported due to security regulations.

5.   Select **Yes** then press <Enter>. When BIOS update is done, press <ESC> to exit BIOS Updater.

6.   Restart your computer.

⚠   DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure.

✍   Ensure to load the BIOS default settings to ensure system compatibility and stability. Select **Load Optimized Defaults** item under the **Exit** BIOS menu. See section **4.10 Exit menu** for details.

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 with RAID 0, RAID 1, RAID 10, and RAID 5 solution.

> 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 **5.2 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 Serial ATA hard disks

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

To install the SATA hard disks for a RAID configuration:

1.   Install the SATA hard disks into the drive bays.

2.   Connect the SATA signal cables.

3.   Connect a SATA power cable to the power connector on each drive.

5.1.3   Setting the RAID item in BIOS

You must enable the RAID function in the BIOS Setup before creating RAID sets using SATA HDDs.

To set the RAID item in BIOS:

1.   Enter the BIOS Setup during POST.

2.   Go to the **Advanced** menu > **PCH Storage Configuration > SATA Controller 1 Mode Selection**, then press <Enter>.

3.   Set the SATA Mode item to **[RAID Mode]**.

4.   Save your changes, and then exit the BIOS Setup.

> 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.

5.1.4   Intel® Rapid Storage Technology Option ROM utility

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

1.   Turn on the system.

2.   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
```
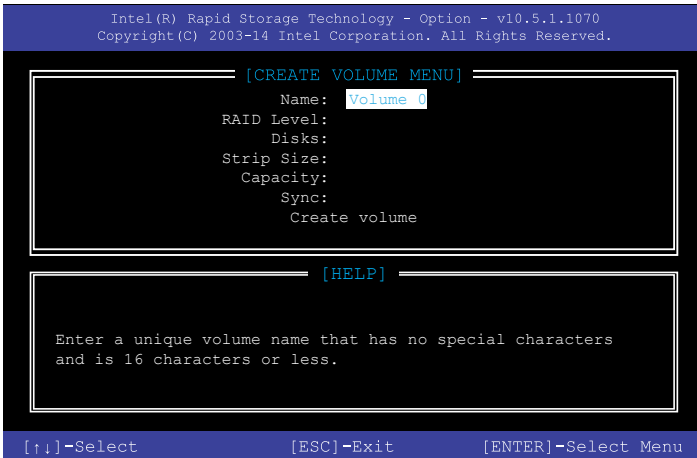
2. Enter a name for the RAID set and press <Enter>.

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 stripe size for the RAID array (for RAID 0, 10 and 5 only),then press <Enter>. The available stripe 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 stripe size for server systems, and a higher stripe 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.
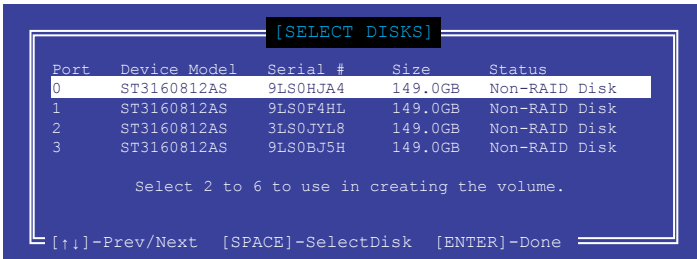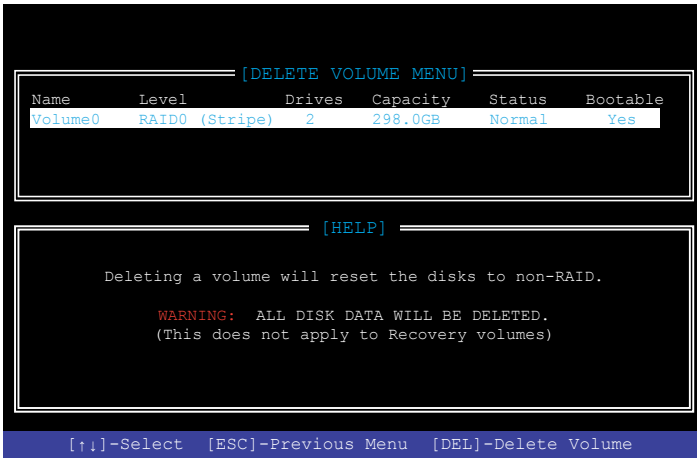
To delete a RAID set:

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):
```
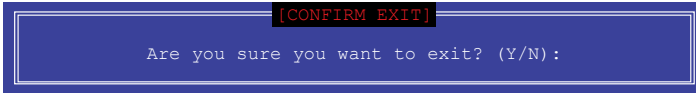
3. Press <Y> to delete the RAID set and return to the utility main menu, or press <N> to return to the DELETE VOLUME menu.

Exiting the Intel® Rapid Storage Technology Option ROM utility

To exit the utility:

1.   From the utility main menu, select **5. 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

A floppy disk with the RAID driver is required when installing a Windows® operating system on a hard disk drive that is included in a RAID set.

> The motherboard does not provide a floppy drive connector. You have to use a USB floppy disk drive when creating a SATA RAID driver disk.

5.2.1   Creating a RAID driver disk without entering the OS

To create a RAID driver disk without entering the OS:

1.   Boot your computer.

2.   Press <Delete> during POST to enter the BIOS setup utility.

3.   Set the optical drive as the primary boot device.

4.   Insert the support DVD into the optical drive.

5.   Save changes and exit BIOS.

6.   When the Make Disk menu appears, press <1> to create a RAID driver disk.

7.   Insert a formatted floppy disk into the USB floppy disk drive, then press <Enter>.

8.   Follow the succeeding screen instructions to complete the process.

5.2.2   Creating a RAID driver disk in Windows®

To create a RAID driver disk in Windows®:

1.   Start Windows®.

2.   Plug the USB floppy disk drive and insert a floppy disk.

3.   Place the motherboard support DVD into the optical drive.

4.   Go to the **Intel AHCI/RAID Driver** menu then click **Intel AHCI/RAID Driver path** to open the RAID driver folder.

5.   Select **32bit** or **64bit** folder depending on your operating system. Copy the files of the selected folder to the root path of your USB floppy disk drive.

> Write-protect the floppy disk to avoid a computer virus infection.

5.2.3   Installing the RAID driver during Windows® OS installation

To install the RAID driver for Windows® 7:

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.

Driver Installation

6

This chapter provides the instructions for installing the necessary drivers for different system components.

6.1 Installing an operating system

- This motherboard supports 32-bit/64-bit Windows® 7, 32-bit/64-bit Windows® 8, and 32-bit/64-bit Windows® 8.1 operating systems (OS).

- Motherboard settings and hardware options vary. The setup procedures presented in this chapter are for reference only. Refer to Windows® operating system documentation for detailed information.

6.2 Support DVD information

The contents of the support DVD are subject to change at any time without notice. Visit the ASUS website at www.asus.com for updates.
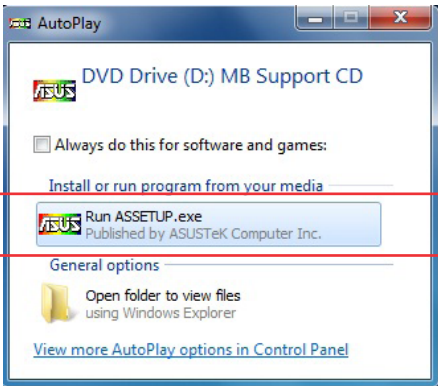
6.2.1 Running the support DVD

Ensure that you have an Administrator account before running the support DVD in Windows® 7, Windows® 8, or Windows® 8.1 operating systems.

To run the support DVD:

1. Place the Support DVD into the optical drive.

2. In the **AutoPlay** dialog box, click or tap **Run ASSETUP.EXE**.

If the **AutoPlay** dialog box does not appear, browse the contents of the support DVD and double-click or tap **\bin\ASSETUP.EXE** to launch the **ASUS motherboard support DVD** main menu.
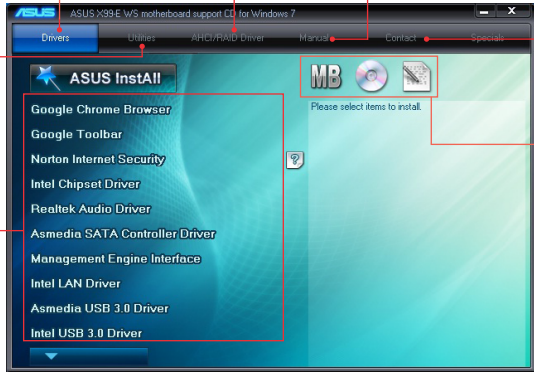
Support DVD main menu

The Drivers menu shows the available device drivers if the system detects installed devices. Install the necessary drivers to use the devices.

The AHCI/RAID Driver menu contains the RAID/AHCI driver disk.

The Manual menu contains the list of supplementary user guides. Click or tap an item to open the folder of the user guide.

The Utilities menu shows the applications and other software that the motherboard supports.

Click or tap to display the ASUS contact information.

Click or tap an icon to display DVD/motherboard information

Click or tap an item to install

6.2.2 Obtaining the software manuals

The software manuals are included in the support DVD. Follow the instructions below to get the necessary software manuals.
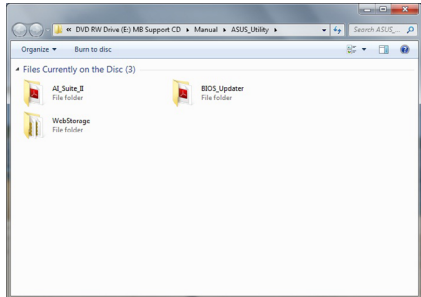
The software manual files are in Portable Document Format (PDF). Install the Adobe® Acrobat® Reader from the **Utilities** tab before opening the files.

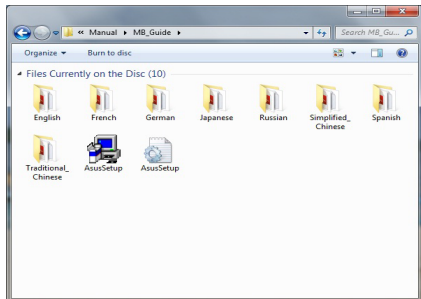To read about your motherboard's utility guide:

1. Click or tap **Manual** tab > **ASUS Motherboard Utility Guide**.

2. From the **Manual** folder, open the folder of the software manual that you wish to read.

3. Some software manuals are provided in different languages. Open the language's folder to view the software manual.

The screenshots in this section are for reference only. The actual software manuals containing in the support DVD vary by models.

6.3   Software information

Most of the applications in the support DVD have wizards that will conveniently guide you through the installation. View the online help or readme file that came with the software application for more information.

6.4   ASUS Utilities

Your motherboard supports the following utilities:

•   USB Charger+

To install these utlities on your computer:

Windows® 7 OS

1.   Place the Support DVD into the optical drive.

2.   In the **AutoPlay** dialog box, click **Run ASSETUP.exe** then select the **Utilities** tab

3.   From the **Utilities** tab, click the name of the utility then follow the succeeding onscreen instructions.

Windows® 8 / Windows® 8.1 OS

1.   Place the Support DVD into the optical drive then follow onscreen instructions.

2.   From the **ASUS motherboard support DVD** main menu, select the **Utilities** tab and click **AI Suite 3**.

3.   Follow the succeeding onscreen instructions.

      If the **ASUS motherboard support DVD** main menu did not appear, try the following steps:

      a.   Go to the **Start Screen** then click or tap the **Desktop** app.

      b.   On the lower left corner of the Desktop, click or tap **File Explorer** then select your DVD drive and tap or double-click the **Setup** application.

6.4.1 USB Charger+

USB Charger+ allows you to quick-charge your portable USB devices even if your computer is off, in sleep mode or hibernate mode.

Before using USB Charger+, ensure to disable the ErP Ready item from the **Advanced > APM > ErP Ready** in the Advanced mode of the BIOS Setup program.

Launching USB Charger+

From your desktop, click/tap **USB Charger+**.

USB Charger+ screen

Click or tap to detect the connected USB device

Indicates that the connected USB device is in charging mode

Click or tap to fast-charge your USB device

Click or tap to stop charging your USB device

Click or tap to apply the settings

Click or tap to discard the settings

Click or tap to select the type of USB device that you wish to charge when the system is off

Ensure to connect your USB device into the USB port that supports this utility. Refer to section **1.5 Rear panel features** of your user guide for more details.

- The USB Charger+ does not support USB hubs and USB extension cables, and generic USB cables.
- The USB Charger+ may not recognize some ASUS devices due to a special design.

6.5   Audio configurations

The Realtek® audio CODEC provides 8-channel audio capability to deliver the ultimate audio experience on your computer. The software provides Jack-Sensing function, S/PDIF Out support, and interrupt capability. The CODEC also includes the Realtek® proprietary UAJ® (Universal Audio Jack) technology for all audio ports, eliminating cable connection errors, and giving users plug and play convenience.

Follow the installation wizard to install the Realtek® Audio Driver from the support DVD that came with the motherboard package.

If the Realtek® audio software is correctly installed, you will find the Realtek® HD Audio Manager icon on the taskbar. Double-click or tap on the icon to display the Realtek® HD Audio Manager.

Realtek® HD Audio Manager

Realtek® HD Audio Manager with DTS UltraPC II for Windows® 8.1 / Windows® 8 / Windows® 7

Configuration option tabs (vary with the audio devices connected)

Advanced settings

Set default device button

Control settings panel

Analog and digital connector status

Appendix

A

ASUS contact information

ASUSTeK COMPUTER INC.

Address	4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan
Telephone	+886-2-2894-3447
Fax	+886-2-2890-7798
Web site	https://www.asus.com

Technical Support

Telephone	+86-21-38429911
Fax	+86-21-58668722 ext: 9101
Online Support	https://www.asus.com/support/Product/ContactUs/Services/ questionform/?lang=en

ASUSTeK COMPUTER INC. (Taiwan)

Address	4F, No. 150, Li-Te Rd., Peitou, Taipei 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	800 Corporate Way, Fremont, CA 94539, 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
Fax	+49-2102-959911
Web site	https://www.asus.com/de/

Technical Support

Telephone	+49-1805-010923
Support Fax	+49-2102-959911
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