



RS720-E9-RS24-E

2U Rackmount Server User Guide



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Safety information

Electrical Safety

- Before installing or removing signal cables, ensure that the power cables for the system unit and all attached devices are unplugged.
- To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before relocating the system.
- When adding or removing any additional devices to or from the system, 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.
- If you encounter technical problems with the product, contact a qualified service technician or your retailer.



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.

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 Information

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

3. Chapter 3: Installation Options

This chapter describes how to install optional components into the barebone server.

4. Chapter 4: Motherboard Information

This chapter gives information about the motherboard that comes with the server. This chapter includes the motherboard layout, jumper settings, and connector locations.

5. Chapter 5: BIOS Setup

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

6. Chapter 6: RAID Configuration

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

7. Chapter 7: Driver Installation

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

Conventions

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.
<i>Italics</i>	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>+
Command	Means that you must type the command exactly as shown, then supply the required item or value enclosed in brackets. Example: At the DOS prompt, type the command line: <code>format A:/S</code>

References

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

1. ASUS Control Center (ACC) user guide

This manual tells how to set up and use the proprietary ASUS server management utility. Visit asuscontrolcenter.asus.com for more information.

2. ASUS websites

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

1

Product Introduction

This chapter describes the general features of the chassis kit. It includes sections on front panel and rear panel specifications.

1.1 System package contents

Check your system package for the following items.

Model Name	RS720-E9-RS24-E
Chassis	ASUS R2P-A-R22475 2U Rackmount Chassis
Motherboard	ASUS Z11PP-D24 Server Board
Component	2 x Redundant 800W 80 PLUS Platinum Power Supply 1 x SAS/SATA back panel 24 x Hot-swap 2.5" Storage Device Bays 1 x Front Panel Board 4 x Riser Cards 4 x System Fans
Accessories	1 x RS720-E9-RS24-E Support CD 1 x Bag of Screws 2 x CPU Heatsink 2 x AC Power Cable
Optional Items	2 x Redundant 1200W 80 PLUS Platinum Power Supply 2 x Redundant 850W 80 PLUS Titanium Power Supply 1 x Friction Rail Kit

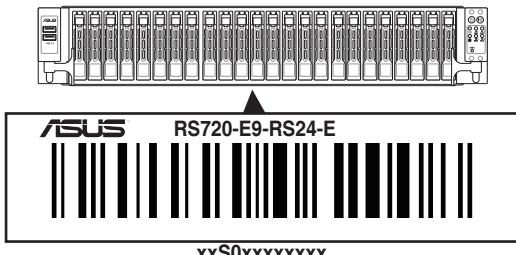


If any of the above items is damaged or missing, contact your retailer.

1.2 Serial number label

The product's serial number contains 12 characters such as xxS0xxxxxxxx and printed on the sticker at the server's front cover.

The correct serial number of the product is required if you need to request for support from the ASUS Technical Support team.



1.3 System specifications

The ASUS RS720-E9-RS24-E features the ASUS Z11PP-D24 server board. The server supports Intel® Xeon® Scalable Processors Family Series plus other latest technologies through the chipsets onboard.

Model Name		RS720-E9-RS24-E
Motherboard		Z11PP-D24
Processor Support		2 x Socket P0 (LGA 3647) 1st Gen Intel® Xeon® Processor Scalable Family 2nd Gen Intel® Xeon® Processor Scalable Family UPI 10.4 GT/s
Core Logic		Intel® PCH C621
Memory	Total Slots	24 (6-channel per CPU, 12 DIMM per CPU)
	Capacity	Maximum up to 9216GB
	Memory Type	DDR4 2933* (1 DIMM per Channel) DDR4 2666/2400/2133 RDIMM/LRDIMM/LRDIMM 3DS (2 DIMM per Channel) Intel® Optane™ DC persistent memory (DCPMM) * 2933MHz will drop to 2666MHz when using 2DPC configurations ** Refer to ASUS server AVL for the latest update
	Memory Size	4GB, 8GB, 12GB, 32GB, 64GB (RDIMM) 64GB, 128GB, 256GB (RDIMM 3DS) 32GB, 64GB, 128GB (LRDIMM) 64GB, 128GB, 256GB (LRDIMM 3DS) 128GB, 256GB, 512GB (DCPMM) * Refer to ASUS server AVL for the latest update
	Total PCI/PCI-X/ PCI-E/PIKE Slots	8+1
Expansion Slots	Slot Type	6 x PCI-E x16 (Gen3 x8 link) or 3 x PCI-E x16 (Gen3 x16 link), FH, HL 1 x PCI-E x16 (Gen3 x16 link), LP, HL 1 x PCI-E x16 (Gen3 x8 link), FH, HL 1 x OCP Mezzanine 2.0 (Gen3 x16 link)
	SATA Controller	Intel® PCH C621 10 x SATA 6Gb/s ports + 1 x M.2 connector (SATA 6Gb/s & PCI-E Gen3 x4 link) or 9 x SATA 6Gb/s ports + 2 x M.2 connector (SATA 6Gb/s & PCI-E Gen3 x4 link) Intel® RSTe (for Windows and Linux; Support software RAID 0, 1, 10 & 5) Intel® VROC (for Windows and Linux; Support software RAID 0, 1, 10 & 5)

(continued on the next page)

Model Name		RS720-E9-RS24-E
Disk Controller	SAS Controller	Optional: ASUS PIKE II 3108 8-port SAS HW RAID card 12G SAS Support
Storage Bays	I = internal A or S will be hot-swappable	Front bays: 24 x 2.5" Hot-swap Storage Device Bays (24 x SATA/SAS) Internal storage: 2 x M.2 (22110, 2280, 2260, 2242) (support SATA/PCIe M.2, SATA RAID)
Networking	LAN	1 x Dual Port Intel I350-AM2 Gigabit LAN controller 1 x Management Port 1 x OCP 2x25GbE (optional)
Graphic	VGA	Aspeed AST2500 64MB
Auxiliary Storage Device Bay (Floppy / Optical Drive)		External slim DVD-RW
I/O Ports, Switches, and LEDs		Front I/O Ports: 2 x USB 2.0 ports Rear I/O Ports: 2 x USB 3.0 ports 1 x VGA port 2 x RJ-45 GbE LAN ports 1 x RJ-45 Mgmt LAN port Rear Switch/LED: 1 x Power switch 1 x Q-Code/Port 80 LED 1 x Message LED 1 x HDD LED 1 x Location LED Front Switch/LED: 1 x Power switch/LED 1 x Location switch/LED 1 x Reset switch 1 x Storage device access LED 1 x Message LED LAN 1-4 LEDs * LAN 3-4 for Mezzanine card use

(continued on the next page)

Model Name		RS720-E9-RS24-E
Management Solution	Out of Band Remote Hardware	On-Board ASMB9-iKVM for KVM-over-IP
	Software	ASUS Control Center (Classic)
OS Support		Please find the latest OS support from http://www.asus.com/
Dimension (Depth x Width x Height)		750 mm x 444 mm x 88 mm (2U) 29.52" x 17.48" x 3.46"
Power Supply (different configuration by region)		1+1 Redundant 800W 80 PLUS Platinum Power Supply (CPU up to 165W) 1200W 80 PLUS Platinum Power Supply (CPU up to 205W) Rating: 100-127Vac/200-240Vac, 10A/5A, 50/60Hz, Class I (240Vdc only for China) 850W 80 PLUS Titanium Power Supply (CPU up to 165W) Rating: 100-127Vac/200-240Vac, 11A/5A, 47-63 Hz
Environment		Operating temperature: 10°C ~ 35°C Non operating temperature: -40°C ~ 60°C Non operating humidity: 20% ~ 90% (Non condensing)

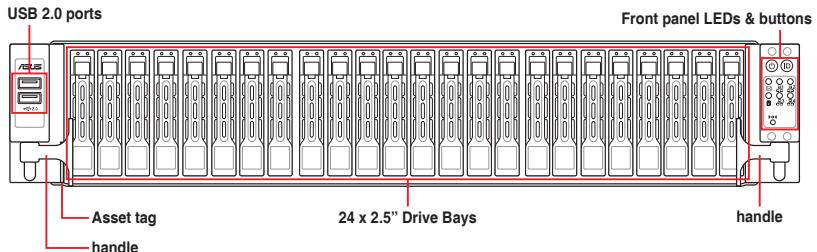
* Specifications are subject to change without notice.

1.4 Front panel features

The barebone server displays a simple yet stylish front panel with easily accessible features. The power and reset buttons, LED indicators, and two USB ports are located on the front panel.

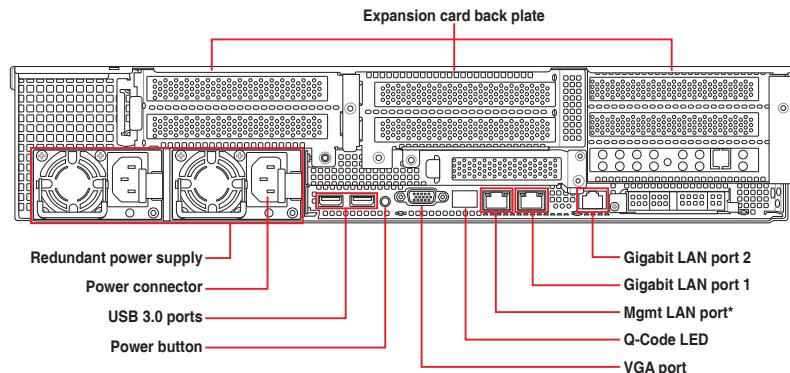


Refer to section 1.7 LED information for the LED descriptions.



1.5 Rear panel features

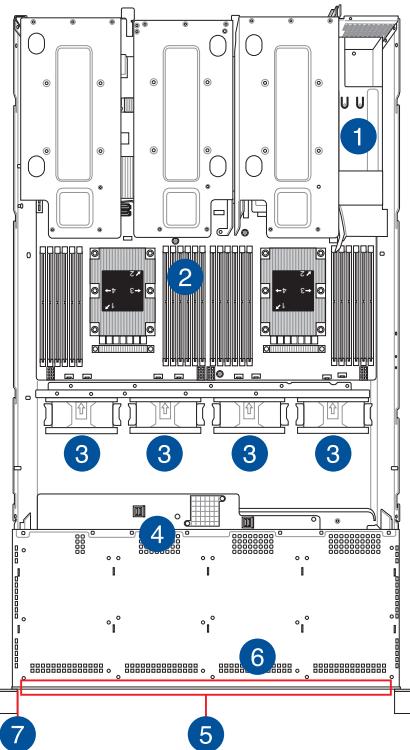
The rear panel includes the expansion slots, system power sockets, and rear fans. The middle part includes the I/O shield with openings for the rear panel connectors on the motherboard.



- * This port is for ASUS ASMB9-iKVM only.
- The Q-Code LED provides the most probable cause of an error code as a starting point for troubleshooting. The actual cause may vary from case to case.
- Refer to the Q-Code table for details.

1.6 Internal features

The barebone server includes the basic components as shown.



1. Redundant Power supply
2. ASUS Z11PP-D24 Server Board
3. System fans
4. SATA/SAS back panel
5. 24 x 2.5" storage device trays
6. Front panel (hidden)
7. Asset tag (hidden)



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

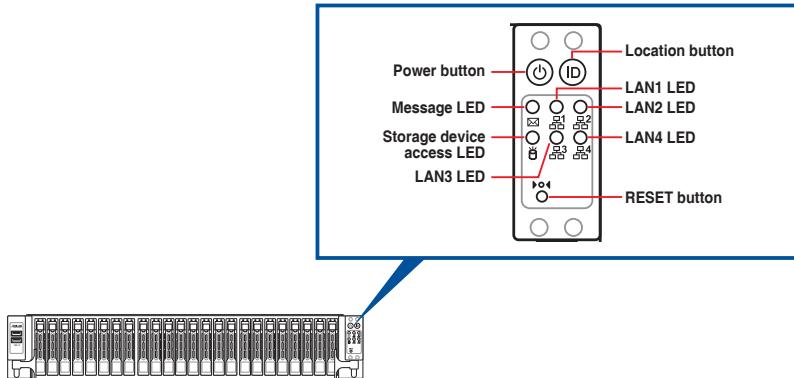


A protection film is pre-attached to the front cover before shipping. Please remove the protection film before turning on the system for proper heat dissipation.

WARNING
HAZARDOUS MOVING PARTS
KEEP FINGERS AND OTHER BODY PARTS AWAY

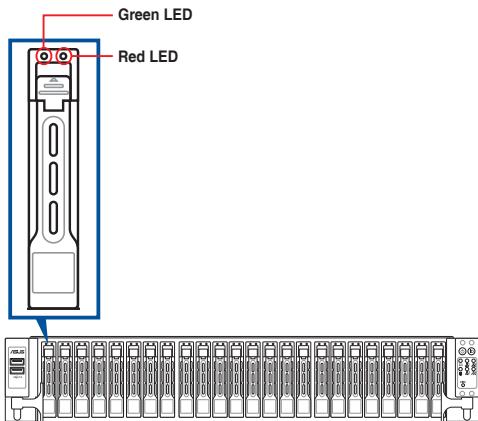
1.7 LED information

1.7.1 Front panel LEDs



LED	Icon	Display status	Description
Power LED	⊕	ON	System power ON
Storage device access LED	ए	OFF	No activity
		Blinking	Read/write data into the storage device
Message LED	✉	OFF	System is normal; no incoming event
		ON	With the onboard ASMB8-iKVM: a hardware monitor event is indicated
LAN LEDs	एं	OFF	No LAN connection
		Blinking	LAN is transmitting or receiving data
		ON	LAN connection is present
Location LED	ID	ON	Location switch is pressed
		OFF	Normal status (Press the location switch again to turn off)

1.7.2 Storage device status LED



SATA/SAS Storage Device LED Description

GREEN	ON	SATA/SAS storage device power ON
RED	ON	Storage device has failed and should be swapped immediately
GREEN/RED	Blinking	RAID rebuilding
GREEN/RED	Blinking	Locate
GREEN/RED	OFF	Storage device not found
GREEN	Blinking	Read/write data from/into the SATA/SAS storage device

1.7.3 LAN (RJ-45) LEDs

ACT/LINK LED SPEED LED



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

1.7.4 Q-Code table

Action	Phase	Post Code	Type	Description
SEC Start up	Security Phase	0x01	Progress	First post code
		0x02	Progress	Load BSP microcode
		0x03	Progress	Perform early platform Initialization
		0x04	Progress	Set cache as ram for PEI phase
		0x05	Progress	Establish Stack
		0x06	Progress	CPU Early Initialization
PSP Boot	PSP Boot Loader phase (Error Post Codes)	0x00	Error	General - Success
		0x01	Error	Generic Error Code
		0x02	Error	Generic Memory Error
		0x03	Error	Buffer Overflow
		0x04	Error	Invalid Parameter(s)
		0x05	Error	Invalid Data Length
		0x06	Error	Data Alignment Error
		0x07	Error	Null Pointer Error
		0x08	Error	Unsupported Function
		0x09	Error	Invalid Service ID
		0x0A	Error	Invalid Address
		0x0B	Error	Out of Resource Error
		0x0C	Error	Timeout
		0x0D	Error	data abort exception
		0x0E	Error	prefetch abort exception
		0x0F	Error	Out of Boundary Condition Reached
		0x10	Error	Data corruption
		0x11	Error	Invalid command
		0x12	Error	The package type provided by BR is incorrect
		0x13	Error	Failed to retrieve FW header during FW validation
		0x14	Error	Key size not supported
		0x15	Error	Agesa0 verification error
		0x16	Error	SMU FW verification error
		0x17	Error	OEM SINGING KEY verification error
		0x18	Error	Generic FW Validation error
		0x19	Error	RSA operation fail - bootloader
		0x1A	Error	CCP Passthrough operation failed - internal status
		0x1B	Error	AES operation fail
		0x1C	Error	CCP state save failed
		0x1D	Error	CCP state restore failed
		0x1E	Error	SHA256 operation fail - internal status
		0x1F	Error	ZLIB Decompression operation fail
		0x20	Error	HMAC-SHA256 operation fail - internal status
		0x21	Error	Booted from boot source not recognized by PSP
		0x22	Error	PSP directory entry not found
		0x23	Error	PSP failed to set the write enable latch
		0x24	Error	PSP timed out because sprom took too long
		0x25	Error	Cannot find BIOS directory
		0x26	Error	SpiRom is not valid
		0x27	Error	slave die has different security state from master
		0x28	Error	SMI interface init failure
		0x29	Error	SMI interface generic error
		0x2A	Error	invalid die ID executes MCM related function
		0x2B	Error	invalid MCM configuration table read from bootrom
		0x2C	Error	Valid boot mode wasn't detected
		0x2D	Error	NVStorage init failure
		0x2E	Error	NVStorage generic error
		0x2F	Error	MCM 'error' to indicate slave has more data to send
		0x30	Error	MCM error if data size exceeds 32B
		0x31	Error	Invalid client id for SVC MCM call
		0x32	Error	MCM slave status register contains bad bits
		0x33	Error	MCM call was made in a single die environment
		0x34	Error	PSP secure mapped to invalid segment (should be 0x400_0000)
		0x35	Error	No physical x86 cores were found on die
		0x36	Error	Insufficient space for secure OS (range of free SRAM to SVC stack base)
		0x37	Error	SYSHUB mapping memory target type is not supported
		0x38	Error	Attempt to unmap permanently mapped TLB to PSP secure region

(continued on the next page)

Action	Phase	Post Code	Type	Description
PSP Boot	PSP Boot Loader phase (Error Post Codes)	0x39	Error	Unable to map an SMN address to AXI space
		0x3A	Error	Unable to map a SYSHUB address to AXI space
		0x3B	Error	The count of CCXs or cores provided by bootrom is not consistent
		0x3C	Error	Uncompressed image size doesn't match value in compressed header
		0x3D	Error	Compressed option used in case where not supported
		0x3E	Error	Fuse info on all dies don't match
		0x3F	Error	PSP sent message to SMU; SMU reported an error
		0x40	Error	Function RunPostX66ReleaseUnitTests failed in memcmp()
		0x41	Error	Interface between PSP to SMU not available.
		0x42	Error	Timer wait parameter too large
		0x43	Error	Test harness module reported an error
		0x44	Error	x86 wrote C2PMMSG_0 interrupting PSP
		0x45	Error	A write to an L3 register failed
		0x46	Error	Mini-BL
		0x47	Error	Mini-BL CCP HMAC Unit-test failed
		0x48	Error	Potential stack corruption in jump to Mini BL
		0x49	Error	Error in Validate and Loading AGESA APOB SVC call
		0x4A	Error	Correct fuse bits for DIAG_BL loading not set
		0x4B	Error	The UmcProgramKeys() function was not called by AGESA
		0x4C	Error	Secure unlock error
		0x4D	Error	Syshub register programming mismatch during readback
		0x4E	Error	Family ID in MPO_SFUSE_SECT[3:1] not correct
		0x4F	Error	An operation was invoked that can only be performed by the GM
		0x50	Error	Failed to acquire host controller semaphore to claim ownership of SMB
		0x51	Error	Timed out waiting for host to complete pending transactions
		0x52	Error	Timed out waiting for slave to complete pending transactions
		0x53	Error	Unable to kill current transaction on host
		0x54	Error	One of: Illegal command
		0x55	Error	An SMBus transaction collision detected
		0x56	Error	Transaction failed to be started or processed by host
		0x57	Error	An unsolicited SMBus interrupt was received
		0x58	Error	An attempt to send an unsupported PSP-SMU message was made
		0x59	Error	An error/data corruption detected on response from SMU for sent msg
		0x5A	Error	MCM Steady-state unit test failed
		0x5B	Error	S3 Enter failed
		0x5C	Error	AGESA BL did not set PSP SMU reserved addresses via SVC call
		0x5E	Error	CcxSecBisiEn not set in fuse RAM
		0x5F	Error	Received an unexpected result
		0x60	Error	VMG Storage Init failed
		0x61	Error	Failure in mbedTLS user app
		0x62	Error	An error occurred whilst attempting to SMN map a fuse register
		0x63	Error	Fuse burn sequence/operation failed due to internal SOC error
		0x64	Error	Fuse sense operation timed out
		0x65	Error	Fuse burn sequence/operation timed out waiting for burn done
		0x66	Error	Failure status indicating that the given SecureOS has been
		0x67	Error	This PSP FW was revoked
		0x68	Error	The platform model/vendor id fuse is not matching the BIOS public key token
		0x69	Error	The BIOS OEM public key of the BIOS was revoked for this platform
		0x6A	Error	PSP level 2 directory not match expected value.
		0x6B	Error	BIOS level 2 directory not match expected value.
		0x6C	Error	HVB validation failure for BIOS RTM volume (OEM public/signature failed to validate).
		0x6D	Error	Generic error indicating the CCP HAL initialization failed
		0x94	Error	Knoll failed to idle correctly after being reset
		0x95	Error	Bad status returned by I2CKnollCheck
		0x96	Error	NACK to general call (no device on Knoll I2C bus)
		0x97	Error	Null pointer passed to I2CKnollCheck
		0x98	Error	Invalid device-ID found during Knoll authentication
		0x99	Error	Error during Knoll/Prom key derivation
		0x9A	Error	Null pointer passed to Crypto function
		0x9B	Error	Error in checksum from wrapped Knoll/Prom keys
		0x9C	Error	Knoll returned an invalid response to a command
		0x9D	Error	Bootsloader failed in Knoll Send Command function
		0x9E	Error	No Knoll device found by verifying MAC

(continued on the next page)

Action	Phase	Post Code	Type	Description
PSP Boot	PSP Boot Loader phase (Status Post Codes)	0xA0	Progress	Bootloader successfully entered C Main
		0xA1	Progress	Master initialized C2P / slave waited for master to init C2P
		0xA2	Progress	HMAC key successfully derived
		0xA3	Progress	Master got Boot Mode and sent boot mode to all slaves
		0xA4	Progress	SpiRom successfully initialized
		0xA5	Progress	BIOS Directory successfully read from SPI to SRAM
		0xA6	Progress	Early unlock check
		0xA7	Progress	Inline Aes key successfully derived
		0xA8	Progress	Inline-AES key programming is done
		0xA9	Progress	Inline-AES key wrapper derivation is done
		0xAA	Progress	Bootloader successfully loaded HW IP configuration values
		0xAB	Progress	Bootloader successfully programmed MBAT table
		0xAC	Progress	Bootloader successfully loaded SMU FW
		0xAD	Progress	PSP and SMU configured WAFL
		0xAE	Progress	User mode test harness completed successfully
		0xAF	Progress	Bootloader loaded Agesa0 from SpiRom
		0xB0	Progress	AGESA phase has completed
		0xB1	Progress	RunPostDramTrainingTests() completed successfully
		0xB2	Progress	SMU FW Successfully loaded to SMU Secure DRAM
		0xB3	Progress	Sent all required boot time messages to SMU
		0xB4	Progress	Validated and ran Security Gasket binary
		0xB5	Progress	UMC Keys generated and programmed
		0xB6	Progress	Inline AES key wrapper stored in DRAM
		0xB7	Progress	Completed FW Validation step
		0xB8	Progress	Completed FW Validation step
		0xB9	Progress	BIOS copy from SPI to DRAM complete
		0xBA	Progress	Completed FW Validation step
		0xBB	Progress	BIOS load process fully complete
		0xBC	Progress	Bootloader successfully release x86
		0xBD	Progress	Early Secure Debug completed
		0xBE	Progress	GelFWVersion command received from BIOS is completed
		0xBF	Progress	SMIInfo command received from BIOS is completed
		0xC0	Progress	Successfully entered WarmBootResume()
		0xC1	Progress	Successfully copied SecureOS image to SRAM
		0xC2	Progress	Successfully copied trustlets to PSP Secure Memory
		0xC3	Progress	About to jump to Secure OS (SBL about to copy and jump)
		0xC4	Progress	Successfully restored CCP and UMC state on S3 resume
		0xC5	Progress	PSP SRAM HMAC validated by Mini BL
		0xC6	Progress	About to jump to <:base in Mini BL
		0xC7	Progress	VMG ECDH unit test started
		0xC8	Progress	VMG ECDH unit test passed
		0xC9	Progress	VMG ECC CDH primitive unit test started
		0xCA	Progress	VMG ECC CDH primitive unit test passed
		0xCB	Progress	VMG SP800-108 KDF-CTR HMAC unit test started
		0xCC	Progress	VMG SP800-108 KDF-CTR HMAC unit test passed
		0xCD	Progress	VMG LAUNCH_* test started
		0xCE	Progress	VMG LAUNCH_* test passed
		0xCF	Progress	MP1 has been taken out of reset
		0xD0	Progress	PSP and SMU Reserved Addresses correct
		0xD1	Progress	Reached Naples steady-state WiFi loop
		0xD2	Progress	Knoll device successfully initialized
		0xD3	Progress	32-byte RandOut successfully returned from Knoll
		0xD4	Progress	32-byte MAC successfully received from Knoll.
		0xD5	Progress	Knoll device verified successfully
		0xD6	Progress	Done enabling power for Knoll
		0xD7	Progress	Enter recovery mode due to trustlet validation fail.
		0xD8	Progress	Enter recovery mode due to OS validation fail.
		0xD9	Progress	Enter recovery mode due to OEM public key not found.

(continued on the next page)

Action	Phase	Post Code	Type	Description
Quick VGA	DXE(Driver Execution Environment) phase	0x10	Progress	PEI Core Entry
		0x11	Progress	PEI cache as ram CPU initial
		0x15	Progress	NB Initialization before installed memory
		0x19	Progress	SB Initialization before installed memory
		0x32	Progress	CPU POST-Memory Initialization
		0x33	Progress	CPU Cache Initialization
		0x34	Progress	Application Processor(s) (AP) Initialization
		0x35	Progress	BSP Selection
		0x36	Progress	CPU Initialization
		0x37	Progress	Pre-memory NB Initialization
		0x3B	Progress	Pre-memory SB Initialization
		0x4F	Progress	DXE Initial Program Load(IPL)
		0x60	Progress	DXE Core Started
		0x61	Progress	DXE NVRAM Initialization
		0x62	Progress	SB run-time Initialization
		0x63	Progress	CPU DXE Initialization
		0x68	Progress	PCI HB Initialization
		0x69	Progress	NB DXE Initialization
		0x6A	Progress	NB DXE SMM Initialization
Normal boot	BDS(Boot Device Selection) phase	0x70	Progress	SB DXE Initialization
		0x71	Progress	SB DXE SMM Initialization
		0x72	Progress	SB DEVICES Initialization
		0x78	Progress	ACPI Module Initialization
		0x79	Progress	CSM Initialization
		0xD0	Progress	CPU PM Structure Initialization
		0x90	Progress	BDS started
		0x91	Progress	Connect device event
		0x92	Progress	PCI Bus Enumeration
		0x93	Progress	PCI Bus Enumeration
		0x94	Progress	PCI Bus Enumeration
		0x95	Progress	PCI Bus Enumeration
		0x96	Progress	PCI Bus Enumeration
		0x97	Progress	Console outout connect event
		0x98	Progress	Console input connect event
		0x99	Progress	AMI Super IO start
		0x9A	Progress	AMI USB Driver Initialization
		0x9B	Progress	AMI USB Driver Initialization
		0x9C	Progress	AMI USB Driver Initialization
		0x9D	Progress	AMI USB Driver Initialization
		0xb2	Progress	Legacy Option ROM Initialization
		0xb3	Progress	Reset system
		0xb4	Progress	USB hotplug
Operating system phase	Operating system phase	0xb6	Progress	NVRAM clean up
		0xb7	Progress	NVRAM configuration reset
		0xA0	Progress	IDE, AHCI Initialization
		0xA1	Progress	IDE, AHCI Initialization
		0xA2	Progress	IDE, AHCI Initialization
		0xA3	Progress	IDE, AHCI Initialization
		0x00-0xFF	Progress	Wait BMC ready
		0xA8	Progress	BIOS Setup Utility password verify
		0xA9	Progress	BIOS Setup Utility start
		0xAB	Progress	BIOS Setup Utility input wait
		0xAD	Progress	Ready to boot event
		0xAE	Progress	Legacy boot event
		0xAA	Progress	APIC mode
		0xAC	Progress	PIC mode

Hardware Information

2

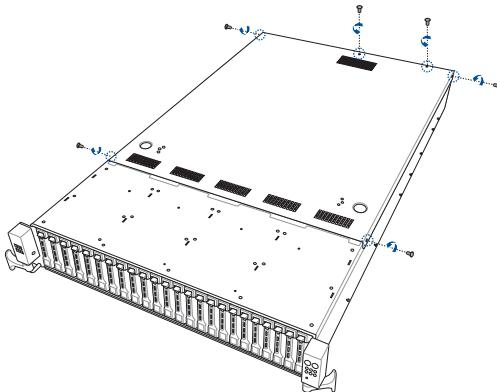
This chapter lists the hardware setup procedures that you have to perform when installing or removing system components.

2.1 Chassis cover

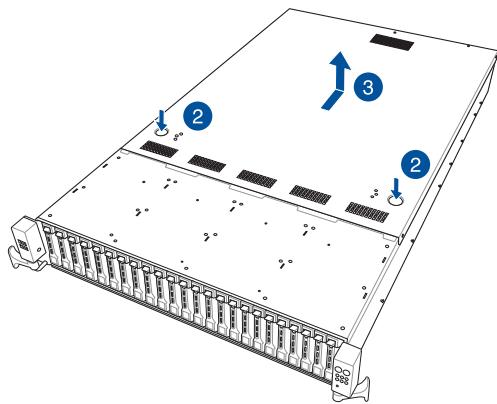
Removing the rear cover

To remove the rear cover:

1. Remove the six (6) screws on the rear cover with a Phillips screwdriver.



2. Push and hold the cover buttons down, then slide the rear cover towards the rear to disengage it from the chassis.
3. Lift the rear cover to completely remove it from the chassis.



2.2 Central Processing Unit (CPU)

The motherboard comes with a surface mount LGA 3647 socket designed for the Intel® Xeon® Processor Scalable Family Series.



- 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 LGA 3647 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.

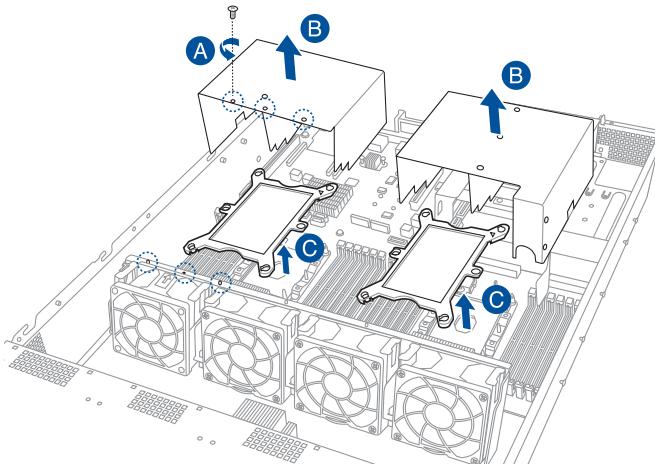
2.2.1 Installing the CPU and heatsink

To install a CPU:

- Remove the rear cover. For more information, see the section **Chassis cover**.
- Remove the air duct screw (A), remove the air ducts (B), and then remove the PnP caps (C) from the CPU sockets.



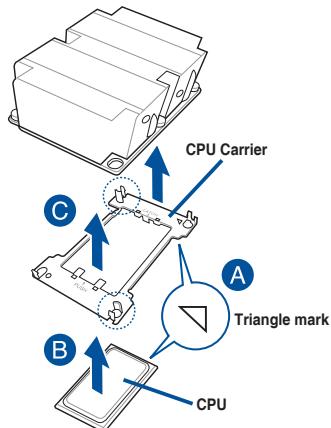
Keep the PnP cap. ASUS will process Return Merchandise Authorization (RMA) requests only if the motherboard comes with the PnP cap on the LGA 3647 socket.



3. Align the triangle mark on the CPU with the triangle mark on the CPU Carrier (A), then install the CPU into the CPU Carrier until it clicks firmly into place (B), and then install the CPU Carrier into the heatsink until it clicks firmly in place (C).



Ensure that the triangle mark on the CPU matches the triangle mark on the CPU Carrier.



4. Align the CPU and CPU Carrier in the correct orientation, and then place the heatsinks on top of the CPU sockets.

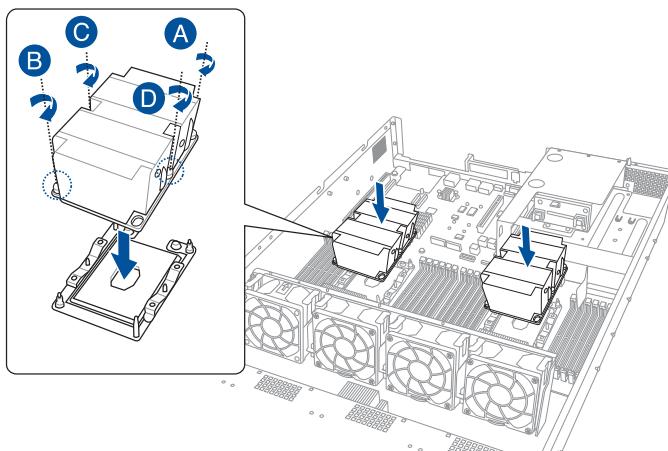


The CPU and CPU Carrier fits in only one correct orientation. DO NOT force the CPU and CPU Carrier into the socket to prevent damaging the CPU pins on the socket.

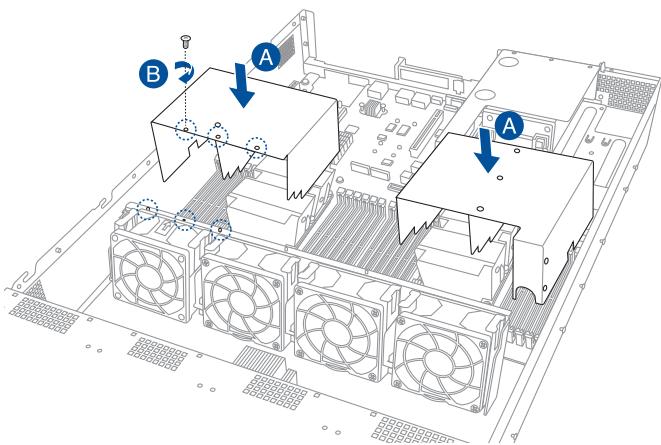
5. Twist each of the four screws with a screwdriver just enough to attach the heatsink to the motherboard. When the four screws are attached, tighten them one by one in a diagonal sequence to completely secure the heatsink.



The heatsink screws are T30 models. A torque value of 12 inch-lbf is recommended.



6. Reinstall the air ducts (A), and then secure the air duct with the air duct screw removed in step 2 (B).

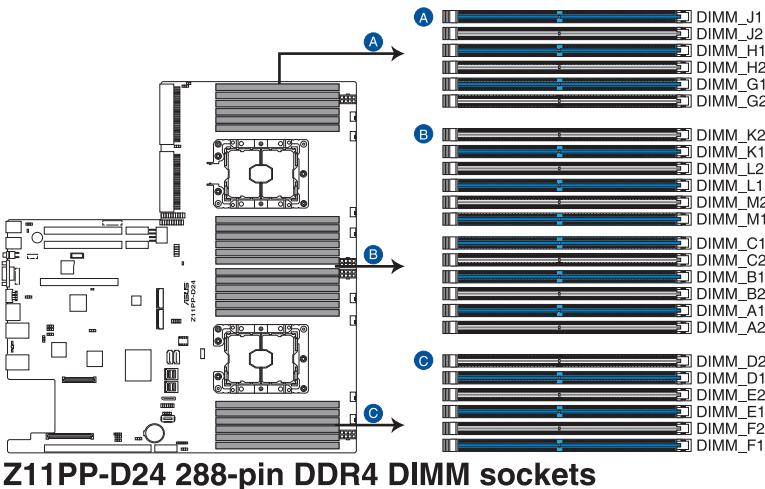


2.3 System memory

2.3.1 Overview

The motherboard comes with 24 Double Data Rate 4 (DDR4) Dual Inline Memory Modules (DIMM) sockets.

The figure illustrates the location of the DDR4 DIMM sockets:



2.3.2 Memory Configurations

You may install 4GB, 8GB, 12GB, and 32GB RDIMMs; 64GB and 128GB RDIMMs (3DS); 32GB, 64GB, and 128GB LRDIMMs; 64GB, 128GB, and 256GB LRDIMMs (3DS); and 128GB, 256GB, and 512GB DCPMMs into the DIMM sockets using the memory configurations in this section.



- Refer to ASUS Server AVL for the updated list of compatible DIMMs.
- Always install DIMMs with the same CAS latency. For optimum compatibility, it is recommended that you obtain memory modules from the same vendor.

Recommended memory configuration for 1 CPU Configuration

1 CPU Configuration (must be on CPU1)						
	DIMM_A2	DIMM_A1	DIMM_B2	DIMM_B1	DIMM_C2	DIMM_C1
1 DIMM		•				
2 DIMMs		•				
4 DIMMs		•		•		
6 DIMMs		•		•		•
8 DIMMs	•	•	•	•		
12 DIMMs	•	•	•	•	•	•

1 CPU Configuration (must be on CPU1)						
	DIMM_D2	DIMM_D1	DIMM_E2	DIMM_E1	DIMM_F2	DIMM_F1
1 DIMM						
2 DIMMs		•				
4 DIMMs		•		•		
6 DIMMs		•		•		•
8 DIMMs	•	•	•	•		
12 DIMMs	•	•	•	•	•	•

Recommended memory configuration for 2 CPU Configuration

2 CPU Configuration						
	DIMM_A2	DIMM_A1	DIMM_B2	DIMM_B1	DIMM_C2	DIMM_C1
2 DIMMs		•				
4 DIMMs		•				
8 DIMMs		•			•	
12 DIMMs		•			•	•
16 DIMMs	•	•	•	•		
20 DIMMs	•	•	•	•		•
24 DIMMs	•	•	•	•	•	•

2 CPU Configuration						
	DIMM_D2	DIMM_D1	DIMM_E2	DIMM_E1	DIMM_F2	DIMM_F1
2 DIMMs						
4 DIMMs		•				
8 DIMMs		•		•		
12 DIMMs		•		•		•
16 DIMMs	•	•	•	•		
20 DIMMs	•	•	•	•		•
24 DIMMs	•	•	•	•	•	•

2 CPU Configuration						
	DIMM_G2	DIMM_G1	DIMM_H2	DIMM_H1	DIMM_J2	DIMM_J1
2 DIMMs		•				
4 DIMMs		•				
8 DIMMs		•		•		
12 DIMMs		•		•		•
16 DIMMs	•	•	•	•		
20 DIMMs	•	•	•	•		•
24 DIMMs	•	•	•	•	•	•

2 CPU Configuration						
	DIMM_K2	DIMM_K1	DIMM_L2	DIMM_L1	DIMM_M2	DIMM_M1
2 DIMMs						
4 DIMMs		•				
8 DIMMs		•		•		
12 DIMMs		•		•		•
16 DIMMs	•	•	•	•		
20 DIMMs	•	•	•	•		•
24 DIMMs	•	•	•	•	•	•

Intel® DC persistent memory population table

1 CPU Configuration

1 CPU Configuration (must be on CPU1)						
Modes	DIMM_F2	DIMM_F1	DIMM_E2	DIMM_E1	DIMM_D2	DIMM_D1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DCPMM		DRAM 1		DRAM 1
MM		DCPMM		DRAM 1		DRAM 1
AD+MM		DCPMM		DRAM 3		DRAM 3
AD		DCPMM	DRAM 1	DRAM 1	DRAM 1	DRAM 1

1 CPU Configuration (must be on CPU1)						
Modes	DIMM_C2	DIMM_C1	DIMM_B2	DIMM_B1	DIMM_A2	DIMM_A1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM3
AD		DCPMM		DRAM 1		DRAM1
MM		DCPMM		DRAM 1		DRAM1
AD+MM		DCPMM		DRAM 3		DRAM3
AD		DCPMM	DRAM 1	DRAM 1	DRAM 1	DRAM1

AD - APP DIRECT MODE

MM - MEMORY MODE

AD+MM - MIXED MODE

DRAM1 - RDIMM, RDIMM 3DS, LRDIMM, LRDIMM 3DS

DRAM2 - RDIMM only

DRAM3 - RDIMM, RDIMM 3DS, LRDIMM

DCPMM - DC PERSISTENT MEMORY

2 CPU Configuration (symmetric population)

2 CPU Configuration (symmetric population)						
Modes	DIMM_F2	DIMM_F1	DIMM_E2	DIMM_E1	DIMM_D2	DIMM_D1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DCPMM		DRAM 1		DRAM 1
MM		DCPMM		DRAM 1		DRAM 1
AD+MM		DCPMM		DRAM 3		DRAM 3
AD		DCPMM	DRAM 1	DRAM 1	DRAM 1	DRAM 1

2 CPU Configuration (symmetric population)

Modes	DIMM_C2	DIMM_C1	DIMM_B2	DIMM_B1	DIMM_A2	DIMM_A1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM3
AD		DCPMM		DRAM 1		DRAM1
MM		DCPMM		DRAM 1		DRAM1
AD+MM		DCPMM		DRAM 3		DRAM3
AD		DCPMM	DRAM 1	DRAM 1	DRAM 1	DRAM1

(continued on the next page)

2 CPU Configuration (symmetric population)

Modes	DIMM_M2	DIMM_M1	DIMM_L2	DIMM_L1	DIMM_K2	DIMM_K1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD	DCPMM			DRAM 1		DRAM 1
MM	DCPMM			DRAM 1		DRAM 1
AD+MM	DCPMM			DRAM 3		DRAM 3
AD	DCPMM	DRAM 1				

2 CPU Configuration (symmetric population)

Modes	DIMM_J2	DIMM_J1	DIMM_H2	DIMM_H1	DIMM_G2	DIMM_G1
AD	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
MM	DCPMM	DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM 1
AD+MM	DCPMM	DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM 3
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1
MM		DRAM 2		DRAM 2	DCPMM	DRAM 2
AD+MM		DRAM 3		DRAM 3	DCPMM	DRAM 3
AD		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
MM		DRAM 1	DCPMM	DRAM 1	DCPMM	DRAM1
AD+MM		DRAM 3	DCPMM	DRAM 3	DCPMM	DRAM3
AD	DCPMM			DRAM 1		DRAM1
MM	DCPMM			DRAM 1		DRAM1
AD+MM	DCPMM			DRAM 3		DRAM3
AD	DCPMM	DRAM 1	DRAM 1	DRAM 1	DRAM 1	DRAM1

AD - APP DIRECT MODE

MM - MEMORY MODE

AD+MM - MIXED MODE

DRAM1 - RDIMM, RDIMM 3DS, LRDIMM, LRDIMM 3DS

DRAM2 - RDIMM only

DRAM3 - RDIMM, RDIMM 3DS, LRDIMM

DCPMM - DC PERSISTENT MEMORY

1 CPU Configuration with 1 DCPMM DIMM (asymmetric population)

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_F2	DIMM_F1	DIMM_E2	DIMM_E1	DIMM_D2	DIMM_D1
AD		DRAM 1		DRAM 1		DRAM 1

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_C2	DIMM_C1	DIMM_B2	DIMM_B1	DIMM_A2	DIMM_A1
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1

AD - APP DIRECT MODE

DRAM1 - RDIMM, RDIMM 3DS, LRDIMM, LRDIMM 3DS

DCPMM - DC PERSISTENT MEMORY

2 CPU Configuration with 1 DCPMM DIMM (asymmetric population)

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_F2	DIMM_F1	DIMM_E2	DIMM_E1	DIMM_D2	DIMM_D1
AD		DRAM 1		DRAM 1		DRAM 1

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_C2	DIMM_C1	DIMM_B2	DIMM_B1	DIMM_A2	DIMM_A1
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_M2	DIMM_M1	DIMM_L2	DIMM_L1	DIMM_K2	DIMM_K1
AD		DRAM 1		DRAM 1		DRAM 1

Asymmetric Population (2nd Socket has no DCPMM DIMM)

Modes	DIMM_J2	DIMM_J1	DIMM_H2	DIMM_H1	DIMM_G2	DIMM_G1
AD		DRAM 1		DRAM 1		DRAM 1

AD - APP DIRECT MODE

DRAM1 - RDIMM, RDIMM 3DS, LRDIMM, LRDIMM 3DS

DCPMM - DC PERSISTENT MEMORY

2 CPU Configuration with 2 DCPMM DIMMs (asymmetric population)

2 CPU Configuration (asymmetric population)						
Modes	DIMM_F2	DIMM_F1	DIMM_E2	DIMM_E1	DIMM_D2	DIMM_D1
AD		DRAM 1		DRAM 1		DRAM 1

2 CPU Configuration (asymmetric population)						
Modes	DIMM_C2	DIMM_C1	DIMM_B2	DIMM_B1	DIMM_A2	
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1

2 CPU Configuration (asymmetric population)						
Modes	DIMM_M2	DIMM_M1	DIMM_L2	DIMM_L1	DIMM_K2	
AD		DRAM 1		DRAM 1		DRAM 1

2 CPU Configuration (asymmetric population)						
Modes	DIMM_J2	DIMM_J1	DIMM_H2	DIMM_H1	DIMM_G2	
AD		DRAM 1		DRAM 1	DCPMM	DRAM 1

AD - APP DIRECT MODE

DRAM1 - RDIMM, RDIMM 3DS, LRDIMM, LRDIMM 3DS

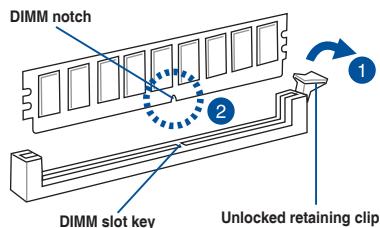
DCPMM - DC PERSISTENT MEMORY

2.3.3 Installing a DIMM on a single clip DIMM socket



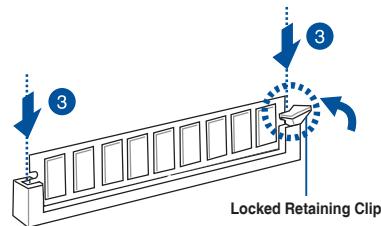
Ensure to unplug the power supply before adding or removing DIMMs or other system components. Failure to do so may cause severe damage to both the motherboard and the components.

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.



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.

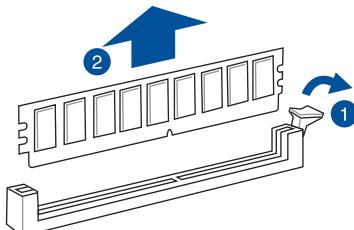
3. Hold the DIMM by both of its ends then insert the DIMM vertically into the socket. Apply force to both ends of the DIMM simultaneously until the retaining clip snaps back into place and the DIMM cannot be pushed in any further to ensure proper sitting of the DIMM.



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

2.3.4 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.



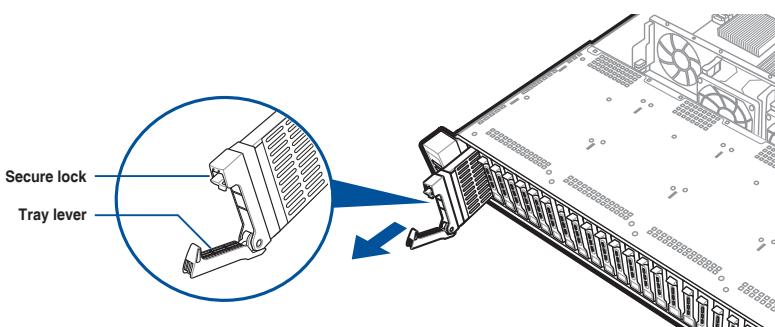
Support the DIMM lightly with your fingers when pressing the retaining clips. The DIMM might get damaged when it flips out with extra force.

2.4 Storage devices

The system supports 24 hot-swap 2.5-inch storage devices on the front panel.

To install a 2.5" hot-swap storage device to the front panel:

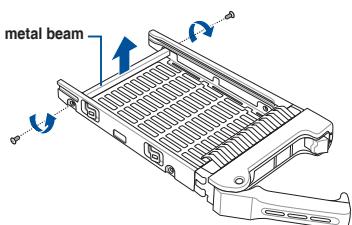
1. Switch the secure lock upward to release the tray lever.
2. Pull the tray lever outward. The drive tray ejects slightly after you pull out the lever. Firmly hold the tray lever and pull the drive tray out of the bay and put it on a flat surface.



3. Release the screws on each side of the drive tray to release the drive tray metal beam.

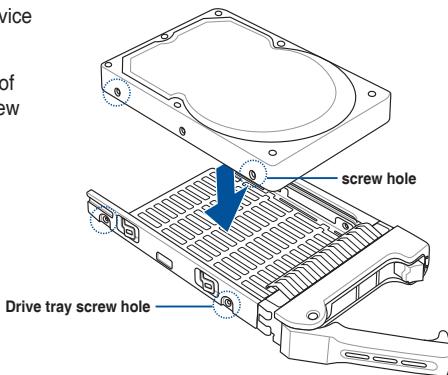


The metal beam supports the drive tray horizontally to prevent the drive tray from bending or deforming.

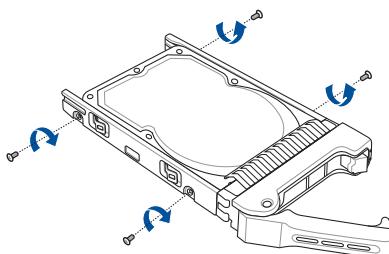


4. Place a 2.5" hot-swap storage device into the drive tray.

Ensure that the four screw holes of the storage device match the screw holes on the drive tray.

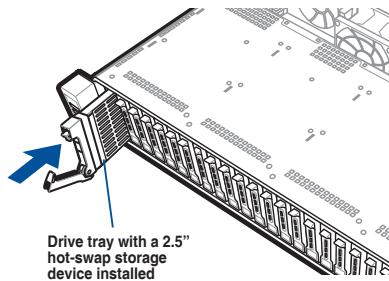


5. Secure the drive tray with four screws (2 screws on each side).



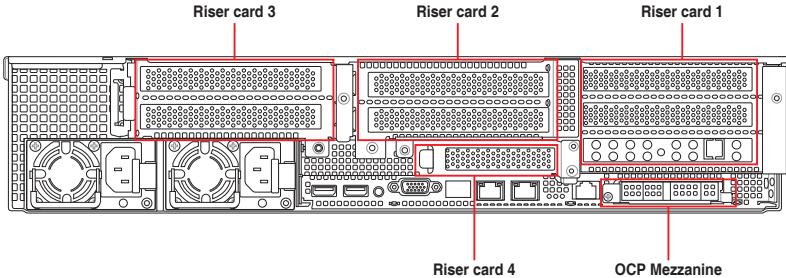
6. Carefully insert the drive tray and push it all the way to the depth of the bay. Lock the secure lock to secure the drive tray in place.

7. Repeat steps 1 to 6 to install the other storage devices.



2.5 Expansion slot

The barebone server comes with four pre-installed riser cards. You need to remove these expansion card brackets if you want to install PCIE expansion cards.



Riser card bracket 1

Riser card bracket 1 supports PCIe Gen3 slots 1-3 top to bottom. Slot 2 can be auto-switch to x16 mode when x16 card is populated whereas slot 1 will be disabled.

PCIe slot	Operation mode	
Slot 1	x8	N/A
Slot 2	x8	x16
Slot 3	x8 (ASUS PIKE II card by default)	x8 (ASUS PIKE II card by default)

Riser card bracket 2

Riser card bracket 2 supports PCIe Gen3 slots 4-5 top to bottom. Slot 4 can be auto-switch to x16 mode when x16 card is populated whereas slot 5 will be disabled.

PCIe slot	Operation mode	
Slot 4	x8	x16
Slot 5	x8	N/A

Riser card bracket 3

Riser card bracket 3 supports PCIe Gen3 slots 6-7 top to bottom. Slot 7 can be auto-switch to x16 mode when x16 card is populated whereas slot 6 will be disabled.

PCIe slot	Operation mode	
Slot 6	x8	N/A
Slot 7	x8	x16

Riser card bracket 4

Riser card bracket 4 supports PCIe Gen3 slot 8.

PCIe slot	Operation mode	
Slot 8		x16

OCP Mezzanine slot

OCP Mezzanine slot supports PCIe Gen3 x16.

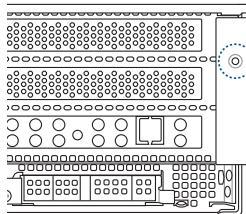
PCIe slot	Operation mode	
OCP Mezzanine		x16

2.5.1 Installing an expansion card to riser card bracket 1

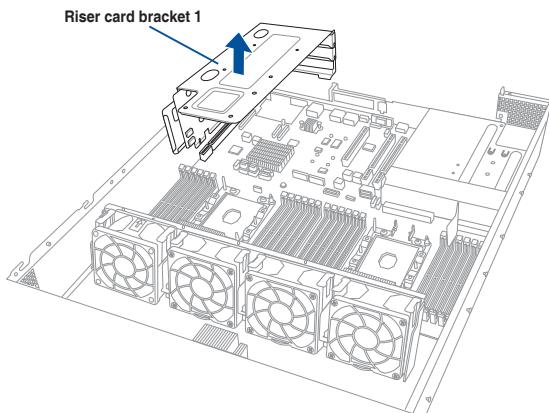
The pre-installed riser card bracket 1 on the PCIE1 slot supports Full-Height (FH) and Half-Length (HL) PCIE x16 expansion cards.

To install an expansion card to the riser card bracket 1:

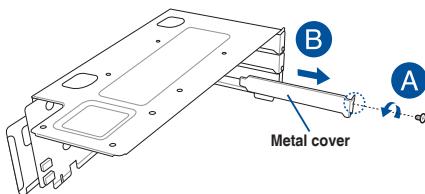
1. Remove the screw that secures the riser card bracket 1 to the chassis.



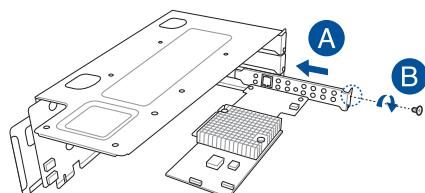
2. Firmly hold the riser card bracket 1, then pull it up to detach it from the PCIE1 slot on the motherboard.



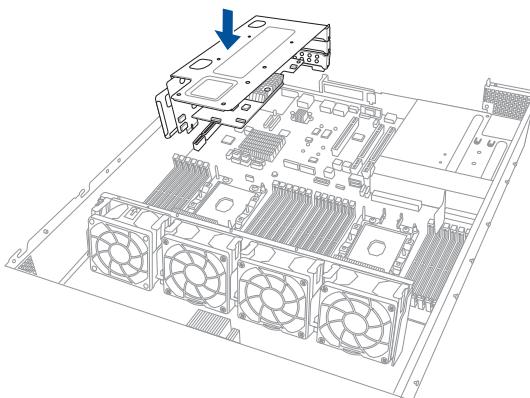
3. Remove the screw from the metal cover (A), then remove the metal cover (B) from the riser card bracket 1.



4. Install the PCIE expansion card into the riser card bracket 1 (A), then secure the expansion card with the screw (B).



5. Install the riser card bracket 1 and the PCIE expansion card assembly into the PCIE1 slot on the motherboard. Ensure that the golden connectors of the riser card bracket 1 is firmly seated in place.

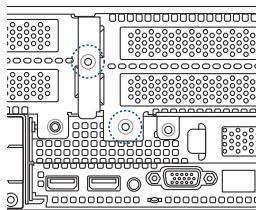


6. Secure the riser card bracket 1 to the chassis with the screw removed in step 1.

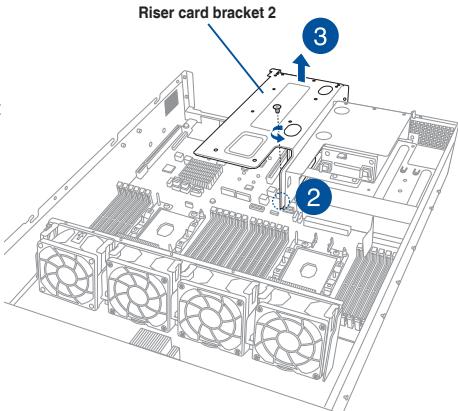
2.5.2 Installing an expansion card to riser card bracket 2

To install an expansion card on the riser card bracket 2:

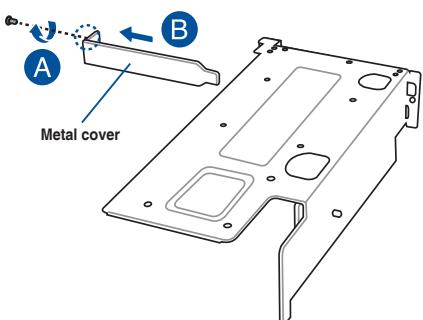
1. Remove the two screws that secure the riser card bracket 2 to the chassis.



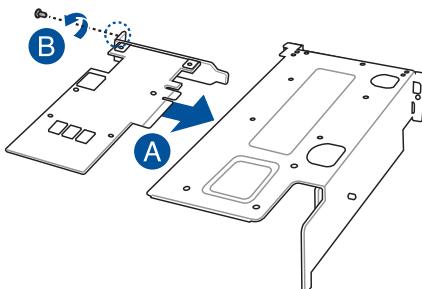
2. Remove the screw that secures the riser card bracket 2 to the motherboard.
3. Firmly hold the riser card bracket 2, then pull it up to detach it from the PCIE3 slot on the motherboard.



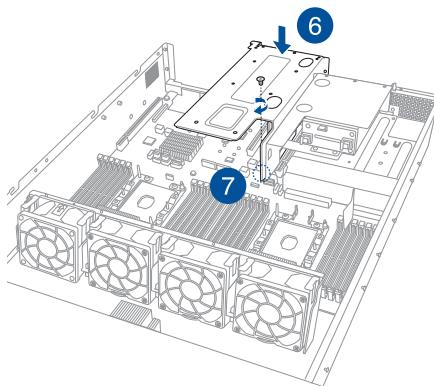
4. Remove the screw from the metal cover (A), then remove the metal cover (B) from the riser card bracket 2.



5. Install the PCIE expansion card into the riser card bracket 2 (A), then secure the expansion card with the screw (B).



6. Install the riser card bracket 2 and the PCIE expansion card assembly into the PCIE3 slot on the motherboard. Ensure that the golden connectors of the riser card bracket 2 is firmly seated in place.
7. Secure the riser card bracket 2 to the motherboard with the screw removed in step 2.

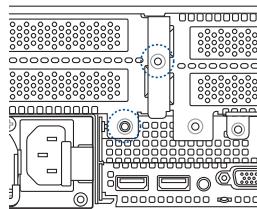


8. Secure the riser card bracket 2 to the chassis with the screws removed in step 1.

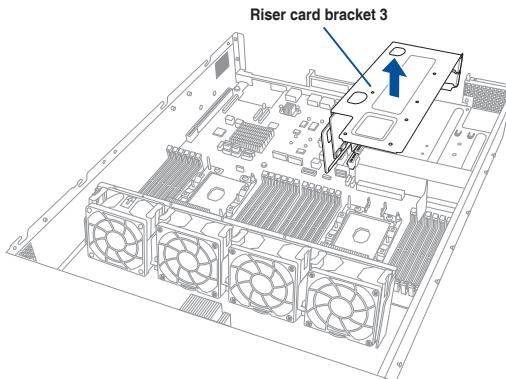
2.5.3 Installing an expansion card to riser card bracket 3

To install an expansion card on the riser card bracket 3:

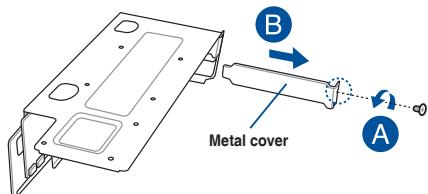
1. Remove the two screws that secure the riser card bracket 3 to the chassis.



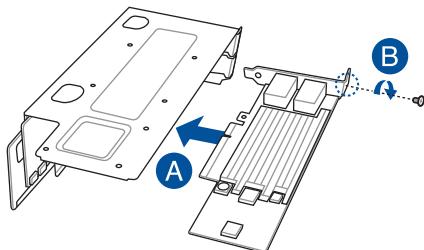
2. Firmly hold the riser card bracket 3, then pull it up to detach it from the PCIE4 slot on the motherboard.



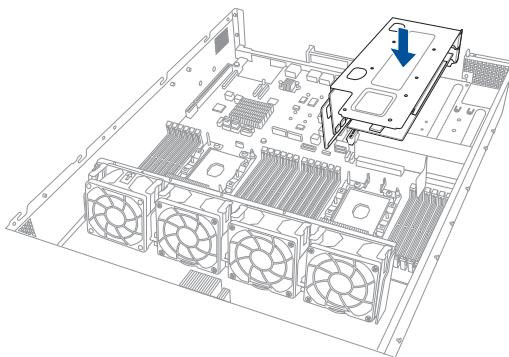
3. Remove the screw from the metal cover (A), then remove the metal cover (B) from the riser card bracket 3.



4. Install the PCIE expansion card into the riser card bracket 3 (A), then secure the expansion card with the screw (B).



5. Install the riser card bracket 3 and the PCIE expansion card assembly into the PCIE4 slot on the motherboard. Ensure that the golden connectors of the riser card bracket 3 is firmly seated in place.



6. Secure the riser card bracket 3 to the chassis with the screws removed in step 1.

2.5.4 Installing an expansion card to riser card bracket 4

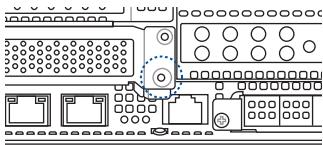
To install an expansion card to the riser card bracket 4:

1. Remove the riser card bracket 1 and riser card bracket 2.

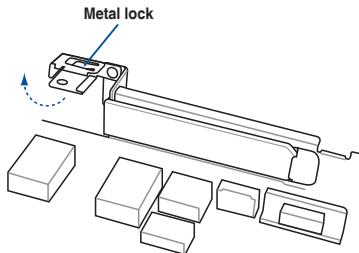


For more information, refer to section [2.5.1 Installing an expansion card to riser card bracket 1](#) and [2.5.2 Installing an expansion card to riser card bracket 2](#).

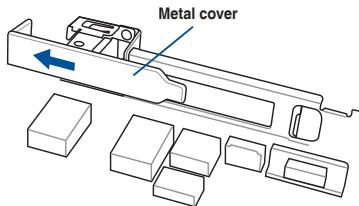
2. Remove the screw that secures the metal lock to the chassis.



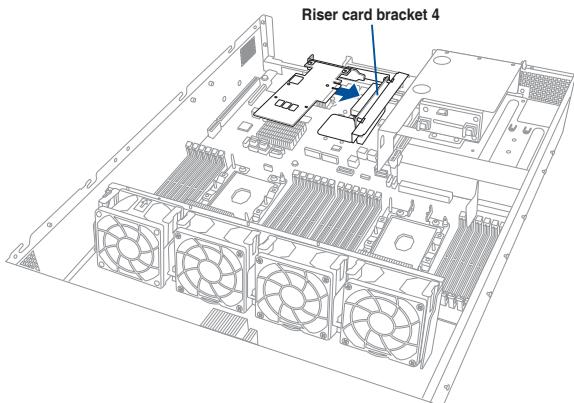
3. Lift the metal lock upward.



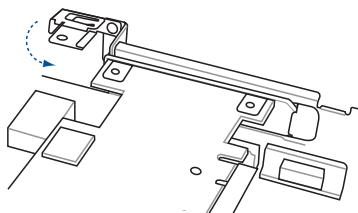
4. Remove the metal cover from the chassis.



5. Install the PCIE expansion card into the riser card bracket 4.



6. Move the metal lock downward to secure the riser card bracket 4 and the PCIE expansion card assembly to the chassis.

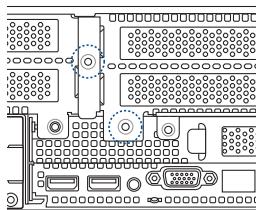


7. Secure the metal lock to the chassis with the screw removed in step 2.

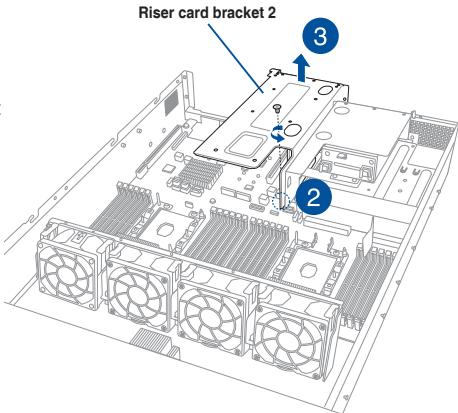
2.5.5 Installing an ASUS PIKE II card

To install an ASUS PIKE II card on the riser card bracket 2:

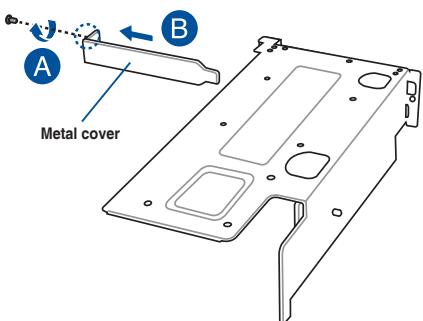
1. Remove the two screws that secure the riser card bracket 2 to the chassis.



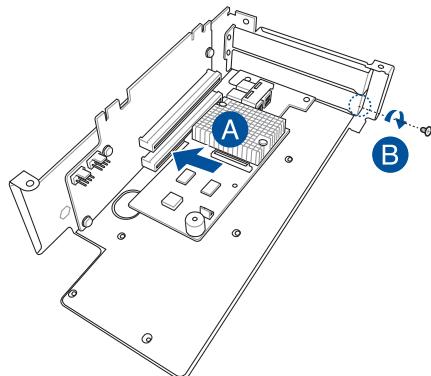
2. Remove the screw that secures the riser card bracket 2 to the motherboard.
3. Firmly hold the riser card bracket 2, then pull it up to detach it from the PCIE3 slot on the motherboard.



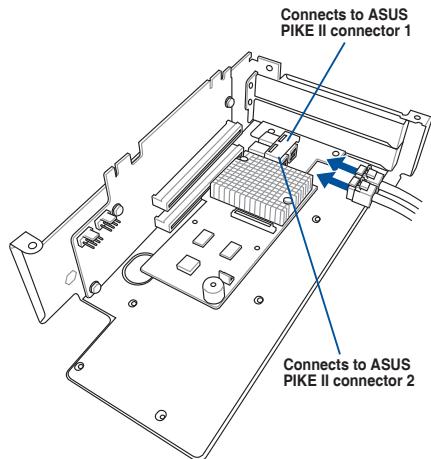
4. Remove the screw from the metal cover (A), then remove the metal cover (B) from the riser card bracket 2.



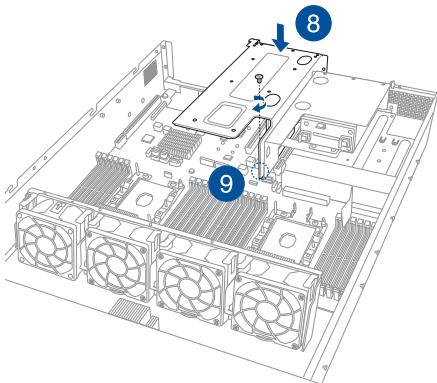
5. Prepare the ASUS PIKE II card.
6. Install the ASUS PIKE II card into the riser card bracket 2 (A), then secure it with the screw (B).



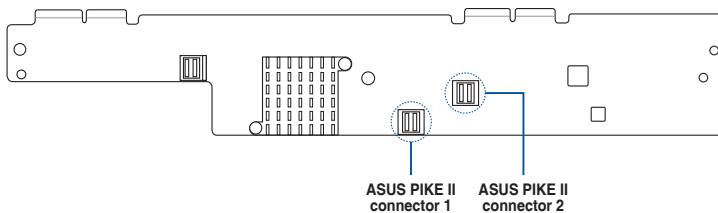
7. Connect the mini-SAS HD cables to the ASUS PIKE II card.



8. Install the riser card bracket 2 and the ASUS PIKE II card assembly into the PCIE3 slot on the motherboard. Ensure that the golden connectors of the riser card bracket 2 is firmly seated in place.
9. Secure the riser card bracket 2 to the motherboard with the screw removed in step 2.



10. Connect the mini-SAS HD cables from the ASUS PIKE II card to the corresponding slots on the expander board.



2.5.6 Configuring an expansion card

After installing the expansion card, configure it by adjusting the software settings.

1. Turn on the system and change the necessary BIOS settings, if any. See Chapter 5 for information on BIOS setup.
2. Assign an IRQ to the card. Refer to the following tables.
3. Install the software drivers for the expansion card.

Standard Interrupt assignments

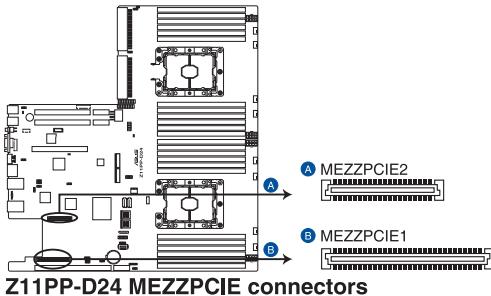
IRQ	Priority	Standard function
0	1	System Timer
1	2	Keyboard Controller
2	-	Programmable Interrupt
3*	11	Communications Port (COM2)
4*	12	Communications Port (COM1)
5*	13	--
6	14	Floppy Disk Controller
7*	15	--
8	3	System CMOS/Real Time Clock
9*	4	ACPI Mode when used
10*	5	IRQ Holder for PCI Steering
11*	6	IRQ Holder for PCI Steering
12*	7	PS/2 Compatible Mouse Port
13	8	Numeric Data Processor
14*	9	Primary IDE Channel
15*	10	Secondary IDE Channel

* These IRQs are usually available for ISA or PCI devices.

2.5.7 Installing Mezzanine cards

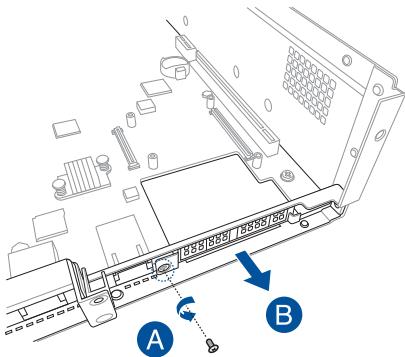
To install a Mezzanine card:

1. Locate the Mezzanine card connector on your motherboard.

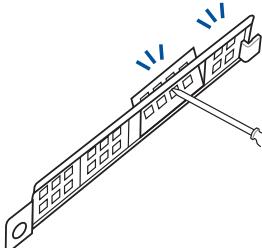


2. Remove the riser card bracket 1. For more information, refer to section **2.5.1 Installing an expansion card to riser card bracket 1**.

3. Remove the screw from the metal cover (A), then remove the metal cover (B) from chassis.

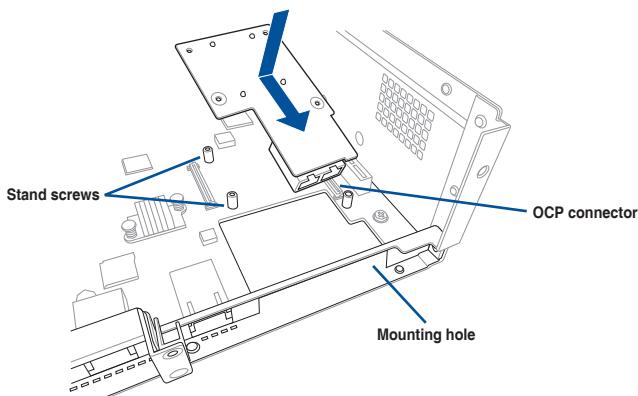


4. Select the slots that are going to be used for your Mezzanine card, then use a screwdriver and pry the corresponding slots until it pops off.

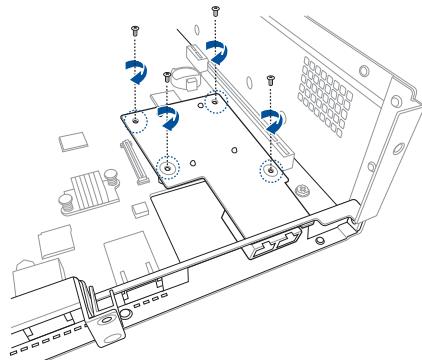


5. Prepare the Mezzanine card.
6. Insert the ports of the Mezzanine card into the mounting hole on the chassis, then insert the golden connector of the Mezzanine card into the OCP connector on the motherboard.

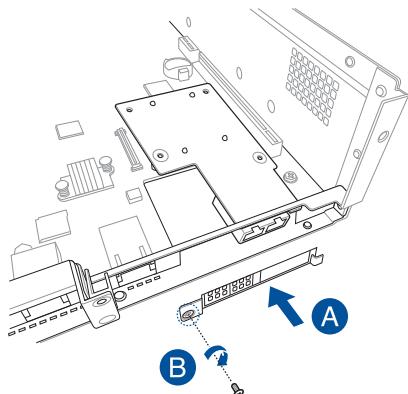
Ensure that the stand screws on the motherboard is aligned and matched to the screw holes of the Mezzanine card.



7. Secure the Mezzanine card with four bundled screws.



8. Reinstall the metal cover (A) and secure it with the screw (B).

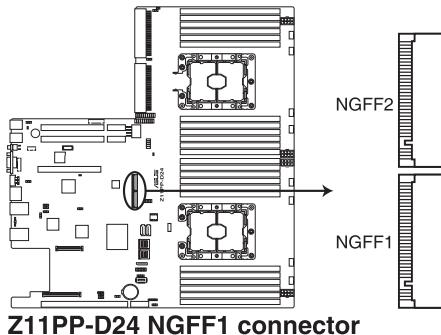


9. Install the riser card bracket 1 into the PCIE connector on the motherboard. For more information, refer to section **2.5.1 Installing an expansion card to riser card bracket 1**.

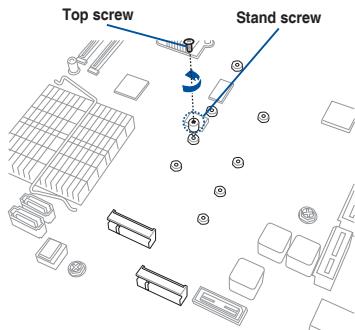
2.5.8 Installing M.2 (NGFF) cards

To install an M.2 (NGFF) card:

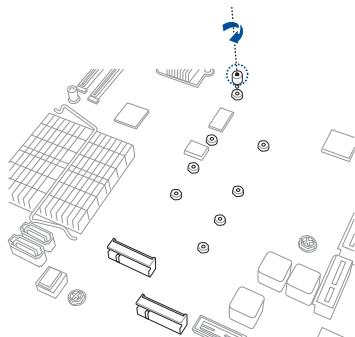
1. Locate the M.2 (NGFF) connectors on your motherboard.



2. Remove the top screw and the stand from the motherboard.

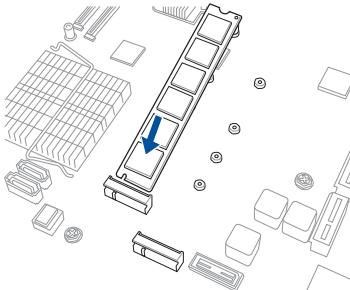


3. Select an appropriate screw hole on the motherboard for your M.2 card, then secure the stand to the motherboard.



4. Prepare the M.2 card.
5. Align and insert the M.2 card into the M.2 connector on the motherboard.

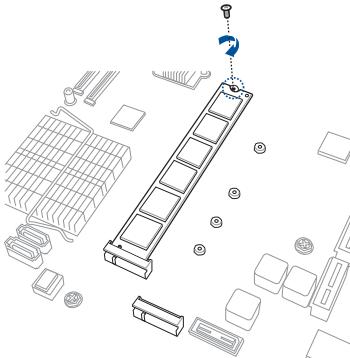
Ensure that the golden connector of the M.2 card is inserted firmly in place and that the screw hole on the M.2 card matches the stand screw on the motherboard.



6. Secure the M.2 card with the top screw.



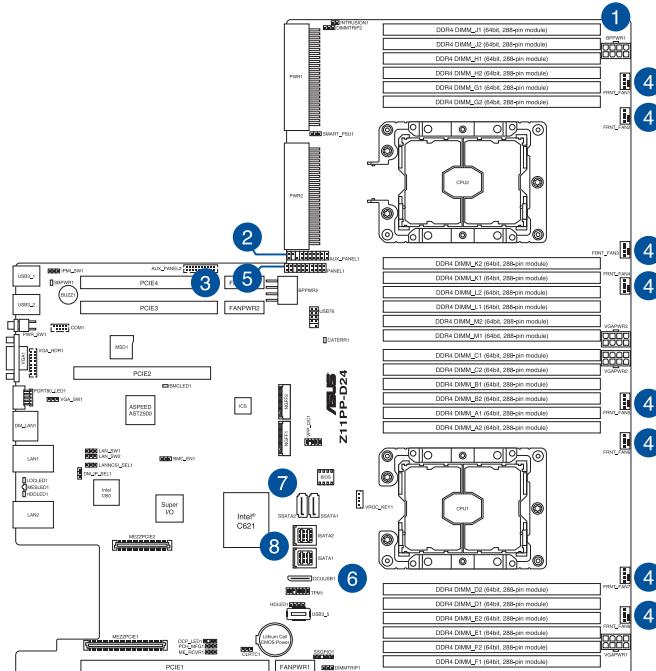
Ensure that the M.2 card is positioned between the top screw and the stand screw before securing it.



2.6 Cable connections



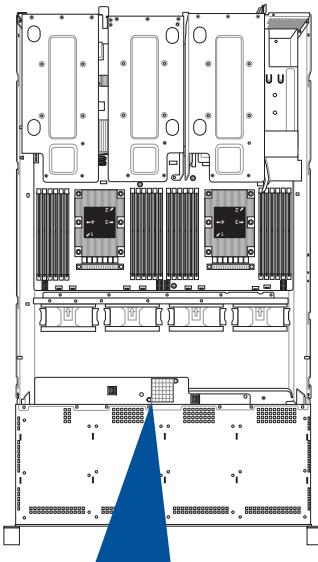
- The bundled system cables are pre-connected before shipment. You do not need to disconnect these cables unless you are going to remove pre-installed components to install additional devices.
- Refer to Chapter 4 for detailed information on the connectors.



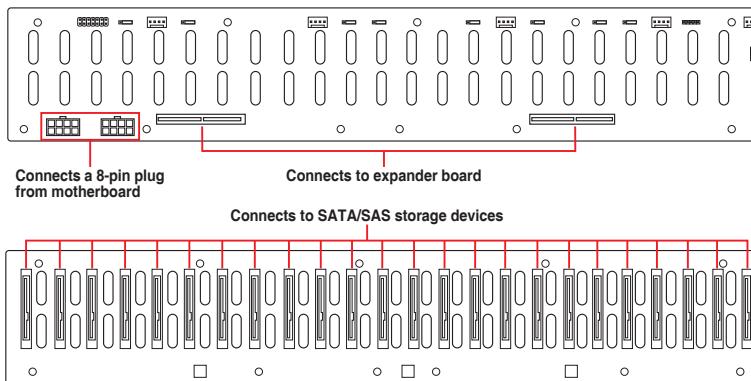
Pre-connected system cables

- 8-pin BPPWR1 power connector (from power supply to backplane)
- Auxiliary panel 1 connector (from motherboard to front I/O board)
- Auxiliary panel 2 connector (from motherboard to front I/O board)
- System fan connectors (from motherboard FAN1-8 to system fans)
- Panel connector (from motherboard to front I/O board)
- OCU-USB to USB connector (from motherboard to front I/O board)
- SATA connectors (from motherboard to SATA/SAS backplane board)
- ISATA connectors (from motherboard to SATA/SAS backplane board)

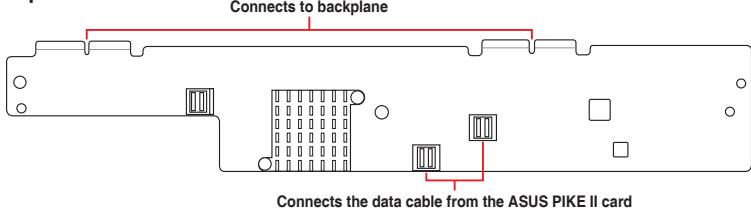
2.7 SATA/SAS backplane cabling



Backplane



Expander board



2.8 Removable/optional components

This section explains how to install optional components into the system and covers the following components:

1. System fans
2. Redundant power supply module



Ensure that the system is turned off before removing any components.

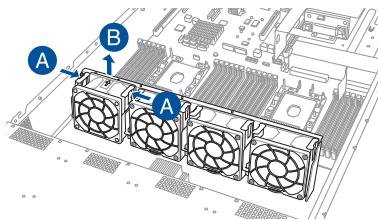


You may need to remove previously installed component or factory shipped components when installing optional components.

2.8.1 System fans

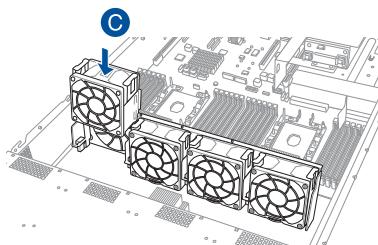
To remove the system fans:

1. Locate the fans you want to replace.
2. Press the retaining clip (A) and lift upward (B) to remove the fan.



To reinstall the system fans:

1. Replace the fan with the same model and size.
2. Align and position the fan with the arrow on the fan pointing to the back of the chassis (C).
3. Install the fan to the fan cage.

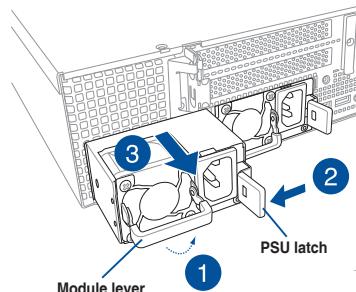


The fan can only be installed in one direction. If the fan cannot be installed, turn it around and try again.

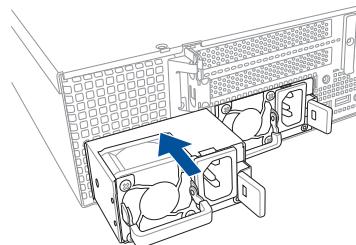
2.8.2 Redundant power supply module

To replace a failed redundant power supply module:

1. Lift up the power supply module lever.
2. Hold the power supply module lever and press the PSU latch.
3. Pull the power supply module out of the system chassis.



4. Insert the replacement power supply module into the chassis then push it inwards until the latch locks into place.



3

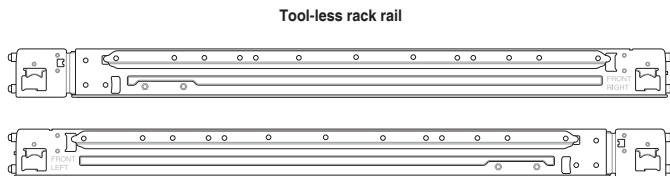
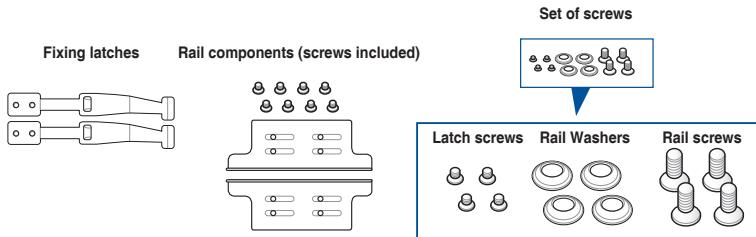
Installation Options

This chapter describes how to install the optional components and devices into the barebone server.

3.1 Tool-less Friction Rail Kit

The tool less design of the rail kit allows you to easily install the rack rails into the server rack without the need for additional tools. The kit also comes with a metal stopping bracket that can be installed to provide additional support and stability to the server.

The tool-less rail kit package includes:



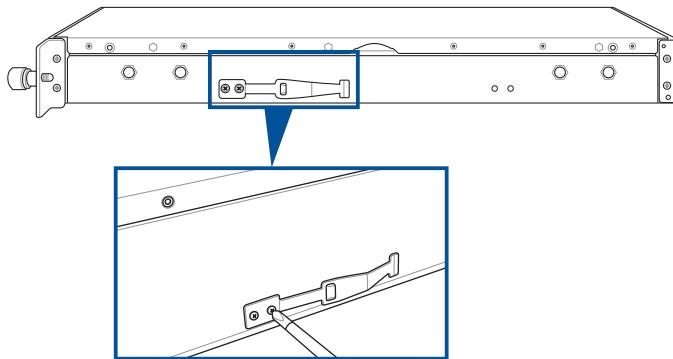
3.2 Installing the tool-less rack rail

To install the tool-less rack rails into the rack:

1. Secure the two fixing latches to the two sides of the server using the set of latch screws.



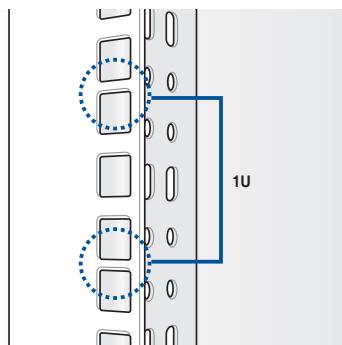
The locations of the screw holes vary with different server models. Refer to your server user manual for details.



2. Select a desired space and place the appropriate rack rail (left and right) on opposite positions on the rack.



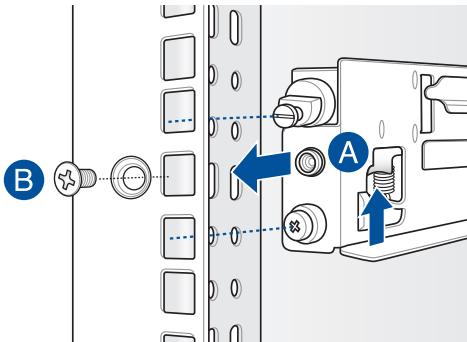
A 1U space consists of three square mounting holes with two thin lips on the top and the bottom.



3. Secure the rail components to the rail using the bundled screws.
4. Press the spring lock (A) then insert the studs into the selected square mounting holes on the rack post.
5. Press the spring lock on the other end of rail then insert the stud into the mounting hole on the rack post. Extend the rack rail, if necessary.
6. (Optional) Use the rail screw and rail washer (B) that comes with the kit to secure the rack rail to the rack post.
7. Perform steps 3 to 5 for the other rack rail.



Ensure that the installed rack rails (left and right) are aligned, secured, and stable in place.

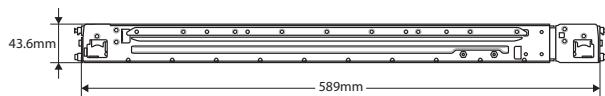
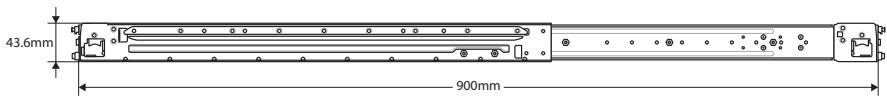


8. Lift the server chassis and insert it into the rack rail.



Ensure that the rack rail cabinet and the rack posts are stable and standing firmly on a level surface.

3.3 Rail kit dimensions

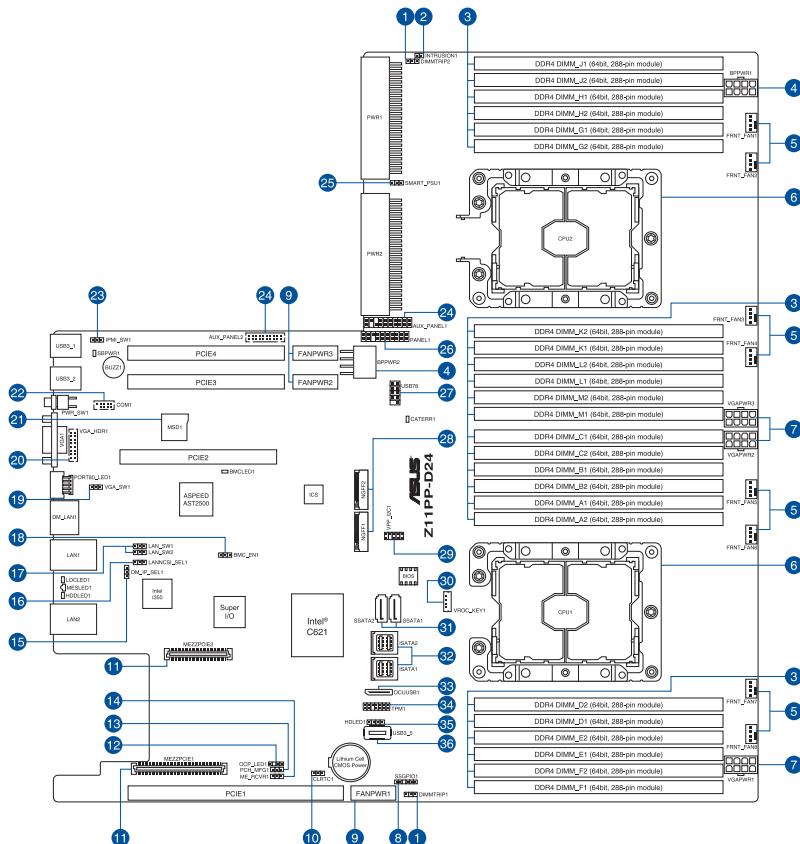


4

Motherboard Information

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

4.1 Motherboard layout



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4.2 Jumpers

1. Clear RTC RAM (3-pin CLRTC1)

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

To erase the RTC RAM:

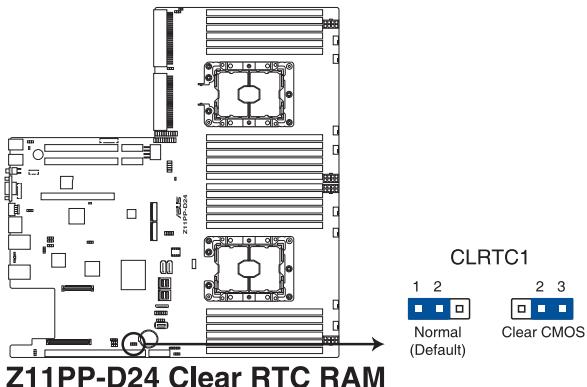
1. Turn OFF the computer and unplug the power cord.
2. Move the jumper cap from pins 1–2 (default) to pins 2–3. Keep the cap on pins 2–3 for about 5–10 seconds, then move the cap back to pins 1–2.
3. Plug the power cord and turn ON the computer.
4. Hold down the **** key during the boot process and enter BIOS setup to re-enter data.



Except when clearing the RTC RAM, never remove the cap on CLRTC jumper default position. Removing the cap will cause system boot failure!

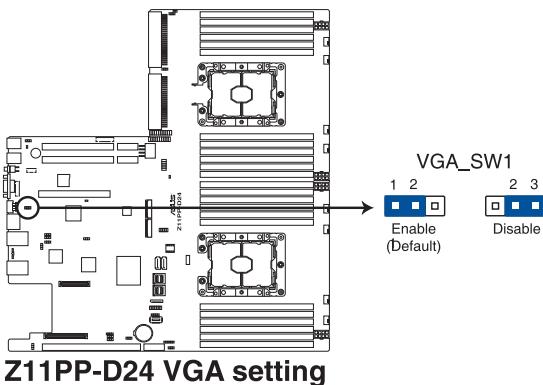


If the steps above do not help, remove the onboard battery and move the jumper again to clear the CMOS RTC RAM data. After the CMOS clearance, reinstall the battery.



2. VGA controller setting (3-pin VGA_SW1)

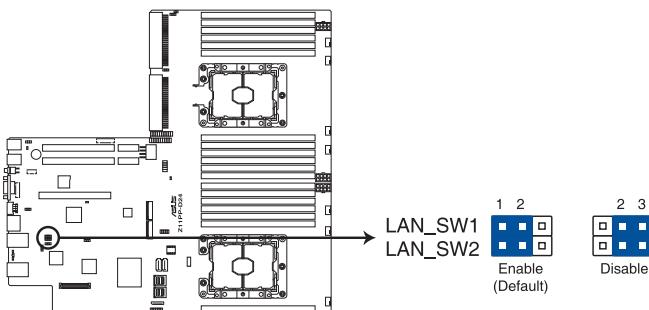
This jumper allows you to enable or disable the onboard VGA controller. Set to pins 1-2 to activate the VGA feature.



Z11PP-D24 VGA setting

3. LAN controller setting (3-pin LAN_SW1, LAN_SW2)

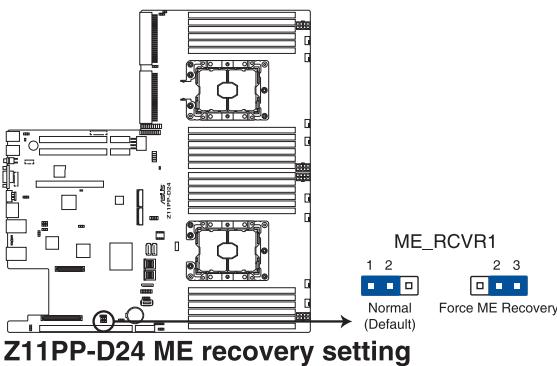
These jumpers allow you to enable or disable the onboard Intel® I350-AM2 Gigabit LAN1/2 controller. Set to pins 1-2 to activate the Gigabit LAN feature.



Z11PP-D24 LAN setting

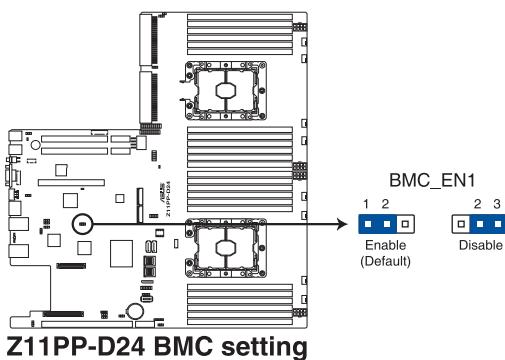
4. ME firmware force recovery setting (3-pin ME_RCVR1)

This jumper allows you to quickly recover the Intel Management Engine (ME) firmware when it becomes corrupted.



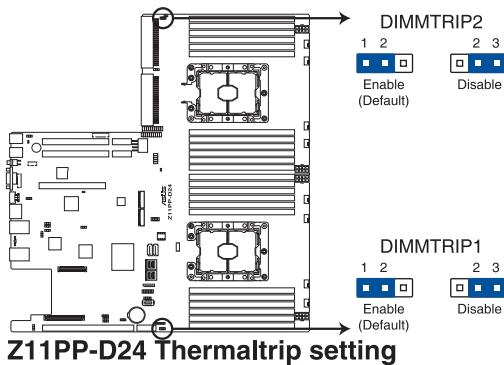
5. Baseboard Management Controller setting (3-pin BMC_EN1)

This jumper allows you to enable (default) or disable on-board BMC. Ensure to set this BMC jumper to enabled to avoid system fan control and hardware monitor error.



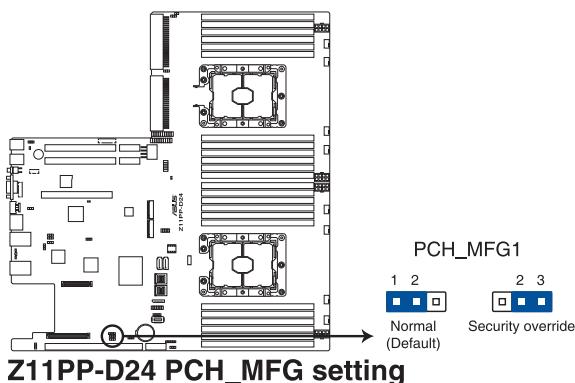
6. DDR4 thermal event setting (3-pin DIMMTRIP1, DIMMTRIP2)

This jumper allows you to enable or disable DDR4 DIMM thermal sensing event pin.



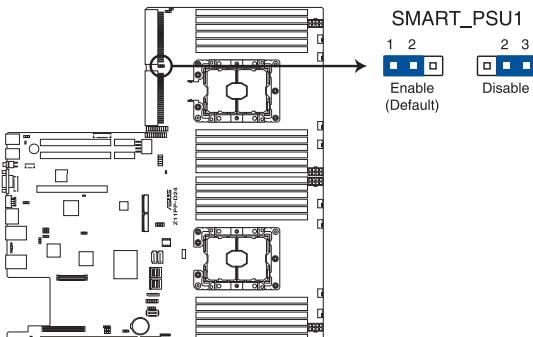
7. PCH_MFG1 setting (3-pin PCH_MFG1)

This jumper allows you to update the BIOS ME block.



8. Smart Ride Through (SmaRT) setting (3-pin SMART_PSU1)

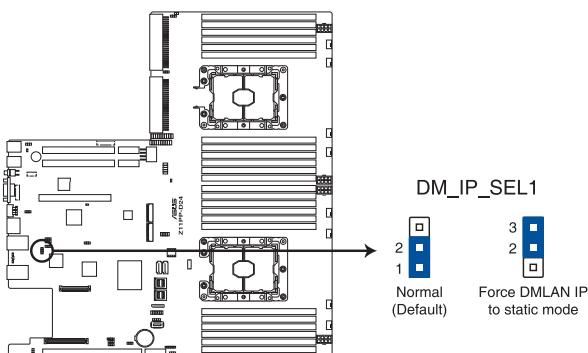
This jumper allows you to enable or disable the Smart Ride Through (SmaRT) function. This feature is enabled by default. Set to pins 2-3 to disable it. When enabled, SmaRT allows uninterrupted operation of the system during an AC loss event.



Z11PP-D24 PMBus 1.2 PSU setting

9. DMLAN setting (3-pin DM_IP_SEL1)

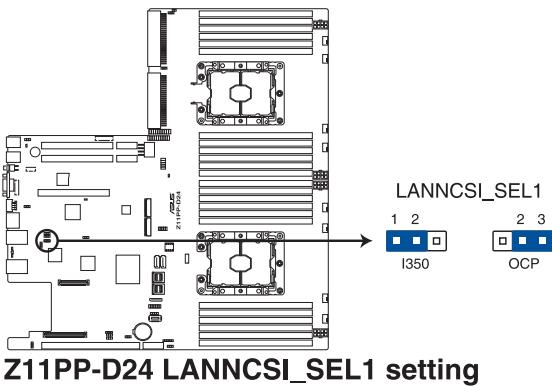
This jumper allows you to select the DMLAN setting. Set to pins 2-3 to force the DMLAN IP to static mode (IP=10.10.10.10, submask=255.255.255.0).



Z11PP-D24 DM_IP_SEL1 setting

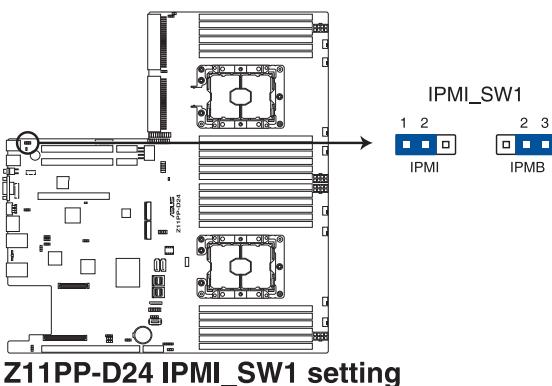
10. LANNCI setting (3-pin LANNCI_SEL1)

This jumper allows you to select which LAN NCSI to function.



11. IPMI SW setting (3-pin IPMI_SW1)

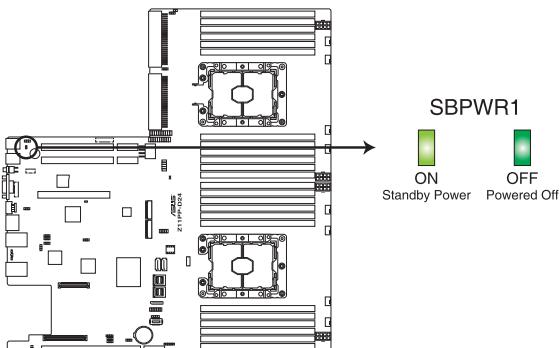
This jumper allows you to select which protocol in the GPU sensor to function.



4.3 Internal LEDs

1. Standby Power LED (SBPWR1)

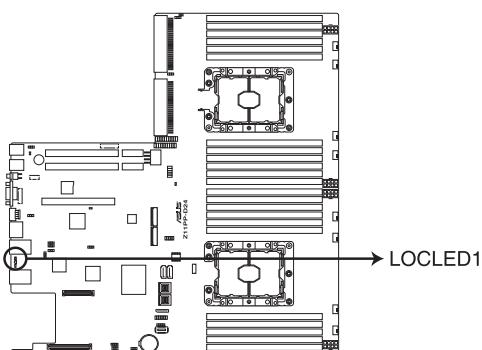
The motherboard comes with a standby power LED. The green LED lights up to indicate that the system is ON, in sleep mode, or in soft-off mode. This is a reminder that you should shut down the system and unplug the power cable before removing or plugging in any motherboard component. The illustration below shows the location of the onboard LED.



Z11PP-D24 Standby Power LED

2. Location LED (LOCLED1)

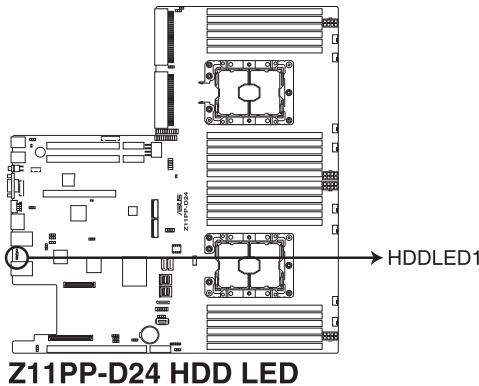
This onboard LED lights up when the Location button on the server is pressed or when triggered by a system management software. The Location LED helps visually locate and quickly identify the server in error on a server rack.



Z11PP-D24 Location LED

3. Hard disk activity LED (HDDLED1)

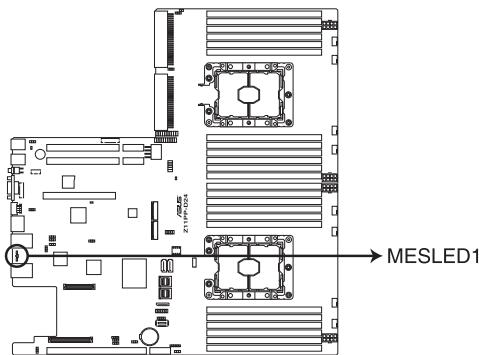
This LED is for the storage devices connected to the onboard SATA, or SATA/SAS add-on card. The read or write activities of any device connected to the onboard SATA, or SATA/SAS add-on card causes the rear panel LED to light up.



Z11PP-D24 HDD LED

4. Message LED (MESLED1)

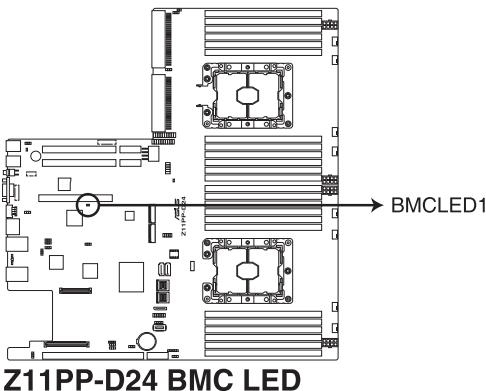
This onboard LED lights up to red when there is a BMC event log is generated.



Z11PP-D24 MESLED

5. BMC LED (BMCLED1)

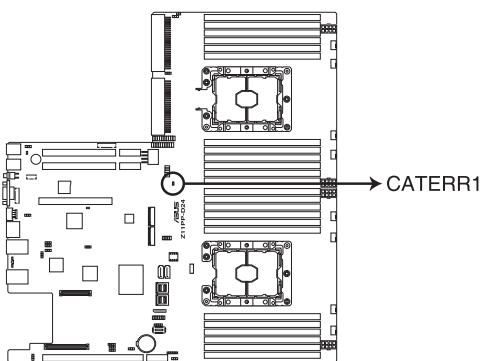
The BMC LED lights up to indicate that the on-board BMC is functional.



Z11PP-D24 BMC LED

6. CATT LED (CATERR1)

The CATT LED indicates that the system has experienced a fatal or catastrophic error and cannot continue to operate.



Z11PP-D24 CATERR1 LED

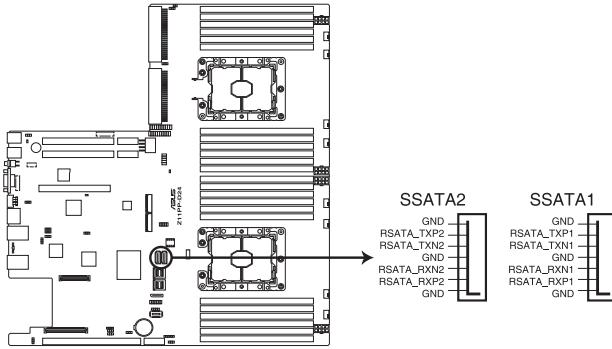
4.4 Internal connectors

1. Serial ATA connectors (7-pin SSATA1-2)

These connectors, controlled by Intel® C621 chipset, are for the Serial ATA signal cables for Serial ATA hard disk drives (SATA 1 connector is used for the optical drive by default).



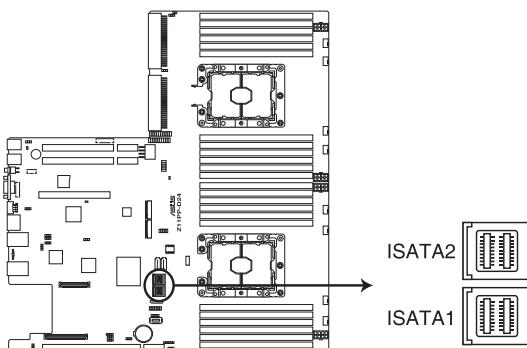
If the SATA M.2 (NGFF1) slot is occupied, the SSATA2 slot will be disabled.



Z11PP-D24 SSATA connectors

2. Mini-SAS HD connector (ISATA1-2)

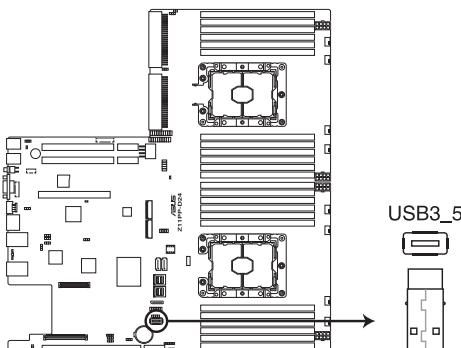
This motherboard comes with mini Serial Attached SCSI (SAS) HD connectors, the storage technology that supports Serial ATA. Each connector supports up to four devices.



Z11PP-D24 ISATA connectors

3. USB 3.0 connectors (Type A USB3_5)

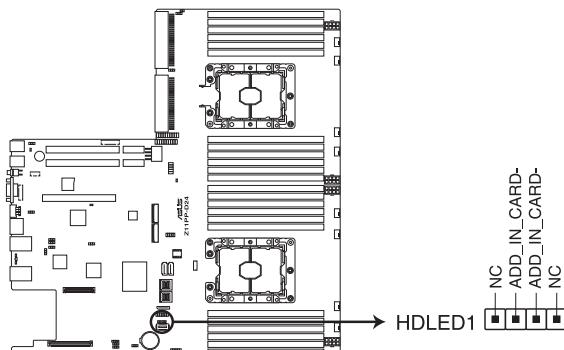
The USB3_5 connector is for Type-A USB 3.0 devices. You can enjoy all the benefits of USB 3.0 including faster data transfer speeds of up to 5 Gbps, faster charging time for USB-chargeable devices, optimized power efficiency, and backward compatibility with USB 2.0.



Z11PP-D24 USB 3.0 connector

4. Hard disk activity LED connector (4-pin HDLED1)

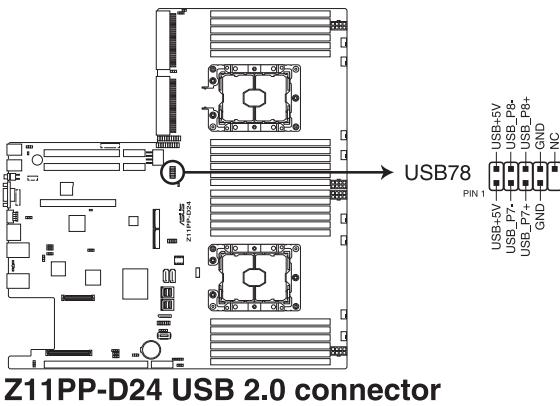
This LED connector is for the storage add-on card cable connected to the SATA or SAS add-on card. The read or write activities of any device connected to the SATA or SAS add-on card causes the front panel LED to light up.



Z11PP-D24 Hard disk activity LED connector

5. USB 2.0 connector (10-1 pin USB78)

This connector is for USB 2.0 ports. Connect the USB module cable to the connector, and then install the module to a slot opening at the back of the system chassis. The USB connectors comply with USB 2.0 specification that supports up to 480 Mbps connection speed.



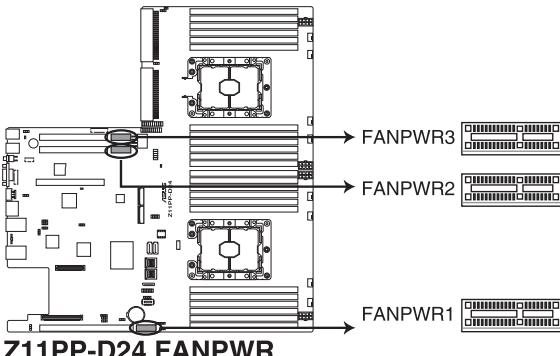
Z11PP-D24 USB 2.0 connector



The USB port module is purchased separately.

6. Fan power connectors (FANPWR1-3)

These connectors are for the power supply plugs that connects to additional fans. 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.



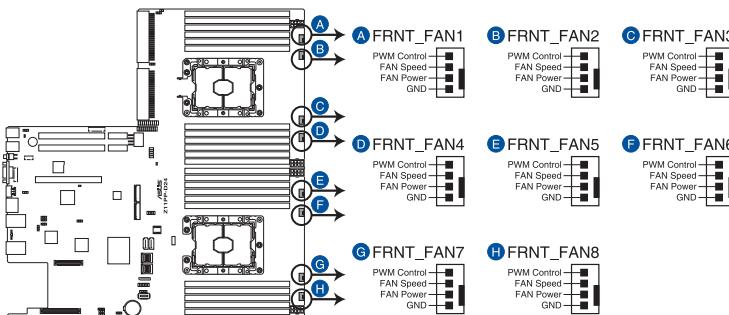
Z11PP-D24 FANPWR

7. System fan connectors (4-pin FAN1-8)

The fan connectors support cooling fans of 0.8A–1.0A (12 W max.) or a total of 6.4 A–8.0 A (96 W max.) at +12V. Connect the fan cables to the fan connectors on the motherboard, making sure that the black wire of each cable matches the ground pin of the connector.



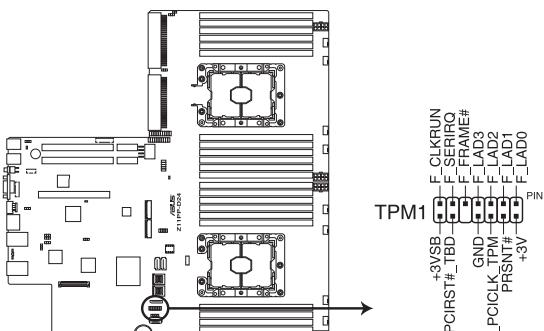
DO NOT forget to connect the fan cables to the fan connectors. Insufficient air flow inside the system may damage the motherboard components. These are not jumpers! DO NOT place jumper caps on the fan connectors!



Z11PP-D24 FAN connectors

8. TPM connector (14-1 pin TPM1)

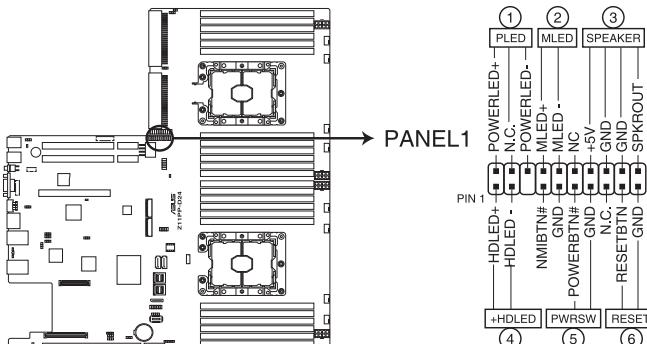
This connector supports a Trusted Platform Module (TPM) system, which can securely store keys, digital certificates, passwords, and data. A TPM system also helps enhance network security, protects digital identities, and ensures platform integrity.



Z11PP-D24 TPM connector

9. System panel connector (20-pin PANEL1)

This connector supports several chassis-mounted functions.



Z11PP-D24 System panel connector

1. System power LED (3-pin PLED)

This 3-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.

2. Message LED (2-pin MLED)

This 2-pin connector is for the message LED cable that connects to the front message LED. The message LED is controlled by the BMC to indicate an abnormal event occurrence.

3. 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.

4. Hard disk drive activity LED (2-pin HDLED)

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

5. ATX power button/soft-off button (2-pin PWRSW)

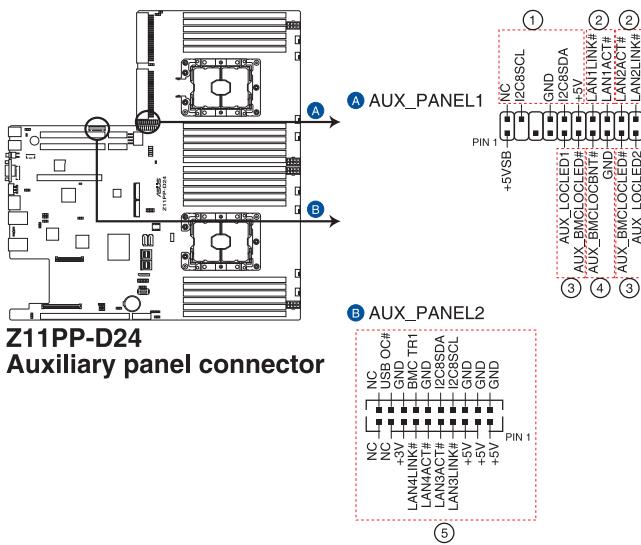
This connector is for the system power button. Pressing the power button turns the system on or puts the system in sleep or soft-off mode depending on the BIOS settings. Pressing the power switch for more than four seconds while the system is ON turns the system OFF.

6. 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.

10. Auxiliary panel connector (20-2 pin AUX_PANEL1, 20-pin AUX_PANEL2)

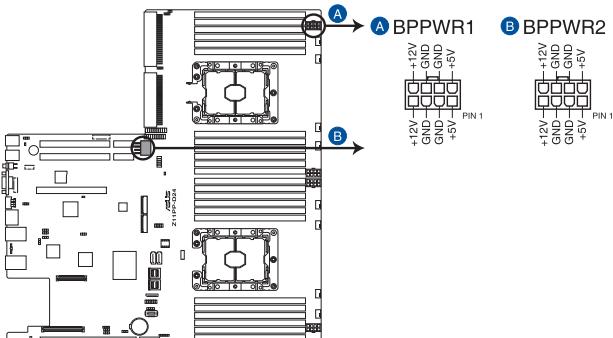
This connector is for additional front panel features including front panel SMB, locator LED and switch, chassis intrusion, and LAN LEDs.



- 1. Front panel SMB (6-1 pin FPSMB)**
These leads connect the front panel SMBus cable.
- 2. LAN activity LED (2-pin LAN1_LED, LAN2_LED)**
These leads are for the Gigabit LAN activity LEDs on the front panel.
- 3. Locator LED (2-pin LOCATORLED1, 2-pin LOCATORLED2)**
These leads are for the locator LED1 and LED2 on the front panel. Connect the Locator LED cables to these 2-pin connector. The LEDs will light up when the Locator button is pressed.
- 4. Locator Button/Switch (2-pin LOCATORBTN)**
These leads are for the locator button on the front panel. This button queries the state of the system locator.
- 5. LAN activity LED and USB port (2-pin LAN3_LED, LAN4_LED, USB ports)**
These leads are for the Gigabit LAN activity LEDs and USB ports on the front panel.

11. Back panel power connectors (8-pin BPPWR1-2)

These connectors are for the power supply plugs that connects to the back panel. 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.



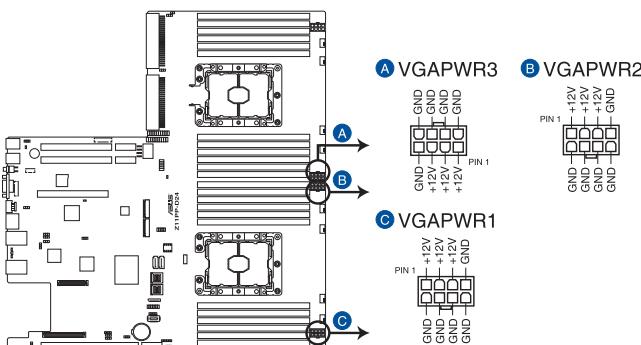
Z11PP-D24 BP power connectors



DO NOT connect VGA cards to these connectors. Doing so may cause system boot errors and permanent damage to your motherboard or device.

12. VGA power connectors (8-pin VGAPWR1-3)

These connectors are for the power supply plugs that connects to the VGA card. 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.



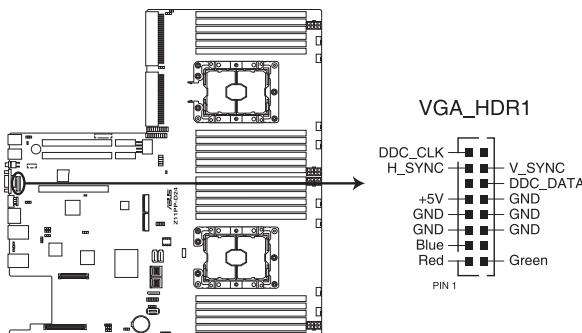
Z11PP-D24 VGA power connectors



DO NOT connect the back panel to these connectors. Doing so may cause system boot errors and permanent damage to your motherboard or device.

13. VGA connector (16-pin VGA_HDR1)

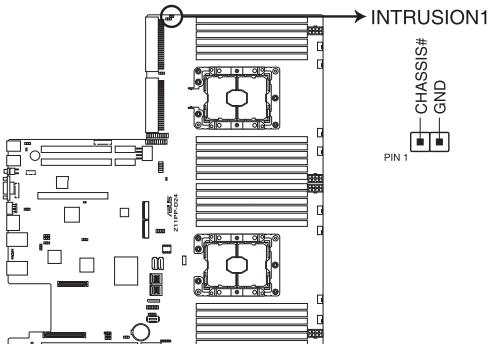
This connector supports the VGA High Dynamic-Range interface.



Z11PP-D24 Internal VGA connector

14. Chassis Intrusion (2-pin INTRUSION1)

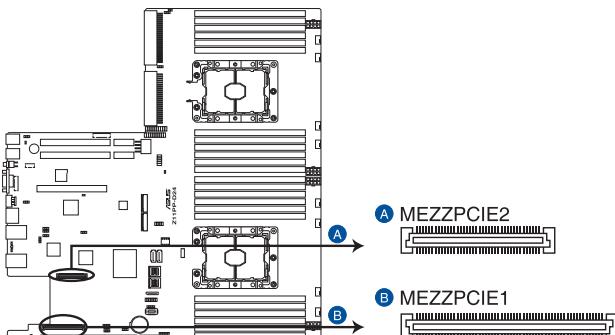
These leads are for the intrusion detection feature for chassis with intrusion sensor or microswitch. When you remove any chassis component, the sensor triggers and sends a high level signal to these leads to record a chassis intrusion event. The default setting is to short the CHASSIS# and the GND pin by a jumper cap to disable the function.



Z11PP-D24 Chassis Intrusion connector

15. Mezzanine PCIE card connectors (MEZZPCIE1-2)

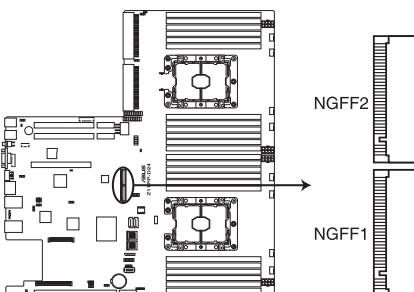
The MEZZPCIE1-2 connector supports Open Compute Project (OCP) cards.



Z11PP-D24 MEZZPCIE connectors

16. M.2 (NGFF) card connectors (NGFF1-2)

These connectors allow you to install M.2 devices.



Z11PP-D24 NGFF1 connector



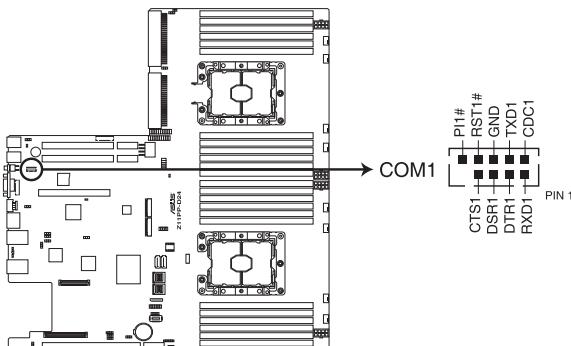
- This connector supports type 2242 / 2260 / 2280 / 22110 devices on both PCI-E and SATA interface.
- If the SATA M.2 (NGFF1) slot is occupied, the SSATA2 slot will be disabled.



The M.2 (NGFF) device is purchased separately

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

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



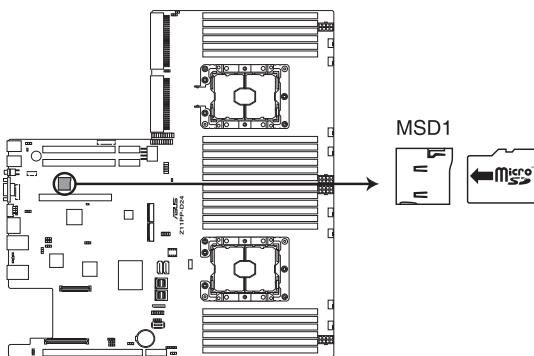
Z11PP-D24 Serial port connector



The COM module is purchased separately.

18. Micro SD card slot (MSD1)

Your motherboard supports SD Memory Card v2.00 (SDHC) / v3.00 (SDXC).



Z11PP-D24 MSD1



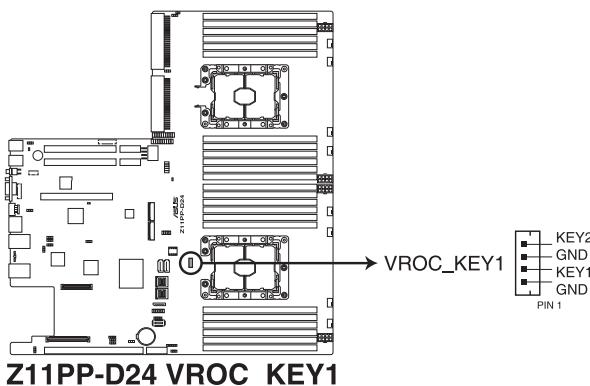
Disconnect all power (including redundant PSUs) from the existing system before you add or remove a Memory Card, then reboot the system to access the Memory Card.



Some memory cards may not be compatible with your motherboard. Ensure that you use only compatible memory cards to prevent loss of data, damage to your device, or memory card, or both.

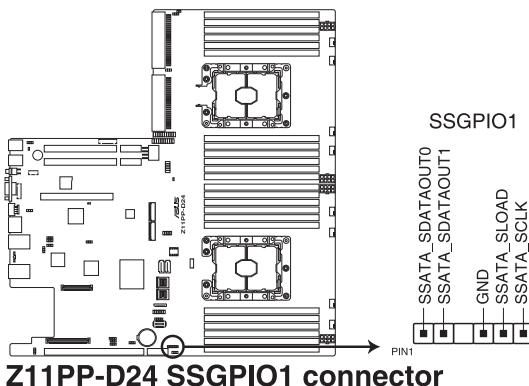
19. VROC_KEY connector (4-pin VROC_KEY)

This connector allows you to connect a KEY module to support Intel VMD RAID function.



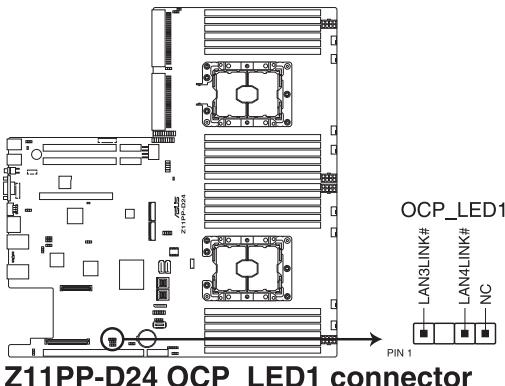
20. Serial General Purpose Input/Output connector (6-1 pin SSGPIO1)

The SSGPIO 1 connector is used for the Intel Rapid Storage Technology Enterprise SGPIO interface that controls the LED pattern generation, device information, and general purpose data.



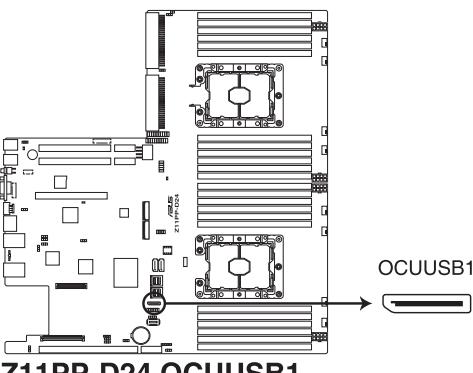
21. OCP LAN Activity LED connector (4-1 pin OCP_LED1)

OCP LAN LED connector supports OCP LAN card Active LED.



22. USB 3.0 connectors (OCUUSB1)

Connect a compatible USB module cable to the OCUUSB1 connector, and then install the module to a slot opening at the back or front of the system chassis. You can enjoy all the benefits of USB 3.0 including faster data transfer speeds of up to 5 Gbps, faster charging time for USB-chargeable devices, optimized power efficiency, and backward compatibility with USB 2.0. (OCUUSB1 connector is used for the front USB panel by default).



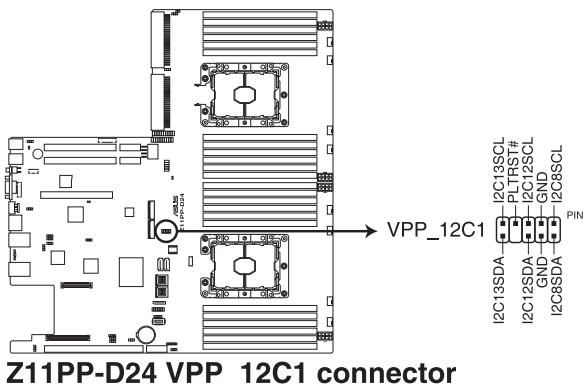
Z11PP-D24 OCUUSB1



The USB port module is purchased separately.

23. VPP_I2C1 connector (10-1 pin VPP_I2C1)

This connector is used for the Intel VMD function and sensor readings.



BIOS Setup

5

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

5.1 Managing and updating your BIOS

The following utilities allow you to manage and update the motherboard Basic Input/Output System (BIOS) setup:

1. ASUS CrashFree BIOS 3

To recover the BIOS using a bootable USB flash disk drive when the BIOS file fails or gets corrupted.

2. ASUS EzFlash

Updates the BIOS using a USB flash disk.

3. BUPDATER

Updates the BIOS in DOS mode using a bootable USB flash disk drive.

Refer to the corresponding sections for details on these utilities.



Save a copy of the original motherboard BIOS file to a bootable USB flash disk drive in case you need to restore the BIOS in the future. Copy the original motherboard BIOS using the BUPDATER utility.

5.1.1 ASUS CrashFree BIOS 3 utility

The ASUS CrashFree BIOS 3 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 update a corrupted BIOS file using a USB flash drive that contains the updated BIOS file.



Prepare a USB flash drive containing the updated motherboard BIOS before using this utility.

Recovering the BIOS from a USB flash drive

To recover the BIOS from a USB flash drive:

1. Insert the USB flash drive with the original or updated BIOS file to one USB port on the system.
2. The utility will automatically recover the BIOS. It resets the system when the BIOS recovery finished.



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



The recovered BIOS may not be the latest BIOS version for this motherboard. Visit the ASUS website at www.asus.com to download the latest BIOS file.

5.1.2 ASUS EZ Flash Utility

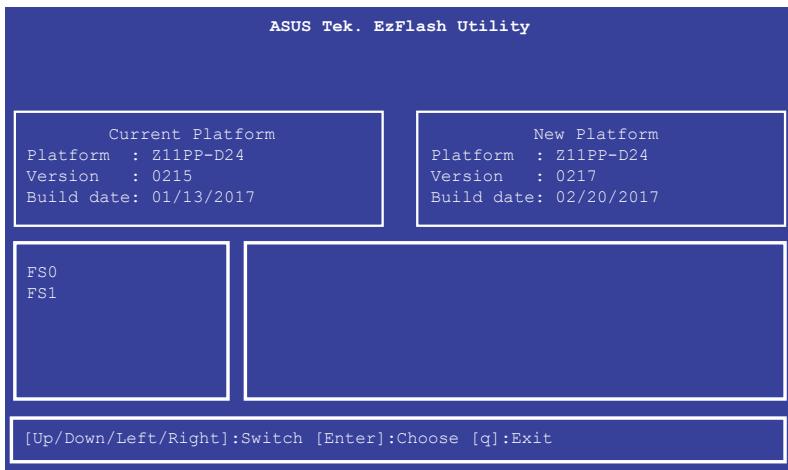
The ASUS EZ Flash Utility feature allows you to update the BIOS without having to use a DOS-based utility.



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 Utility:

1. Insert the USB flash disk that contains the latest BIOS file into the USB port.
2. Enter the BIOS setup program. Go to the **Tool** menu then select **ASUS EZ Flash Utility**. Press <Enter>.



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, 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. Press <F5> and select **Yes** to load the BIOS default settings.

5.1.3 BUPDATER utility



The succeeding BIOS screens are for reference only. The actual BIOS screen displays may not be the same as shown.

The BUPDATER utility allows you to update the BIOS file in the DOS environment using a bootable USB flash disk drive with the updated BIOS file.

Updating the BIOS file

To update the BIOS file using the BUPDATER utility:

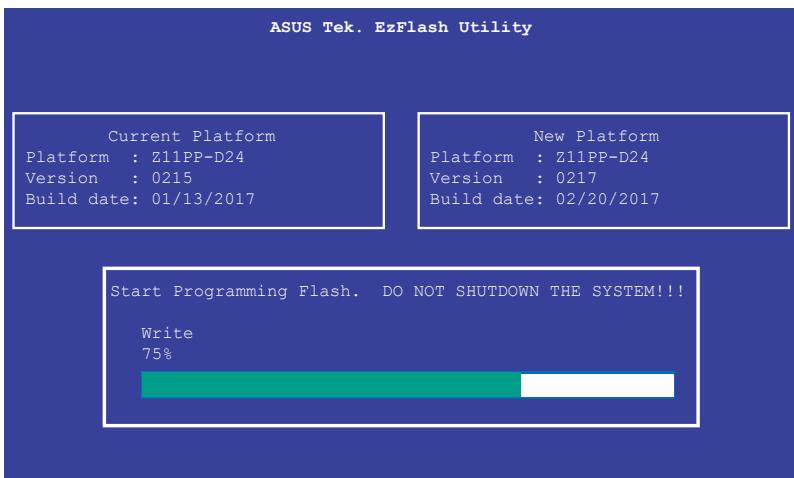
1. Visit the ASUS website at www.asus.com and download the latest BIOS file for the motherboard. Save the BIOS file to a bootable USB flash disk drive.
2. Copy the BUPDATER utility (BUPDATER.exe) from the ASUS support website at www.asus.com/support to the bootable USB flash disk drive you created earlier.
3. Boot the system in DOS mode, then at the prompt, type:

BUPDATER /i[filename].CAP

where [filename] is the latest or the original BIOS file on the bootable USB flash disk drive, then press <Enter>.

```
A: \>BUPDATER /i[file name].CAP
```

4. The utility verifies the file, then starts updating the BIOS file.



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

5. The utility returns to the DOS prompt after the BIOS update process is completed. Reboot the system from the hard disk drive.

The BIOS update is finished! Please restart your system.
C:\>

5.2 BIOS setup program

This motherboard supports a programmable firmware chip that you can update using the provided utility described in section [5.1 Managing and updating your BIOS](#).

Use the BIOS Setup program when you are installing a motherboard, reconfiguring your system, or prompted to “Run Setup.” This section explains how to configure your system using this utility.

Even if you are not prompted to use the Setup program, you can change the configuration of your computer in the future. For example, you can enable the security password feature or change the power management settings. This requires you to reconfigure your system using the BIOS Setup program so that the computer can recognize these changes and record them in the CMOS RAM of the firmware chip.

The firmware chip on the motherboard stores the Setup utility. When you start up the computer, the system provides you with the opportunity to run this program. Press **** during the Power-On Self-Test (POST) to enter the Setup utility; otherwise, POST continues with its test routines.

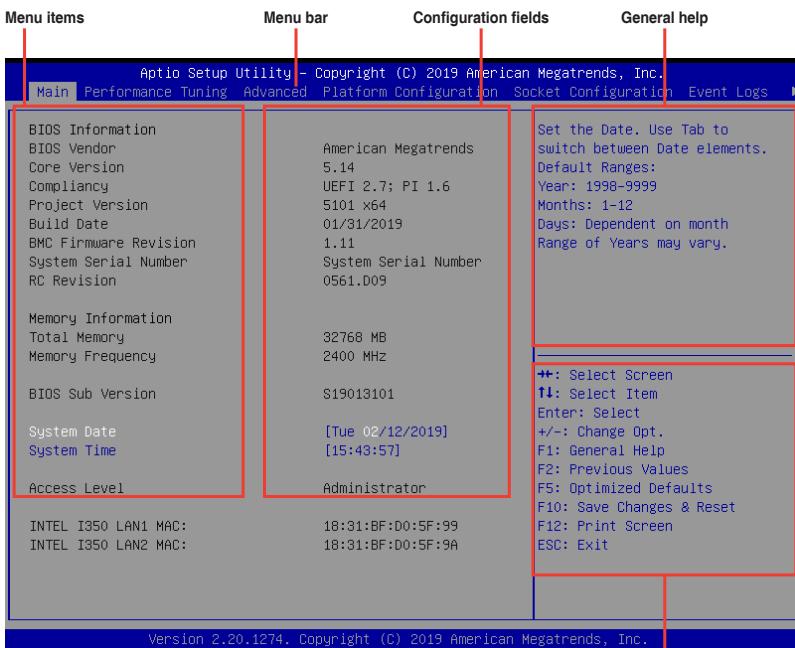
If you wish to enter Setup after POST, restart the system by pressing **<Ctrl>+<Alt>+<Delete>**, or by pressing the reset button on the system chassis. You can also restart by turning the system off and then back on. Do this last option only if the first two failed.

The Setup program is designed to make it as easy to use as possible. Being a menu-driven program, it lets you scroll through the various sub-menus and make your selections from the available options using the navigation keys.



- The default BIOS settings for this motherboard apply for most conditions to ensure optimum performance. If the system becomes unstable after changing any BIOS settings, load the default settings to ensure system compatibility and stability. Press **<F5>** and select **Yes** to load the BIOS default settings.
- The BIOS setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.
- Visit the ASUS website (www.asus.com) to download the latest BIOS file for this motherboard.

5.2.1 BIOS menu screen



5.2.2 Menu bar

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

Main	For changing the basic system configuration
Performance Tuning	For changing the performance settings
Advanced	For changing the advanced system settings
Platform Configuration	For changing the platform settings
Socket Configuration	For changing the socket settings
Event Logs	For changing the event log settings
Server Mgmt	For changing the Server Mgmt settings
Security	For changing the security settings
Boot	For changing the system boot configuration
Tool	For configuring options for special functions
Save & Exit	For selecting the exit options

To select an item on the menu bar, press the right or left arrow key on the keyboard until the desired item is highlighted.

5.2.3 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 (such as Advanced) on the menu bar have their respective menu items.

5.2.4 Submenu items

A solid triangle before each item on any menu screen means that the item has a submenu. To display the submenu, select the item then press <Enter>.

5.2.5 Navigation keys

At the bottom right corner of a menu screen are the navigation keys for the BIOS setup program. Use the navigation keys to select items in the menu and change the settings.

5.2.6 General help

At the top right corner of the menu screen is a brief description of the selected item.

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

5.2.8 Pop-up window

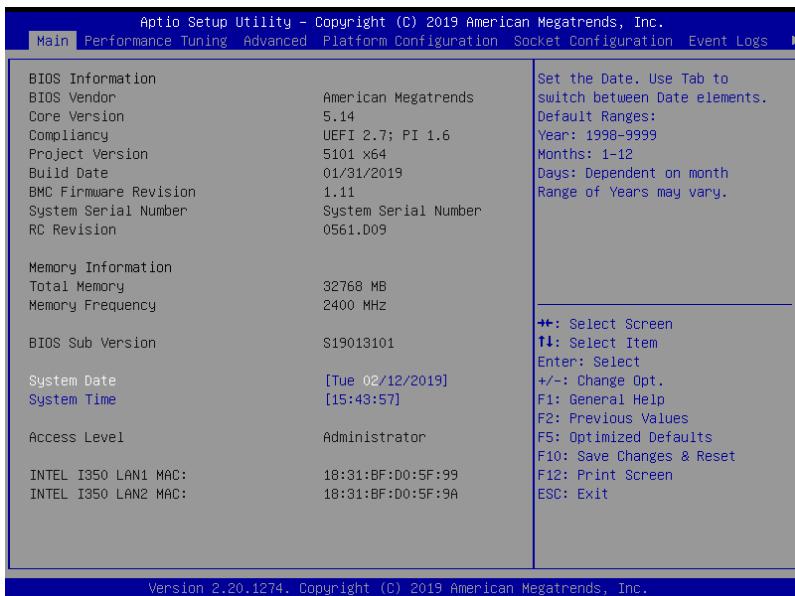
Select a menu item and press <Enter> to display a pop-up window with the configuration options for that item.

5.2.9 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.

5.3 Main menu

When you enter the BIOS Setup program, the Main menu screen appears. 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.



5.3.1 System Date [Day xx/xx/yyyy]

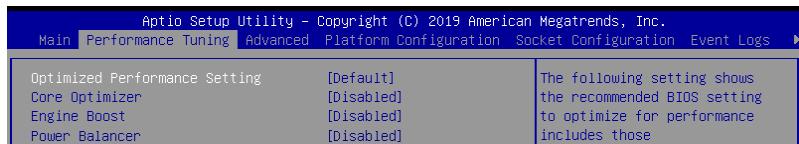
Allows you to set the system date.

5.3.2 System Time [xx:xx:xx]

Allows you to set the system time.

5.4 Performance Tuning menu

The Performance Tuning menu items allow you to change performance related settings for different scenarios.



Optimized Performance Setting [Default]

Allows you to select performance settings for different scenarios.

[Default] Default settings.

[By Benchmark] Optimize for different kinds of benchmarks. Select this option, then select a benchmark type from the >> list.

[By Workload] Optimize for different kinds of workloads. Select this option, then select a workload type from the >> list.

Configuration options:

[Peak Frequency Optimized] - Applies settings with performance and power consumption balance. Recommended for users that need higher performance.

[Latency Optimized] - Applies settings with low latency results. Recommended for latency-sensitive users.

[Power Efficient Optimized] - Applies settings with power efficiency. Recommended for general users.

[HPC] - Applies settings with optimized compute capability. Recommended for traditional HPC applications.



Core Optimizer and Engine Boost appear only when you set Optimized Performance Setting to [Default] or [By Benchmark].

Core Optimizer [Disabled]

Enable this item to keep the processor operating at the turbo frequency.

Configuration options: [Disabled] [Enabled]



Linux support may vary by version of the OS.

Engine Boost [Disabled]

Enable this item to boost the CPU's frequency.

Configuration options: [Disabled] [Level1] [Level2] [Level3(Max)]



Operate with an ambient temperature of 25°C or lower for optimized performance.

Power Balancer [Disabled]

Select [Enable Auto] to dynamically adjust the frequency of all CPU cores based on the current utilization, delivering better performance per watt for improved system energy efficiency.

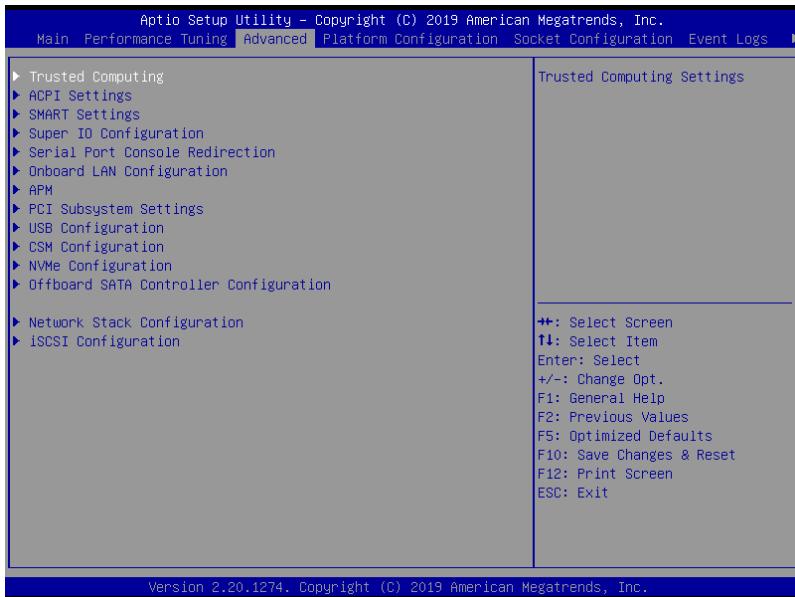
Configuration options: [Disabled] [Enable Auto] [Enable Manual]

5.5 Advanced menu

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



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



5.5.1 Trusted Computing

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
Configuration Security Device Support NO Security Device Found	[Enable]	Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.

Configuration

Security Device Support [Disabled]

Allows you to enable or disable the BIOS support for security device.

Configuration options: [Disabled] [Enabled]

5.5.2 ACPI Settings

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
ACPI Settings Enable ACPI Auto Configuration Enable Hibernation	[Disabled] [Enabled]	Enables or Disables BIOS ACPI Auto Configuration.

Enable ACPI Auto Configuration [Disabled]

Allows you to enable or disable the BIOS ACPI Auto Configuration.

Configuration options: [Disabled] [Enabled]

Enable Hibernation [Enabled]

Allows you to enable or disable the ability of the system to hibernate (OS/Sleep State).

Configuration options: [Disabled] [Enabled]



This option may be not effective with some OS.

5.5.3 Smart Settings

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.
Advanced

SMART Settings	Run SMART Self Test on all HDDs during POST.
SMART Self Test [Enabled]	

SMART Self Test [Enabled]

Allows you to run SMART Self Test on all HDDs during POST.

Configuration options: [Disabled] [Enabled]

5.5.4 Super IO Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.
Advanced

Super IO Configuration	Set Parameters of Serial Port 1 (COMA)
Super IO Chip NCT6793D	
▶ Serial Port 1 Configuration	

Serial Port 1 Configuration

Allows you to set the parameters of Serial Port 1.

Serial Port [Enabled]

Allows you to enable or disable Serial Port.

Configuration options: [Disabled] [Enabled]



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

Change Settings [Auto]

Allows you to choose the setting for Super IO device.

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

[IO=3F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]

[IO=2F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]

[IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]

[IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]

5.5.5 Serial Port Console Redirection

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.

Advanced

COM1	Console Redirection [Disabled]	Console Redirection Enable or Disable.
▶ Console Redirection Settings		
COM2	Console Redirection [Disabled]	
▶ Console Redirection Settings		
Legacy Console Redirection		
▶ Legacy Console Redirection Settings		
Serial Port for Out-of-Band Management/		
Windows Emergency Management Services (EMS)		
Console Redirection [Disabled]		
▶ Console Redirection Settings		

++: Select Screen
!!: Select Item
Enter: Select
+/-: Change Opt

COM1/COM2

Console Redirection [Disabled]

Allows you to enable or disable the console redirection feature.

Configuration options: [Disabled] [Enabled]



The following item appears only when you set **Console Redirection** to **[Enabled]**.

Console Redirection Settings

These items become configurable only when you enable the **Console Redirection** item. The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

Terminal Type [VT-UTF8]

Allows you to set the terminal type.

[VT100] ASCII char set.

[VT100+] Extends VT100 to support color, function keys, etc.

[VT-UTF8] Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.

[ANSI] Extended ASCII char set.

Bits per second [57600]

Selects serial port transmission speed. The speed must be matched on the other side.

Long or noisy lines may require lower speeds.

Configuration options: [9600] [19200] [38400] [57600] [115200]

Data Bits [8]

Configuration options: [7] [8]

Parity [None]

A parity bit can be sent with the data bits to detect some transmission errors. [Mark] and [Space] parity do not allow for error detection.

[None]	None
[Even]	parity bit is 0 if the num of 1's in the data bits is even
[Odd]	parity bit is 0 if num of 1's in the data bits is odd
[Mark]	parity bit is always 1
[Space]	parity bit is always 0

Stop Bits [1]

Stop bits indicate the end of a serial data packet. (A start bit indicates the beginning.) The standard setting is 1 stop bit. Communication with slow devices may require more than 1 stop bit.

Configuration options: [1] [2]

Flow Control [Hardware RTS/CTS]

Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a "stop" signal can be sent to stop the data flow. Once the buffers are empty, a "start" signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.

Configuration options: [None] [Hardware RTS/CTS]

VT -UTF8 Combo Key Support [Enabled]

This allows you to enable the VT -UTF8 Combination Key Support for ANSI/VT100 terminals.

Configuration options: [Disabled] [Enabled]

Recorder Mode [Disabled]

With this mode enabled only text will be sent. This is to capture Terminal data.

Configuration options: [Disabled] [Enabled]

Legacy OS Redirection Resolution [80x24]

This allows you to set the number of rows and columns supported on the Legacy OS.

Configuration options: [80x24] [80x25]

Putty Keypad [VT100]

This allows you to select the FunctionKey and Keypad on Putty.

Configuration options: [VT100] [LINUX] [XTERM] [SCO] [ESCN] [VT400]

Redirection After BIOS POST [Always Enable]

This setting allows you to specify if Bootloader is selected than Legacy console redirection.

Configuration options: [Always Enable] [Bootloader]

Legacy Console Redirection Settings

Legacy Console Redirection Port [COM1]

Allows you to select a COM port to display redirection of Legacy OS and Legacy OPROM Messages.

Configuration options: [COM1] [COM2]

Serial Port for Out-of-Band Management/Windows Emergency Management Services (EMS)

Console Redirection [Disabled]

Allows you to enable or disable the console redirection feature.

Configuration options: [Disabled] [Enabled]



The following item appears only when you set **Console Redirection** to **[Enabled]**.

Console Redirection Settings

Out-of-Band Mgmt Port [COM1]

Microsoft Windows Emergency Management Services (EMS) allow for remote management of a Windows Server OS through a serial port.

Configuration options: [COM1] [COM2]

Terminal Type [VT-UTF8]

Microsoft Windows Emergency Management Services (EMS) allow for remote management of a Windows Server OS through a serial port.

Configuration options: [VT100] [VT100+] [VT-UTF8] [ANSI]

Bits per second [115200]

Microsoft Windows Emergency Management Services (EMS) allow for remote management of a Windows Server OS through a serial port.

Configuration options: [9600] [19200] [57600] [115200]

Flow Control [None]

Microsoft Windows Emergency Management Services (EMS) allow for remote management of a Windows Server OS through a serial port.

Configuration options: [None] [Hardware RTS/CTS] [Software Xon/Xoff]

5.5.6 Onboard LAN Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.	
Advanced	
Onboard I350 LAN Configuration	Intel LAN Enable/Disable
INTEL I350 LAN1 MAC:	18:31:BF:D0:5F:99
INTEL I350 LAN2 MAC:	18:31:BF:D0:5F:9A
Intel LAN1 Enable	[Enabled]
Intel LAN1 ROM Type	[PXE]
Intel LAN2 Enable	[Enabled]
Intel LAN2 ROM Type	[Disabled]

Onboard I350 LAN Configuration

Intel LAN1 Enable [Enabled]

Allows you to enable or disable the Intel LAN.

Configuration options: [Disabled] [Enabled]



The following items appear only when **Intel LAN1 Enable** is set to **[Enabled]**.

Intel LAN 1 ROM Type [PXE]

Allows you to select the Intel LAN ROM type.

Configuration options: [PXE] [iSCSI] [Disabled]

Intel LAN2 Enable [Enabled]

Allows you to enable or disable the Intel LAN.

Configuration options: [Disabled] [Enabled]



The following items appear only when **Intel LAN2 Enable** is set to **[Enabled]**.

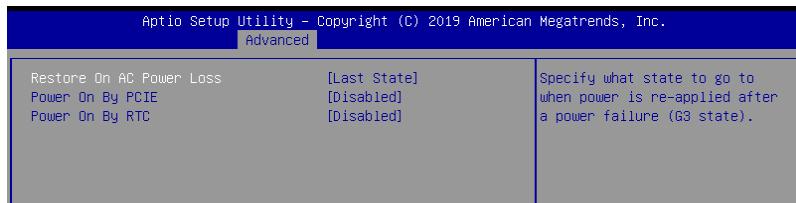
Intel LAN 2 ROM Type [Disabled]

Allows you to select the Intel LAN ROM type.

Configuration options: [PXE] [iSCSI] [Disabled]

5.5.7 APM

Allows you to configure the Advance Power Management (APM) settings.



Restore AC Power Loss [Last State]

When set to [Power Off], the system goes into off state after an AC power loss. When set to [Power On], the system will reboot after an AC power loss. When set to [Last State], the system goes into either off or on state, whatever the system state was before the AC power loss.

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

Power On By PCIE [Disabled]

[Disabled] Disables the PCIE devices to generate a wake event.

[Enabled] Enables the PCIE devices to generate a wake event.

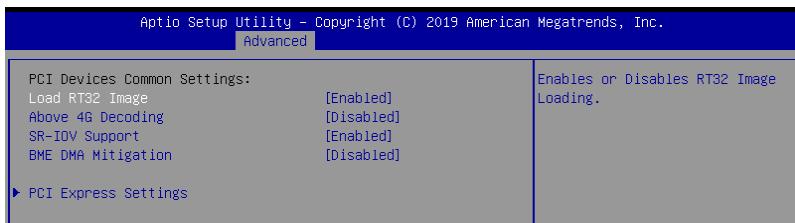
Power On By RTC [Disabled]

[Disabled] Disables RTC to generate a wake event.

[Enabled] When set to [Enabled], the items **RTC Alarm Date (Days)** and **Hour/Minute/Second** will become user-configurable with set values.

5.5.8 PCI Subsystem Settings

Allows you to configure PCI, PCI-X, and PCI Express Settings.



Load RT32 Image [Enabled]

This option allows you to enable or disable RT32 Image Loading.

Configuration options: [Disabled] [Enabled]

Above 4G Decoding [Disabled]

Allows you to enable or disable 64-bit capable devices to be decoded in above 4G address space. It only works if the system supports 64-bit PCI decoding.

Configuration options: [Disabled] [Enabled]

SR-IOV Support [Enabled]

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

Configuration options: [Disabled] [Enabled]

BME DMA Mitigation [Disabled]

This allows you to enable or disable re-enabling Bus Master Attribute disabled during PCI enumeration for PCI Bridges after SMM locked.

Configuration options: [Disabled] [Enabled]

PCIE Express Settings

PCI Express Device Register Settings

Relaxed Ordering [Enabled]

Enables or disables PCI Express device relaxed ordering.

Configuration options: [Disabled] [Enabled]

Extended Tag [Disabled]

If Enable allows device to use 8-bit tag field as a requester.

Configuration options: [Disabled] [Enabled]

No Snoop [Enabled]

Enables or disables PCI Express device No snoop option.

Configuration options: [Disabled] [Enabled]

PCI Express Link Register Settings

ASPM Support [Disabled]

Allows to set the ASPM level. Configuration options: [Disabled] [Autot] [Force L0s]

- [Force L0s] Force all links to L0s state.
- [Auto] BIOS auto configure.
- [Disabled] Disabled ASPM.

Unpopulated Links [Keep Link ON]

In order to save power, software will disable unpopulated PCI Express links, if this option set to Disabled.

Configuration options: [Keep Link ON] [Disabled]

PCIE OPROM Slot Options

PCIE1-3 Slot OPROM [Enabled]

This option allows you to enable or disable the OPROM of the PCIe slots.

Configuration options: [Disabled] [Enabled]

MEZZ1 Slot OPROM [Enabled]

This option allows you to enable or disable the OPROM of the MEZZ slot.

Configuration options: [Disabled] [Enabled]

5.5.9 USB Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
USB Configuration		Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected. DISABLE option will keep USB devices available only for EFI applications.
USB Module Version	21	
USB Controllers:		
1 XHCI		
USB Devices:		
5 Drives, 2 Keyboards, 1 Mouse, 1 Hub		
Legacy USB Support	[Enabled]	
USB Mass Storage Driver Support	[Enabled]	
Mass Storage Devices:		++: Select Screen !!: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F5: Optimized Defaults F10: Save Changes & Reset
JetFlashTranscend 4GB 8.07	[Auto]	
AMI Virtual CDROM0 1.00	[Auto]	
AMI Virtual Floppy0 1.00	[Auto]	
AMI Virtual HDisk0 1.00	[Auto]	
AMI Virtual HDisk1 1.00	[Auto]	

Legacy USB Support [Enabled]

Allows you to enable or disable Legacy USB device support.

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

USB Mass Storage Driver Support [Enabled]

Allows you to enable or disable the USB Mass Storage driver support.

Configuration options: [Disabled] [Enabled]

Mass Storage Devices

AMI Virtual CDROM0-2 / Floppy / HDisk0 1.00 [Auto]

Allows you to select the mass storage device emulation type.

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

5.5.10 CSM Configuration

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Advanced

Compatibility Support Module Configuration		Enable/Disable CSM Support.
CSM Support	[Enabled]	
CSM16 Module Version	07.82	
GateA20 Active	[Upon Request]	
Option ROM Messages	[Force BIOS]	
INT19 Trap Response	[Immediate]	
Boot option filter	[Legacy only]	
Option ROM execution		
Network	[Legacy]	+*: Select Screen
Storage	[Legacy]	!: Select Item
Video	[Legacy]	Enter: Select
Other PCI devices	[Legacy]	+/-: Change Opt.
		F1: General Help
		F2: Previous Values

CSM Support [Enabled]

This option allows you to enable or disable CSM Support.

Configuration options: [Disabled] [Enabled]



The following item appears only when **CSM Support** is set to **[Enabled]**.

GateA20 Active [Upon Request]

This allows you to set the GA20 option.

Configuration options: [Upon Request] [Always]

Option ROM Messages [Force BIOS]

This allows you to set the display mode for option ROM.

Configuration options: [Force BIOS] [Keep Current]

INT19 Trap Response [Immediate]

[Immediate] Execute the trap right away.

[Postponed] Execute the trap during legacy boot.

Boot Option filter [Legacy only]

This option allows you to control the Legacy/UEFI ROMs priority.

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

Network / Storage / Video [Legacy]

This option allows you to control the execution of UEFI and Legacy PXE / Storage / Video OpROM.

Configuration options: [UEFI] [Legacy]

Other PCI devices [Legacy]

This item determines the OpROM execution policy for devices other than Network, Storage, or Video.

Configuration options: [UEFI] [Legacy]

5.5.11 NVMe Configuration

This page will display the NVMe controller and drive information.

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.	
Advanced	
NVMe controller and Drive information	
No NVME Device Found	

5.5.12 Offboard SATA Controller Configuration

This page will display the offboard SATA controller and drive information.

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.	
Advanced	
No PCIe SATA Controllers / PCIe SSDs are Present	

5.5.13 Network Stack Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
Network Stack	[Disabled]	Enable/Disable UEFI Network Stack

Network stack [Disabled]

Enables or disables the network stack feature.

Configuration options: [Disable] [Enable]



The following item appears only when **Network stack** is set to **[Enabled]**.

Ipv4 PXE Support [Disabled]

Enables or disables the Ipv4 PXE Boot Support. If disabled, Ipv4 PXE boot option will not be created.

Configuration options: [Disabled] [Enabled]

Ipv4 HTTP Support [Disabled]

Enables or disables the Ipv4 HTTP Boot Support. If disabled, Ipv4 HTTP boot option will not be created.

Configuration options: [Disabled] [Enabled]

Ipv6 PXE Support [Disabled]

Enables or disables the Ipv6 PXE Boot Support. If disabled, Ipv6 PXE boot option will not be created.

Configuration options: [Disabled] [Enabled]

Ipv6 HTTP Support [Disabled]

Enables or disables the Ipv6 HTTP Boot Support. If disabled, Ipv6 HTTP boot option will not be created.

Configuration options: [Disabled] [Enabled]

PXE boot wait time [0]

Wait time to press ESC key to abort the PXE boot.

Media detect time [1]

Wait time (in seconds) to detect media.

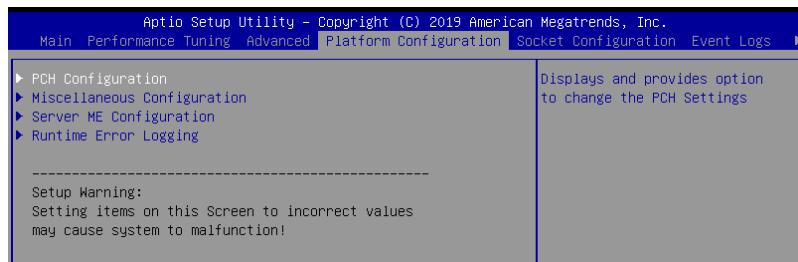
5.5.14 iSCSI Configuration

Allows you to configure the iSCSI parameters.

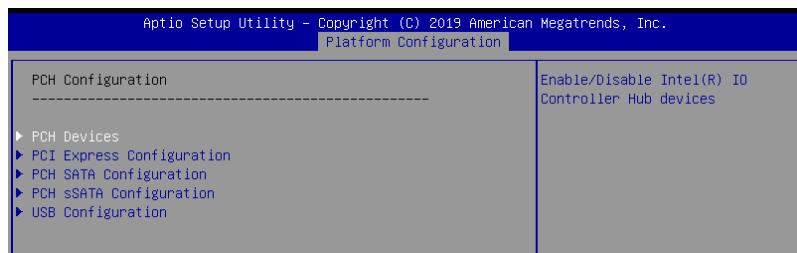


5.6 Platform Configuration menu

The IntelRCSetup menu items allow you to change the platform settings.



5.6.1 PCH Configuration



PCH Devices

DeepSx Power Policies [Disabled]

Allows you to configure the DeepSx Mode configuration.

Configuration options: [Disabled] [Enabled in S5] [Enabled in S4 and S5]

GP27 Wake From DeepSx [Disabled]

Allows you to enable or disable GP27 Wake From DeepSx.

Configuration options: [Disabled] [Enabled]

PCI Express Configuration

PCI-E ASPM Support (Global) [L1 Only]

Allows you to select ASPM support for all downstream devices.

Configuration options: [Per individual port] [L1 Only]

PCH DMI ASPM [Platform-POR]

Allows you to configure the PCH DMI ASPM.

Configuration options: [Platform-POR] [ASPM L1] [Disabled]

PCH SATA Configuration

SATA Controller [Enabled]

Allows you to enable or disable the SATA Controller.

Configuration options: [Disabled] [Enabled]

Configure sSATA as [AHCI]

Allows you to identify the SATA port connected to Solid State Drive or Hard Disk Drive.

Configuration options: [IDE] [AHCI] [RAID]

Support Aggressive Link Power Management [Enabled]

Allows you to enable or disable the Support Aggressive Link Power (SALP) Management.

Configuration options: [Disabled] [Enabled]

SATA Port 1-8

Port 1-8

Allows you to enable or disable the SATA port.
Configuration options: [Disabled] [Enabled]

PCH sSATA Configuration

sSATA Controller [Enabled]

Allows you to enable or disable the sSATA Controller.
Configuration options: [Disabled] [Enabled]

Configure sSATA as [AHCI]

Allows you to identify the SATA port connected to Solid State Drive or Hard Disk Drive.
Configuration options: [IDE] [AHCI] [RAID]

Support Aggressive Link Power Management [Enabled]

Allows you to enable or disable the Support Aggressive Link Power (SALP) Management.
Configuration options: [Disabled] [Enabled]

sSATA Port 1-3

Port 1-3

Allows you to enable or disable the SATA port.
Configuration options: [Disabled] [Enabled]

USB Configuration

USB Precondition [Disabled]

Allows you to enable or disable precondition work on USB host controller and root ports for faster enumeration.

Configuration options: [Disabled] [Enabled]

XHCI Manual Mode [Disabled]

This option is used by validation.

Configuration options: [Disabled] [Enabled]



The following items appears only when the **XHCI Manual Mode** is set to **[Enabled]**.

Trunk Clock Gating (BTCG) [Enabled]

Allows you to enable or disable BTCG.
Configuration options: [Disabled] [Enabled]

Enable USB 3.0 pins [Disable all pins]

Allows you to enable or disable USB 3.0 pins or on a per pin basis.
Configuration options: [Select Per-Pin] [Disable all pins] [Enable all pins]

USB Per-Connector Disable [Disabled]

Allows you to enable or disable each of the USB physical connectors. Once a connector is disabled, any USB devices plugged into the connector will not be detected by BIOS or OS.

Configuration options: [Disabled] [Enabled]



The following items appears only when the **USB Per-Connector Disable** is set to **[Enabled]**.

USB_1-8 [Enabled]

Configuration options: [Disabled] [Enabled]

USB3_1-5 [Enabled]

Configuration options: [Disabled] [Enabled]

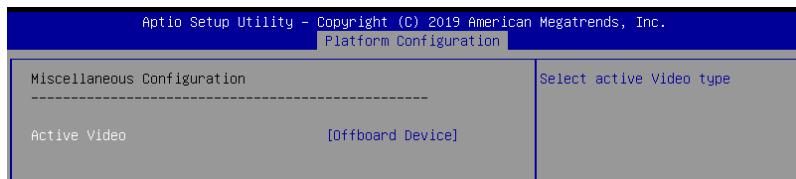
Security Configuration

SMM BIOS Write Protect [Enabled]

Allows you to enable or disable SMM BIOS Write Protect.

Configuration options: [Disabled] [Enabled]

5.6.2 Miscellaneous Configuration



Active Video [Offboard Device]

Allows you to select the video type.

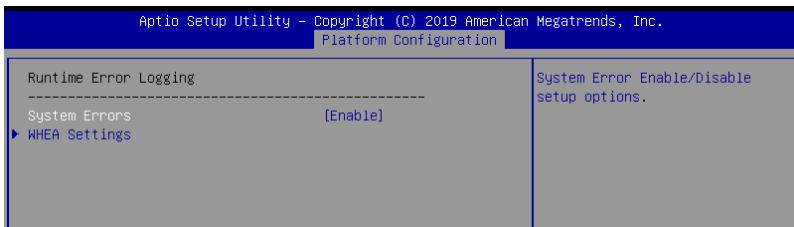
Configuration options: [Auto] [Onboard Device] [Offboard Device]

5.6.3 Server ME Configuration

Displays the Server ME Technology parameters on your system.



5.6.4 Runtime Error Logging Support



Runtime Error Logging

System Errors [Enabled]

This item allows you to enable or disable System Errors.

Configuration options: [Disabled] [Enabled]

Whea Settings

Whea Support [Disabled]

This item allows you to enable or disable the WHEA support.

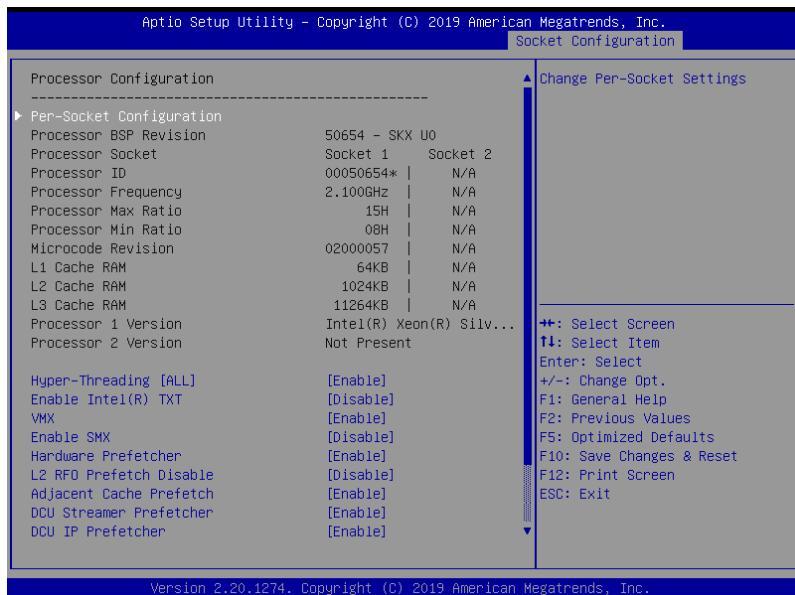
Configuration options: [Disabled] [Enabled]

5.7 Socket Configuration menu

The IntelRCSetup menu items allow you to change the socket settings.



5.7.1 Processor Configuration



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Hyper Threading [ALL] [Enabled]

Allows you to enable or disable the Hyper-Threading Technology function. When disabled, only one thread per activated core is enabled.

Configuration options: [Disabled] [Enabled]

Enable Intel(R) TXT Support [Disabled]

Forces the XD feature log to always return 0 when disabled.

Configuration options: [Disabled] [Enabled]

VMX [Enabled]

Enables the Vanderpool Technology. Takes effect after reboot.

Configuration options: [Disabled] [Enabled]

Enable SMX [Disabled]

Enables the Safer Mode Extensions.

Configuration options: [Disabled] [Enabled]

Hardware Prefetcher [Enabled]

This Item allows you to turn on/off the mid level cache(L2) streamer prefetcher.

Configuration options: [Disabled] [Enabled]

L2 RFO Prefetch Disable [Disabled]

This Item allows you to turn on/off L2 RFO prefetcher.

Configuration options: [Disabled] [Enabled]

Adjacent Cache Prefetch [Enabled]

This Item allows you to turn on/off prefetching of adjacent cache lines.

Configuration options: [Disabled] [Enabled]

DCU Streamer Prefetcher [Enabled]

This Item allows you to enable or disable prefetcher of next L1 data line.

Configuration options: [Disabled] [Enabled]

DCU IP Prefetcher [Enabled]

This Item allows you to enable or disable prefetch of next L1 line based upon sequential load history.

Configuration options: [Disabled] [Enabled]

LLC Prefetch [Disabled]

This Item allows you to enable or disable LLC Prefetch on all threads.

Configuration options: [Disabled] [Enabled]

DCU Mode [32K 8Way Without ECC]

Configuration options: [32K 8Way Without ECC] [16K 4Way With ECC]

Extended APIC [Disabled]

This Item allows you to enable or disable the extended APIC support.

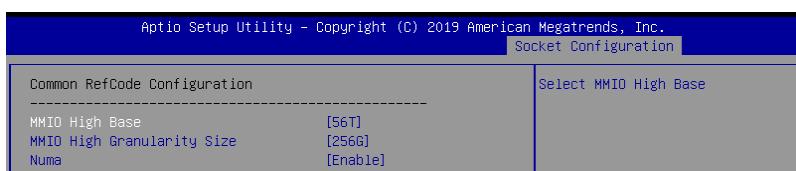
Configuration options: [Disabled] [Enabled]

AES-NI [Enabled]

This Item allows you to enable or disable the AES-NI support.

Configuration options: [Disabled] [Enabled]

5.7.2 Common RefCode Configuration



MMIO High Base [56T]

This item allows you to select the MMIO High Base.

Configuration options: [56T] [40T] [24T] [16T] [4T] [1T]

MMIO High Granularity Size [256G]

This item allows you to select the allocation size used to assign MMIOH resources.

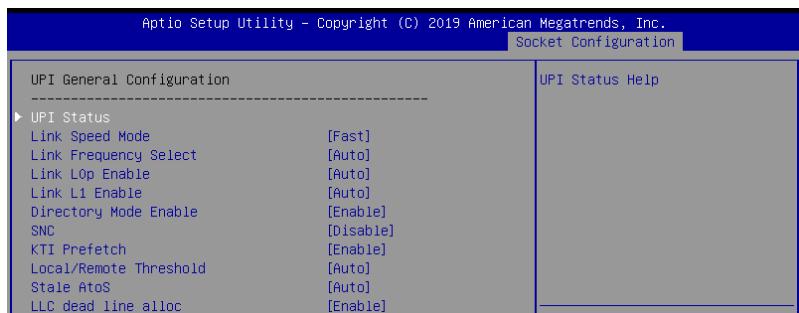
Configuration options: [1G] [4G] [16G] [64G] [256G] [1024G]

Numa [Enabled]

This item enables or disables the Non uniform Memory Access (NUMA).

Configuration options: [Disabled] [Enabled]

5.7.3 UPI Configuration



UPI General Configuration

UPI Status

This item displays information about the UPI status.

Link Speed Mode [Fast]

This item allows you to select the UPI link speed as either the fast mode or slow mode.
Configuration options: [Slow] [Fast]

Link Frequency Select [Auto]

This item allows for selecting the UPI link frequency.
Configuration options: [Auto] [9.6 GB/s] [10.4 GB/s] [Use Per Link Setting]

UPI Link0p Enable [Enabled]

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

UPI Link1 Enable [Enabled]

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

Directory Mode Enable [Enabled]

Configuration options: [Disabled] [Enabled]

SNC [Disabled]

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

KTI Prefetch [Enabled]

Configuration options: [Disabled] [Enabled]

Local/Remote Threshold [Auto]

Configuration options: [Disabled] [Auto] [Low] [Medium] [High]

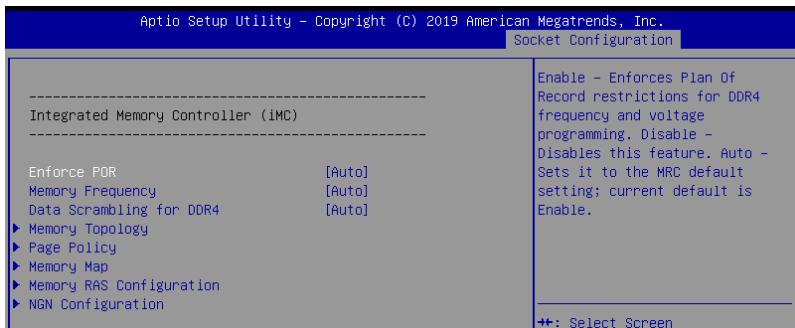
Stale AtoS [Disabled]

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

LLC dead line alloc [Enabled]

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

5.7.4 Memory Configuration



Enforce POR [Auto]

Allows you to enforce POR restrictions for DDR4 frequency and voltage programming.
Configuration options: [Auto] [POR] [Disabled]

Memory Frequency [Auto]

Allows you to select the memory frequency setting.
Configuration options: [Auto] [1800] - [3000-OvrClk]

Data Scrambling for DDR4 [Auto]

Allows you to enable or disable data scrambling.
Configuration options: [Auto] [Disabled] [Enabled]

Memory Topology

Displays memory topology with DIMM population information.

Page Policy

Allows you to configure Page Policy settings.

Page Policy [Disabled]

Configuration options: [Auto] [Closed] [Adaptive]

Memory Map

IMC Interleaving [Auto]

Select different IMC interleaving setting.
Configuration options: [Auto] [1-way Interleave] [2-way Interleave]

Channel Interleaving [Auto]

Select different channel interleaving setting.
Configuration options: [Auto] [1-way Interleave] [2-way Interleave]
[3-way Interleave]

Rank Interleaving [Auto]

Select different rank interleaving setting.

Configuration options: [Auto] [1-way Interleave] [2-way Interleave]
[4-way Interleave] [8-way Interleave]

Memory RAS Configuration

Mirror Mode [Disabled]

Allows you to select Mirror Modes. Mirror Mode will set entire 1LM/2LM memory in system to be mirrored, consequently reducing the memory capacity by half. Enabling Mirror Mode will disable XPT Prefetch.

Configuration options: [Disabled] [Mirror Mode 1LM] [Mirror Mode 2LM]

UEFI ARM Mirror [Disabled]

Allows you to enable or disable UEFI ARM Mirror.

Configuration options: [Disabled] [Enabled]

Memory Rank Sparing [Disabled]

Allows you to enable or disable Memory Rank Sparing

Configuration options: [Disabled] [Enabled]

Patrol Scrub [Enabled]

Allows you to enable or disable Patrol Scrub.

Configuration options: [Disabled] [Enabled]

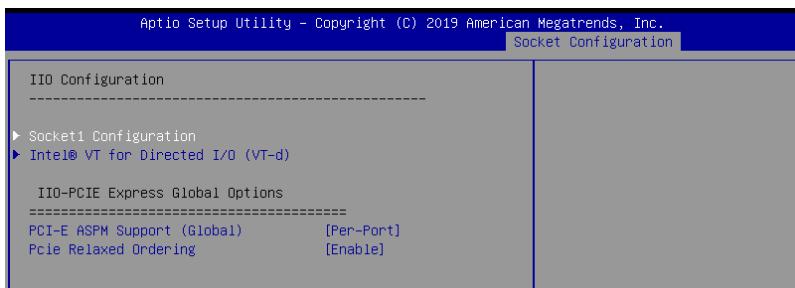
NGN Configuration

Average Power Budget (in mW) [18000]

Allows you to set the power management policy for average power in 250 mW increments.

Configuration options: [10000] - [18000]

5.7.5 IIO Configuration



Socket1 Configuration

This item allows you to configure settings related to the corresponding PCIE port.

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

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

Allows you to enable or disable the Intel Virtualization Technology for Directed I/O.

Configuration options: [Disabled] [Enabled]

PCI Express Global Options

PCI-E ASPM Support (Global) [Per-Port]

Allows you to enable or disable ASPM support for all downstream devices.

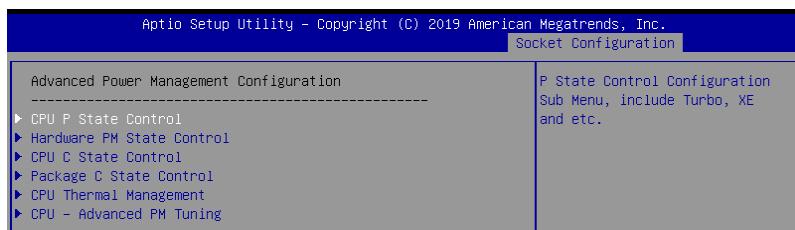
Configuration options: [Disabled] [Per-Port] [L1 Only]

PCIE relaxed Ordering [Enabled]

Allows you to enable or disable PCIE relaxed Ordering.

Configuration options: [Disabled] [Enabled]

5.7.6 Advanced Power Management Configuration



CPU P State Control

Boot performance mode [Max Performance]

Allows you to switch between Boot performance mode.

Configuration options: [Max Performance] [Max Efficient] [Set by Intel Node Manager]

Energy Efficient Turbo [Enabled]

Allows you to enable or disable Energy Efficient Turbo.

Configuration options: [Disabled] [Enabled]

Turbo Mode [Enabled]

Allows you to enable or disable Turbo Mode.

Configuration options: [Disabled] [Enabled]

Hardware PM State Control

Hardware P-States [Native Mode]

Allows you to switch between Hardware P-States mode.

Configuration options: [Disabled] [Native Mode] [Out of Band Mode] [Native Mode with no Legacy Support]

CPU C State Control

Autonomous Core C-State [Disabled]

Allows you to enable or disable Autonomous Core C-State Report.

Configuration options: [Disabled] [Enabled]

CPU C6 Report [Auto]

Allows you to select CPU C6 Report.

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

OS ACPI Cx [ACPI C2]

Allows you to select OS ACPI Cx Report.

Configuration options: [ACPI C2] [ACPI C3]

Package C State Control

Package C State [Auto]

Allows you to select Package C State.

Configuration options: [C0/C1 state] [C2 state] [C6(non Retention state] [C6(Retention state] [No Limit] [Auto]

CPU Thermal Control

CPU T-State Control

Software Controlled T-States [Disabled]

Allows you to enable or disable Software Controlled T-States.

Configuration options: [Disabled] [Enabled]

CPU - Advanced PM Tuning

Energy Perf BIAS

Power Performance Tuning [OS Controls EPB]

Configuration options: [OS Controls EPB] [BIOS Controls EPB]



The following item appears only when you set **Power Performance Tuning** to **[OS Controls EPB]**.

PECI PCS EPB [OS Controls EPB]

This option controls whether PECI has control over EPB.

Configuration options: [OS Controls EPB] [PECI Controls EPB using PCS]



The following item appears only when you set **Power Performance Tuning** to **[BIOS Controls EPB]**.

ENERGY_PERF_BIAS_CFG Mode [Balanced Performance]

Configuration options: [Performance] [Balanced Performance] [Balanced Power]
[Power]

Dynamic Loadline Switch [Enabled]

Configuration options: [Disabled] [Enabled]

Workload Configuration [UMA]

This option allows optimization for the workload characterization.

Configuration options: [UMA] [NUMA]

Averaging Time Window [17]

This option is used to control the effective window of the average C0 and P0 time.

Configuration options: [0] - [FF]

P0 TotalTimeThreshold Low [23]

The HW switching mechanism DISABLES the performance setting (0) when the total P0 time is less than the threshold set.

Configuration options: [0] - [3F]

P0 TotalTimeThreshold High [3a]

The HW switching mechanism Enables the performance setting (0) when the total P0 time is greater than the threshold set.

Configuration options: [0] - [3F]

5.8 Event Logs menu

The Event Logs menu items allow you to change the event log settings and view the system event logs.



5.8.1 Change Smbios Event Log Settings

Press <Enter> to change the Smbios Event Log configuration.



All values changed here do not take effect until computer is restarted.

Enabling/Disabling Options

Smbios Event Log [Enabled]

Change this to enable or disable all features of Smbios Event Logging during boot.

Configuration options: [Disabled] [Enabled]

Erasing Settings

Erase Event Log [No]

Choose options for erasing Smbios Event Log. Erasing is done prior to any logging activation during reset.

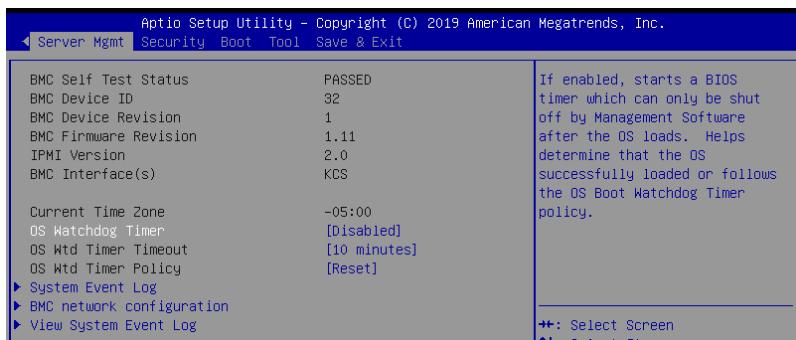
Configuration options: [No] [Yes, Next reset] [Yes, Every reset]

5.8.2 View Smbios Event Log

Press <Enter> to view all smbios event logs.

5.9 Server Mgmt menu

The Server Management menu displays the server management status and allows you to change the settings.



OS Watchdog Timer [Disabled]

This item allows you to start a BIOS timer which can only be shut off by Intel Management Software after the OS loads.

Configuration options: [Disabled] [Enabled]



The following items is configurable only when the **OS Watchdog Timer** is set to **[Enabled]**.

OS Wtd Timer Timeout [10 minutes]

Allows you to configure the length to the OS Boot Watchdog Timer.

Configuration options: [5 minutes] [10 minutes] [15 minutes] [20 minutes]

OS Wtd Timer Policy [Reset]

This item allows you to configure the how the system should respond if the OS Boot Watch Timer expires.

Configuration options: [Do Nothing] [Reset] [Power Down]

System Event Log

Allows you to change the SEL event log configuration.

Erase SEL [No]

Allows you to choose options for erasing SEL.

Configuration options: [No] [Yes, On next reset] [Yes, On every reset]

When SEL is Full [Do Nothing]

Allows you to choose options for reactions to a full SEL.

Configuration options: [Do Nothing] [Erase Immediately]

BMC network configuration

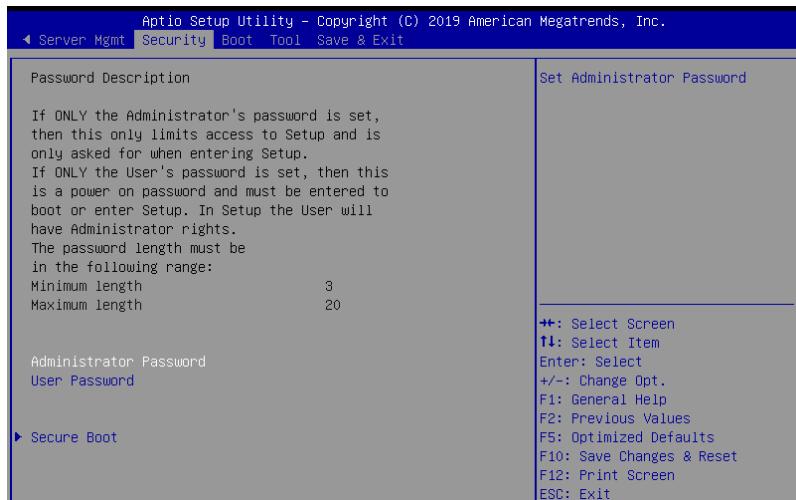
The sub-items in this configuration allow you to configure the BMC network parameters.

View System Event Log

This item allows you to view the system event log records.

5.10 Security menu

This menu allows a new password to be created or a current password to be changed. The menu also enables or disables the Secure Boot state and lets the user configure the System Mode state.



Administrator Password

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.

User Password

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 a user password:

1. Select the Clear User Password item and press <Enter>.
2. Select **Yes** from the Warning message window then press <Enter>.

Secure Boot

This item allows you to customize the Secure Boot settings.

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Security		
Secure Boot	[Disabled] Not Active	Secure Boot feature is Active if Secure Boot is Enabled, Platform Key(PK) is enrolled and the System is in User mode.

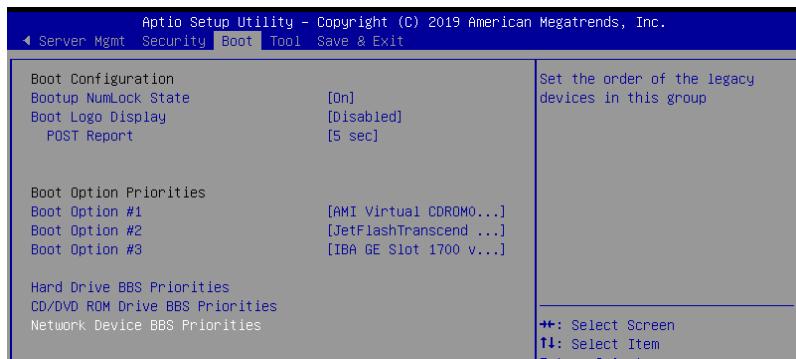
Secure Boot

Allows you to enable or disable Secure Boot.

Configuration options: [Disabled] [Enabled]

5.11 Boot menu

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



Bootup NumLock State [On]

Allows you to select the power-on state for the NumLock.

Configuration options: [Off] [On]

Boot Logo Display [Auto]

Allows you to enable or disable the full screen logo display feature.

Configuration options: [Auto] [Full Screen] [Disabled]

POST Report [5 sec]

Allows you to set the desired POST Report waiting time from 1 to 10 seconds.

Configuration options: [1 sec] ~ [10 sec] [Until Press ESC]

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 select the boot device during system startup, press **<F8>** when ASUS Logo appears.
- To access Windows OS in Safe Mode, please press **<F8>** after POST.

Hard Drive / CD/DVD ROM Drive / Network Device BBS Priorities

These items allow you to set the order of the legacy devices in this group.

5.12 Tool menu

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



IPMI Hardware Monitor

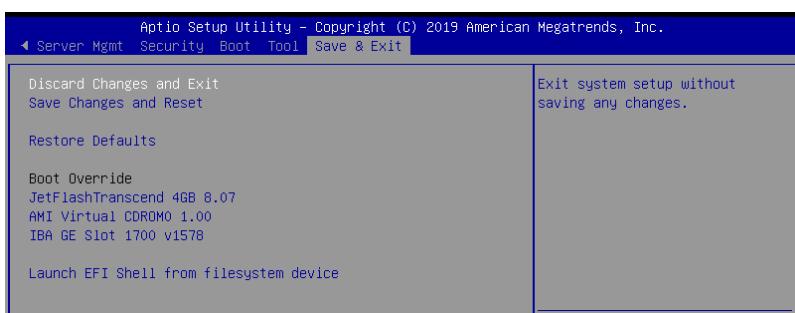
Allows you to run the IPMI hardware monitor.

Start EZ Flash

Allows you to run ASUS EZ Flash BIOS ROM Utility when you press <Enter>. Refer to the ASUS EZ Flash Utility section for details.

5.13 Save & Exit menu

The Save & Exit menu items allow you to save or discard your changes to the BIOS items.



Pressing <Esc> does not immediately exit this menu. Select one of the options from this menu or <F10> from the legend bar to exit.

Discard Changes & Exit

Exit System setup without saving any changes.

Save Changes & Reset

Exit System setup after saving the changes.

Restore Defaults

Restore/load default values for all the setup options.

Boot Override

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

6

RAID Configuration

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

6.1 Setting up RAID

The motherboard supports the **Intel® Rapid Storage Technology enterprise Option ROM Utility** with RAID 0, RAID 1, RAID 10, and RAID 5 support (for Windows OS and Linux).

6.1.1 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 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.

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.



If you want to boot the system from a hard disk drive included in a created RAID set, copy first the RAID driver from the support DVD to a floppy disk before you install an operating system to the selected hard disk drive.

6.1.2 Installing hard disk drives

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

To install the SATA hard disks for RAID configuration:

1. Install the SATA hard disks into the drive bays following the instructions in the system user guide.
2. Connect a SATA signal cable to the signal connector at the back of each drive and to the SATA connector on the motherboard.
3. Connect a SATA power cable to the power connector on each drive.

6.1.3 Setting the RAID item in BIOS

You must set the RAID item in the BIOS Setup before you can create a RAID set from SATA hard disk drives attached to the SATA connectors supported by Intel® C621 chipset.

To do this:

1. Enter the BIOS Setup during POST.
2. Go to the **Platform Configuration menu** Menu > **PCH Configuration** Menu > **PCH SATA Configuration**, then press <Enter>.
3. Set **Configure sSATA as** to [RAID Mode]
4. Press <F10> to save your changes and exit the BIOS Setup.



Refer to Chapter 5 for details on entering and navigating through the BIOS Setup.

6.1.4 RAID configuration utilities

Depending on the RAID connectors that you use, you can create a RAID set using the utilities embedded in each RAID controller. For example, use the **Intel® Rapid Storage Technology** if you installed Serial ATA hard disk drives on the Serial ATA connectors supported by the Intel® C621 chipset.

Refer to the succeeding section for details on how to use the RAID configuration utility.

6.2 Intel® Rapid Storage Technology enterprise SATA/SSATA Option ROM Utility

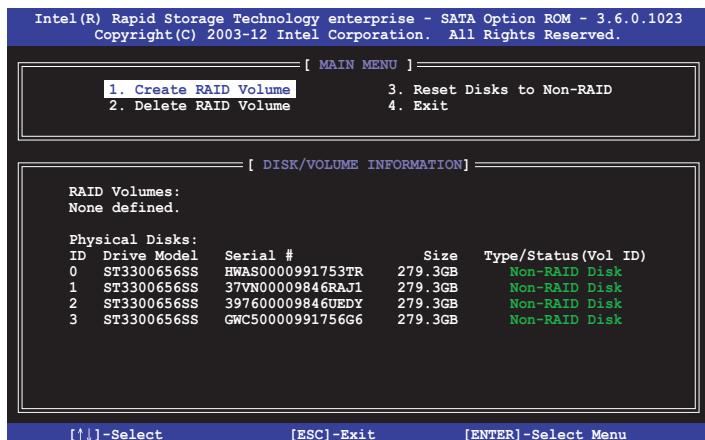
The Intel® Rapid Storage Technology enterprise SATA/SSATA Option ROM utility allows you to create RAID 0, RAID 1, RAID 10 (RAID 1+0), and RAID 5 set from Serial ATA hard disk drives that are connected to the Serial ATA connectors supported by the Southbridge.



Before you proceed, ensure that you have installed the Serial ATA hard disk drives, have set the correct jumper settings of the motherboard, and have set the correct SATA mode in the BIOS setup. You can refer to the **Installing hard disk drives** and **Setting the RAID mode sections in BIOS** for more information.

To launch the Intel® Rapid Storage Technology enterprise SATA/SSATA Option ROM utility:

1. Turn on the system.
2. During POST, press <Ctrl>+<l> to display the utility main menu.



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

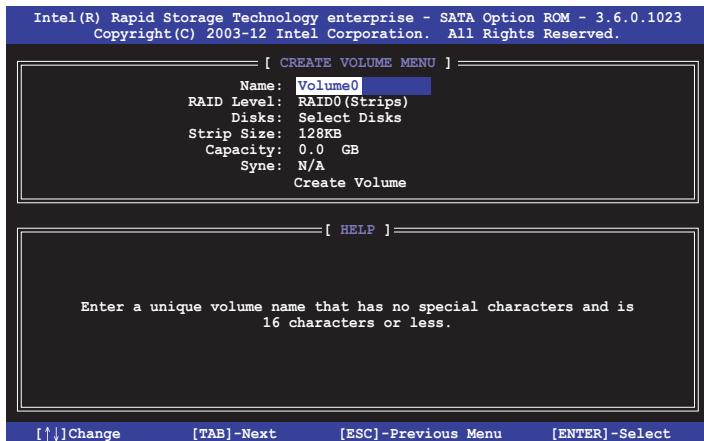


The RAID BIOS setup screens shown in this section are for reference only and may not exactly match the items on your screen.

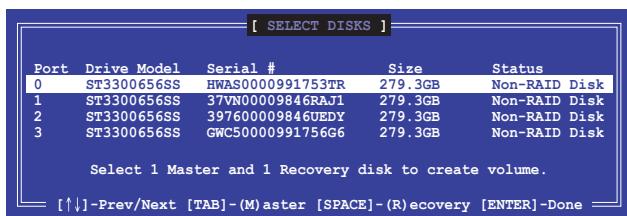
6.2.1 Creating a RAID set

To create a RAID set:

1. From the utility main menu, select **1. Create RAID Volume** and press <Enter>.
2. Key in a name for the RAID set and press <Enter>.



3. Press the up/down arrow keys to select a RAID Level that you wish to create then press <Enter>.
4. From the **Disks** item field, press <Enter> to select the hard disk drives that you want to include in the RAID set.



5. Use the up/down arrow keys to move the selection bar then press <Space> to select a disk. A small triangle before the Port number marks the selected drive. Press <Enter> when you are done.

6. Use the up/down arrow keys 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: 128KB
RAID 10: 64KB
RAID 5: 64KB



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. In the **Capacity** field item, key in the RAID volume capacity that you want to use and press <Enter>. The default value field indicates the maximum allowed capacity.
8. Press <Enter> to start creating the RAID volume.
9. From the following warning message, press <Y> to create the RAID volume and return to the main menu, or press <N> to go back to the **CREATE VOLUME** menu.



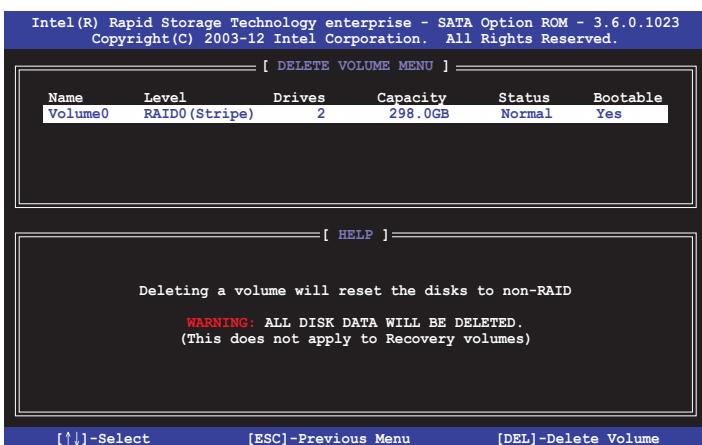
6.2.2 Deleting a RAID set



Take caution 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>.
2. From the Delete Volume Menu, press the up/down arrow keys to select the RAID set you want to delete then press .



3. Press <Y> to confirm deletion of the selected RAID set and return to the utility main menu, or press <N> to return to the **DELETE VOLUME** menu.



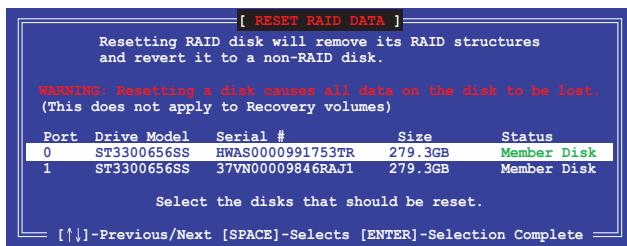
6.2.3 Resetting disks to Non-RAID



Take caution before you reset a RAID volume hard disk drive to non-RAID. Resetting a RAID volume hard disk drive deletes all internal RAID structure on the drive.

To reset a RAID set:

1. From the utility main menu, select **3. Reset Disks to Non-RAID** and press <Enter>.
2. Press the up/down arrow keys to select the drive(s) or disks of the RAID set you want to reset, then press <Space>. A small triangle before the Port number marks the selected drive. Press <Enter> when you are done.



3. Press <Y> in the confirmation window to reset the drive(s) or press <N> to return to the utility main menu.

6.2.4 Exiting the Intel® Rapid Storage Technology enterprise SATA/SSATA Option ROM utility

To exit the utility:

1. From the utility main menu, select **4. Exit** then press <Enter>.
2. Press <Y> to exit or press <N> to return to the utility main menu.



6.2.5 Rebuilding the RAID



This option is only for the RAID 1 set.

Rebuilding the RAID with other non-RAID disk

If any of the SATA hard disk drives included in the RAID 1 array failed, the system displays the status of the RAID volume as “**Degraded**” during POST. You can rebuild the RAID array with other installed non-RAID disks.

To rebuild the RAID with other non-RAID disk:

1. During POST, press <Ctrl>+<l> at the prompt to enter the Intel Rapid Storage Technology option ROM utility.
2. If there is a non-RAID SATA Hard Disk available, the utility will prompt you to rebuild the RAID. Press the up/down arrow keys to select the destination disk then press <Enter> to start the rebuilding process, or press <ESC> to exit.



Select a destination disk with the same size as the original hard disk.

- The utility immediately starts rebuilding after the disk is selected. When done, the status of the degraded RAID volume is changed to “**Rebuild**”.

```

Intel(R) Rapid Storage Technology enterprise - SATA Option ROM - 3.6.0.1023
Copyright(C) 2003-12 Intel Corporation. All Rights Reserved.

[ MAIN MENU ] ==

1. Create RAID Volume      3. Reset Disks to Non-RAID
2. Delete RAID Volume     4. Exit

[ DISK/VOLUME INFORMATION ] ==

RAID Volumes:
ID  Name      Level1      Strip      Size      Status      *Data is Encrypted
1   Volume0   RAID1(Mirror)  N/A       149.0GB   Rebuild    Yes

Physical Devices:
Port  Drive Model  Serial #      Size      Type/Status(Vol ID)
1    ST3160812AS  9LS0F4HL    149.0GB   Member Disk(0)
2    ST3160812AS  3LS0JYL8    149.0GB   Member Disk(0)

Volumes with "Rebuild" status will be rebuilt within the operating system.

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

```

- Press <Esc> to exit Intel Rapid Storage Technology and reboot the system.
- Select **Start > Programs > Intel Rapid Storage > Intel Rapid Storage Console** or click the **Intel Rapid Storage Technology** tray icon to load the Intel Rapid Storage Manager utility.
- From the **View** menu, select **Advanced Mode** to display the details of the Intel Rapid Storage Console.
- From the **Volumes view** option, select **RAID volume** to view the rebuilding status. When finished, the status is changed to “**Normal**”.

Rebuilding the RAID with a new hard disk

If any of the SATA hard disk drives included in the RAID array failed, the system displays the status of the RAID volume as “**Degraded**” during POST. You may replace the disk drive and rebuild the RAID array.

To rebuild the RAID with a new hard disk:

- Remove the failed SATA hard disk and install a new SATA hard disk of the same specification into the same SATA Port.



Select a destination disk with the same size as the original hard disk.

- Reboot the system then follow the steps in section **Rebuilding the RAID with other non-RAID disk**.

6.2.6 Setting the Boot array in the BIOS Setup Utility

You can set the boot priority sequence in the BIOS for your RAID arrays when creating multi-RAID using the Intel® Rapid Storage Technology enterprise SATA Option ROM utility.

To set the boot array in the BIOS:



Set at least one of the arrays bootable to boot from the hard disk.

1. Reboot the system and press to enter the BIOS setup utility during POST.
2. Go to the **Boot** menu and select the boot option priority.
3. Use up/down arrow keys to select the boot priority and press <Enter>. See the **Boot menu** section of Chapter 5 for more details.
4. From the **Exit** menu, select **Save Changes & Exit**, then press <Enter>.
5. When the confirmation window appears, select **Yes**, then press <Enter>.

6.3 Intel® Rapid Storage Technology enterprise (Windows)

The Intel® Rapid Storage Technology enterprise allows you to create RAID 0, RAID 1, RAID 10 (RAID 1+0), and RAID 5 set(s) from Serial ATA hard disk drives that are connected to the Serial ATA connectors supported by the Southbridge.

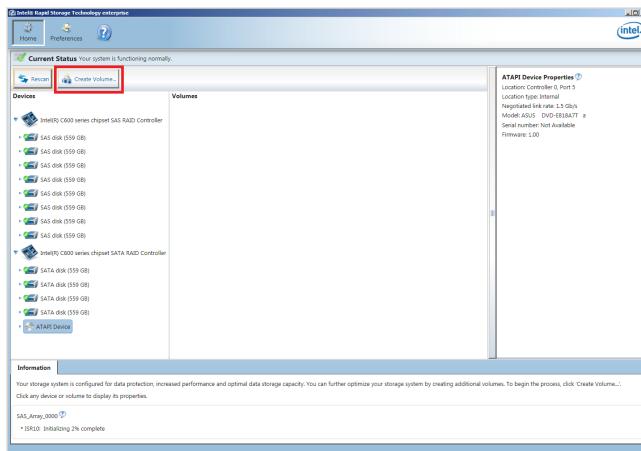


You need to manually install the Intel® Rapid Storage Technology enterprise utility on a Windows® operating system. Please refer to the installation instructions in Chapter 7.

To enter the Intel® Rapid Storage Technology enterprise utility under Windows operating system:

1. Turn on the system and go to the windows desktop.
2. Click the **Intel® Rapid Storage Technology enterprise** icon to display the main menu.

Your storage system is configured for data protection, increased performance and optimal data storage capacity. You can create additional volumes to further optimize your storage system.

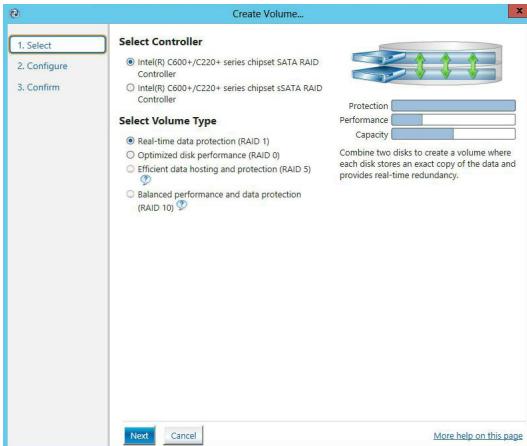


You can click **Rescan** to re-scan any attached hard disks.

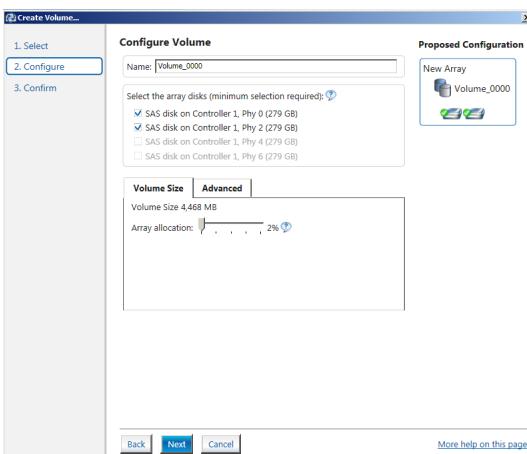
6.3.1 Creating a RAID set

To create a RAID set:

1. From the utility main menu, select **Create Volume** and select volume type.
2. Click **Next**.



3. Enter a name for the RAID set, then select the array disks.
4. Select **Volume Size** tab, you can drag the bar to decide the volume size.
5. Click **Next**.

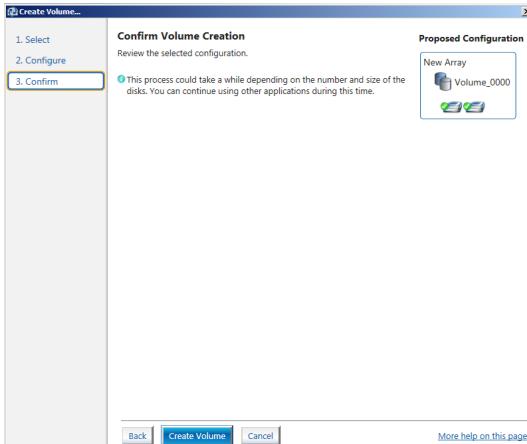


- If you do not want to keep the data on one of the selected disks, select **NO** when prompted.
- If you want to **Enable volume write-back cache** or **Initialize volume**, click **Advanced**.

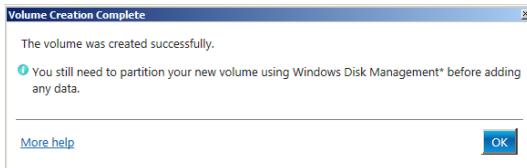
6. Confirm the volume creation, then click **Create Volume** to continue.



This process could take a while depending on the number and size of the disks. You can continue using other applications during this time.

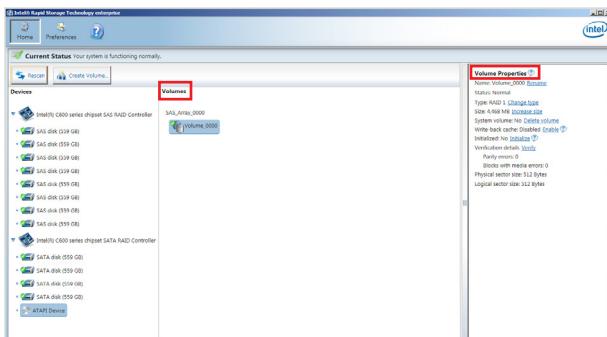


7. Wait until the process is completed, then click **OK** when prompted.



You still need to partition your new volume using Windows Disk Management before adding any data.

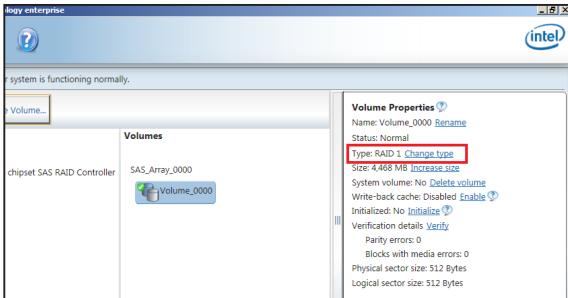
The RAID set is displayed in the **Volumes** list and you can change the settings in **Volume Properties**.



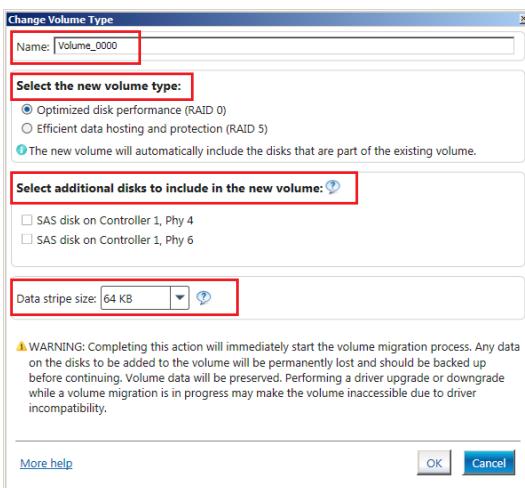
6.3.2 Changing a Volume Type

To change the volume type in **Volume Properties**:

1. Click the SATA array items you want to change in **Volumes** field.
2. From the **Volume Properties** field, select **Type: RAID 1 Change type**.



3. You can change the **Name**, **Select the new volume type**, and **Select additional disks to include in the new volume** if needed.
4. Select the **Data stripe size** for the RAID array (for RAID 0, 10 and 5 only), and click **OK**. The available stripe size values range from 4 KB to 128 KB. The following are typical values:
RAID 0: 128KB
RAID 10: 64KB
RAID 5: 64KB



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.

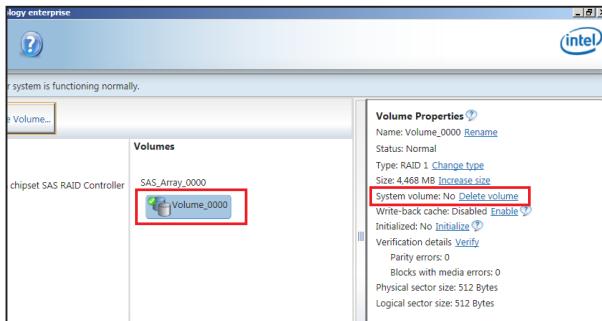
6.3.3 Deleting a volume



Be cautious when deleting a volume. You will lose all data on the hard disk drives. Before you proceed, ensure that you back up all your important data from your hard drives.

To delete a volume:

1. From the utility main menu, select the volume (ex. Volume_0000) in **Volumes** field you want to delete.



2. Select **Delete volume** in **Volume Properties** field. The following screen appears.

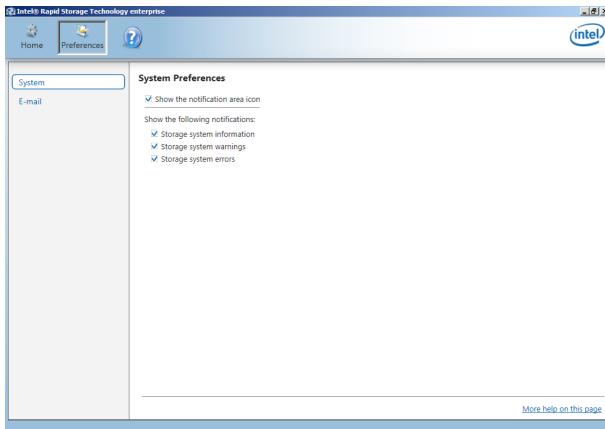


3. Click **Yes** to delete the volume and return to the utility main menu, or click **No** to return to the main menu.

6.3.4 Preferences

System Preferences

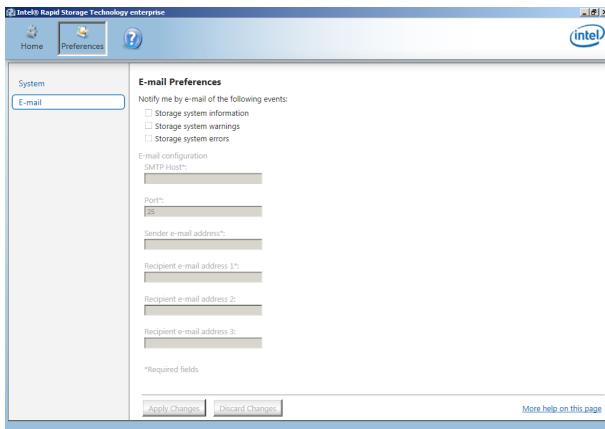
Allow you to set to show the notification area icon and show system information, warning, or errors here.



E-Mail Preferences

Allow you to set to sent e-mail of the following events:

- Storage system information
- Storage system warnings
- Storage system errors



7

Driver Installation

This chapter provides the instructions for installing the necessary drivers for different system components in the Windows® Operating Systems.

7.1 RAID driver installation

After creating the RAID sets for your server system, you are now ready to install an operating system to the independent hard disk drive or bootable array. This part provides the instructions on how to install the RAID controller drivers during OS installation.

7.1.1 Creating a USB flash drive with RAID drive

When installing Windows® Server OS, you can load the RAID driver from a USB flash drive. You can create a USB flash drive with RAID driver in Windows by copying the files from the support DVD to the USB flash drive.

To copy the RAID driver to a USB flash drive in Windows environment:

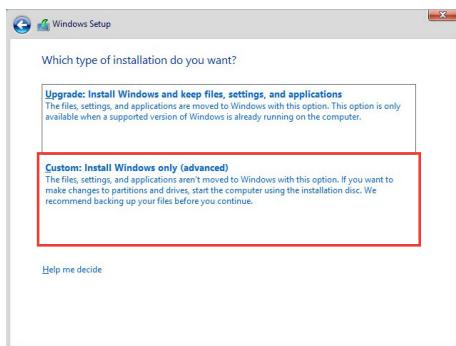
1. Place the motherboard support DVD in the optical drive.
2. Connect a USB flash drive to your system.
3. Click on the optical drive to browse the contents of the support DVD.
4. Click **Drivers > C620 INTEL RAID > Windows > Driver** and then copy the RAID driver folder to the USB flash drive.

7.1.2 Installing the RAID controller driver

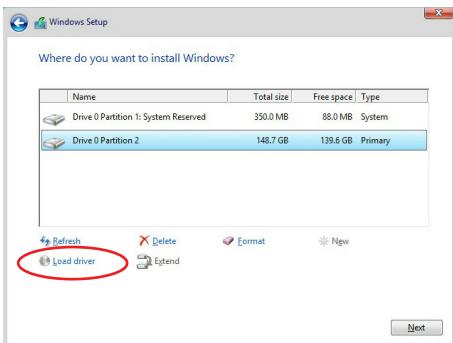
During Windows® Server 2012 R2 OS installation

To install the RAID controller driver when installing Windows® Server 2012 R2 OS:

1. Boot the computer using the Windows® Server 2012 R2 OS installation disc. Follow the screen instructions to start installing Windows Server 2012 R2.
2. When prompted to choose a type of installation, click **Custom: Install Windows only (advanced)**.



3. Click **Load Driver**.



4. A message appears reminding you to insert the installation media containing the driver of the RAID controller driver (the installation media can be a CD, DVD, or USB flash drive).

- If you have only one optical drive installed in your system, eject the Windows OS installation disc and replace with the motherboard Support DVD into the optical drive.
- Or you may connect a USB flash drive containing the RAID controller driver.

Click **Browse** to continue.



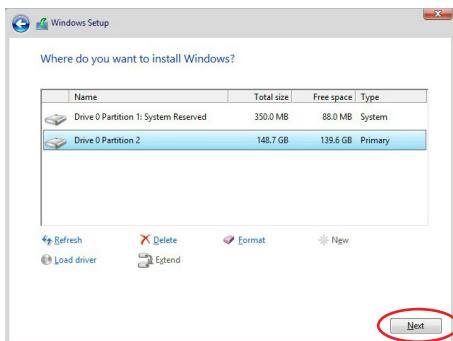
5. Locate the driver in the corresponding folder of the Support DVD or USB flash drive and then click **OK** to continue.

6. Select the RAID controller driver you need from the list and click **Next**.

7. When the system finishes loading the RAID driver,

- Replace the motherboard Support DVD with the Windows Server installation disc.
- Remove the USB flash drive.

Select the drive to install Windows and click **Next**.



8. Setup then proceeds with the OS installation. Follow screen instructions to continue.

7.2 Management applications and utilities installation

The support DVD that is bundled with your motherboard contains drivers, management applications, and utilities that you can install to maximize the features of your motherboard.



1. The contents of the support DVD are subject to change at any time without notice. Visit the ASUS website (www.asus.com) for the latest updates on software and utilities.
2. The support DVD is supported on Windows® Server 2012 R2 and Windows® Server 2016.

7.3 Running the Support DVD

When you place the support DVD into the optical drive, the DVD automatically displays the main screen if Autorun is enabled in your computer. By default, the Drivers tab is displayed.



If Autorun is NOT enabled in your computer, browse the contents of the support DVD to locate the file **ASSETUP.EXE** from the **BIN** folder. Double-click the **ASSETUP.EXE** to run the support DVD.

The main screen of the Support DVD contains the following tabs:

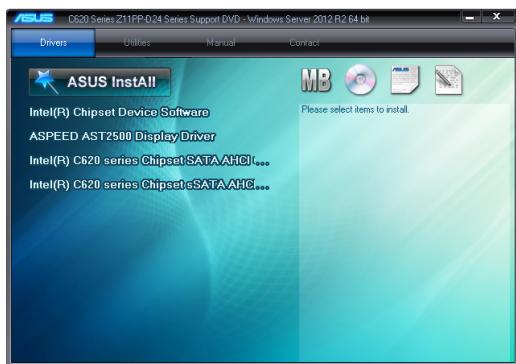
1. Drivers
2. Utilities
3. Manual
4. Contact



The main screen of the Support DVD looks exactly the same on the Windows® Server 2012 R2 and on the Windows® Server 2016 Operating System (OS).

7.3.1 Drivers menu tab

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



7.3.2 Utilities menu tab

The Utilities menu displays the software applications and utilities that the motherboard supports.



7.3.3 Manual menu

The Manual menu provides the link to the Broadcom NetXtreme II Network Adapter user guide.



You need an internet browser installed in your OS to view the User Guide.



7.3.4 Contact information menu

The Contact menu displays the ASUS contact information, e-mail addresses, and useful links if you need more information or technical support for your motherboard.



7.4 Intel® chipset device software installation

This section provides the instructions on how to install the Intel® chipset device software on the system.

You need to manually install the Intel® chipset device software on a Windows operating system.

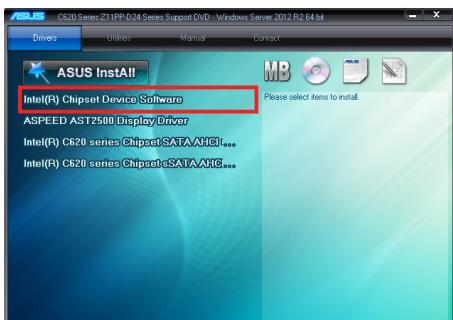
To install the Intel® chipset device software:

1. Restart the computer, and then log on with **Administrator** privileges.
2. Insert the motherboard/system support DVD into the optical drive. The support DVD automatically displays the **Drivers** menu if Autorun is enabled in your computer.

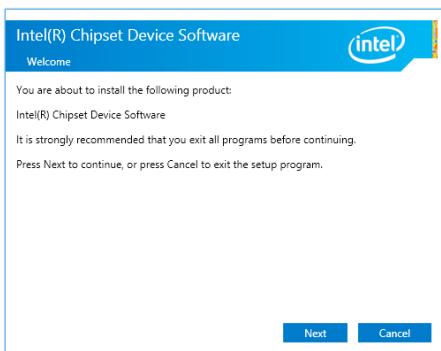


If Autorun is NOT enabled in your computer, browse the contents of the support DVD to locate the file **ASSETUP.EXE** from the **BIN** folder. Double-click the **ASSETUP.EXE** to run the support DVD.

3. Click the item **Intel® Chipset Device Software** from the menu.



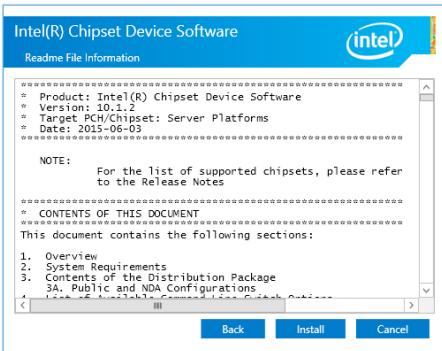
4. The **Intel(R) Chipset Device Software** window appears. Click **Next** to start the installation.



5. Read the **License Agreement** and click **Accept** to continue the process.



6. Read the **Readme File Information** and click **Install** to start the installation process.



7. Click **Restart Now** to complete the setup process.



7.5 VGA driver installation

This section provides the instructions on how to install the ASPEED Video Graphics Adapter (VGA) driver.

You need to manually install the ASPEED VGA driver on a Windows® operating system.

To install the ASPEED VGA driver:

1. Restart the computer, and then log on with **Administrator** privileges.
2. Insert the motherboard/system support DVD into the optical drive. The support DVD automatically displays the **Drivers** menu if Autorun is enabled in your computer.



If Autorun is NOT enabled in your computer, browse the contents of the support DVD to locate the file **ASSETUP.EXE** from the **BIN** folder. Double-click the **ASSETUP.EXE** to run the support DVD.

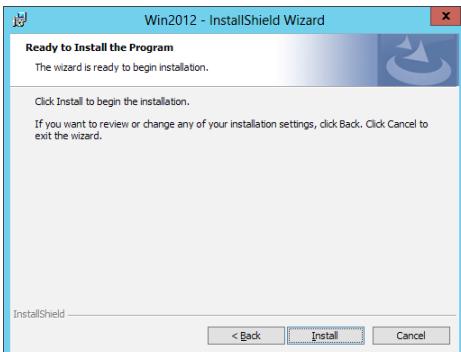
3. Click the **ASPEED AST2500 Display Driver** to begin installation.



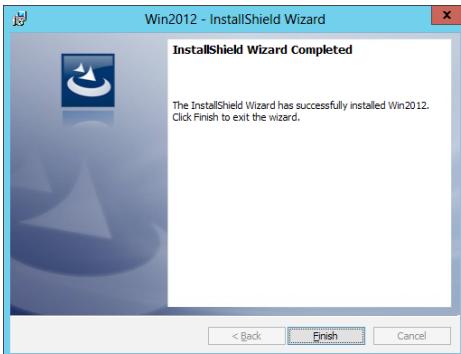
4. From the installation window, click **Next** to start the installation.



5. Click **Install** to start the installation process.



6. Click **Finish** to complete the installation.



7.6 Intel® Rapid Storage Technology enterprise 5.0 installation

This section provides the instructions on how to install the Intel® Rapid Storage Technology enterprise 5.0 on the system.

You need to manually install the Intel® Rapid Storage Technology enterprise 5.0 utility on a Windows® operating system.

To install the Intel® Rapid Storage Technology enterprise 5.0 utility:

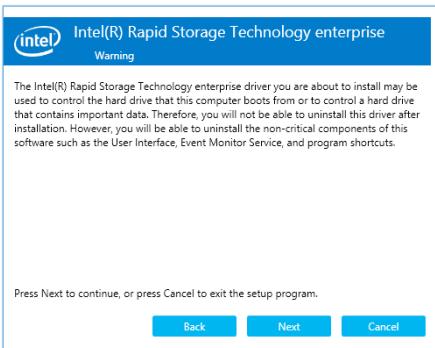
1. Restart the computer, and then log on with **Administrator** privileges.
2. Insert the motherboard/system support DVD into the optical drive, and navigate to the **Utilities** menu.
3. Click the **Intel® Rapid Storage Technology enterprise 5.0** to begin installation.



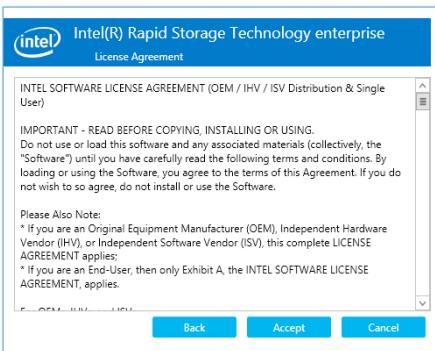
4. The **Intel® Rapid Storage Technology enterprise** window appears. Click **Next** to start the installation.



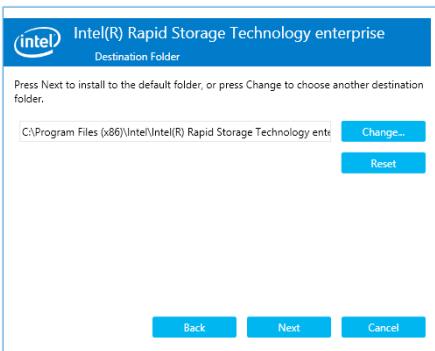
5. Read the **Warning** message and click **Next** to continue.



6. Read the **License Agreement** and click **Accept** to continue the process.



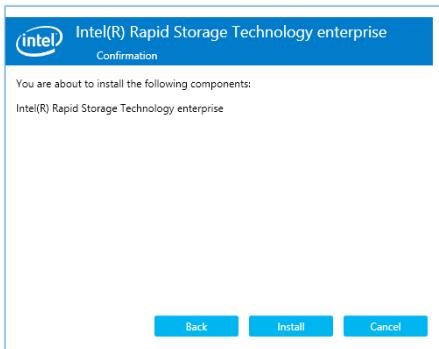
7. Select the destination folder and click **Next** to continue.



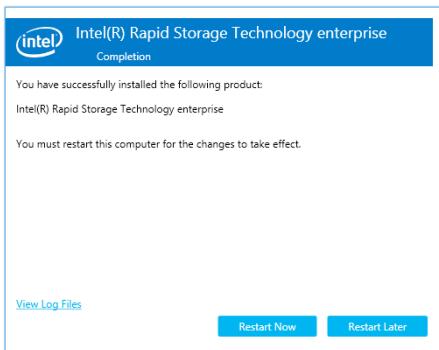
8. Tick the features that you would like to install and click **Next** to continue.



9. Click **Install** to start the installation process.



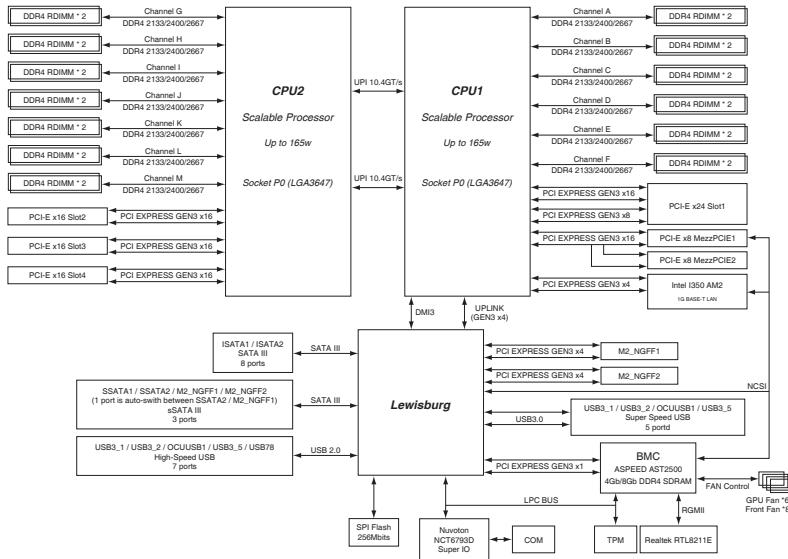
10. Click **Restart Now** to complete the setup process.



Appendix

This appendix includes additional information that you may refer to when configuring the motherboard.

Z11PP-D24 block diagram



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/>.

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