MS-98M9

(v1.x) Industrial Computer Board

Copyright and Trademarks Notice

Revision History

Revision	Date
V1.0	2020/01

Technical Support

If a problem arises with your product and no solution can be obtained from the user's manual, please contact your place of purchase or local distributor. Alternatively, please visit https://www.msi.com/support/ for further guidance.

Safety Instructions

- Always read the safety instructions carefully.
- Keep this User's Manual for future reference.
- Keep this equipment away from humidity.
- Lay this equipment on a reliable flat surface before setting it up.
- The openings on the enclosure are for air convection hence protects the equipment from overheating. DO NOT COVER THE OPENINGS.
- Make sure the voltage of the power source and adjust properly 110/220V before connecting the equipment to the power inlet.
- Place the power cord such a way that people can not step on it. Do not place anything over the power cord.
- Always Unplug the Power Cord before inserting any add-on card or module.
- All cautions and warnings on the equipment should be noted.
- Never pour any liquid into the opening that could damage or cause electrical shock.
- If any of the following situations arises, get the equipment checked by service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated into the equipment.
  - The equipment has been exposed to moisture.
  - The equipment does not work well or you can not get it work according to User's Manual.
  - The equipment has dropped and damaged.
  - The equipment has obvious sign of breakage.
- DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT UNCONDITIONED, STORAGE TEMPERATURE ABOVE 60°C, IT MAY DAMAGE THE EQUIPMENT.

Chemical Substances Information

In compliance with chemical substances regulations, such as the EU REACH Regulation (Regulation EC No. 1907/2006 of the European Parliament and the Council), MSI provides the information of chemical substances in products at:

https://www.msi.com/html/popup/csr/evmtprtt_pcm.html

Battery Information

European Union:

Batteries, battery packs, and accumulators should not be disposed of as unsorted household waste. Please use the public collection system to return, recycle, or treat them in compliance with the local regulations.

廢電池請回收

Taiwan:

For better environmental protection, waste batteries should be collected separately for recycling or special disposal.

California, USA:

The button cell battery may contain perchlorate material and requires special handling when recycled or disposed of in California.

For further information please visit:

https://www.dtsc.ca.gov/hazardouswaste/perchlorate/

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.

CE Conformity

Hereby, Micro-Star International CO., LTD declares that this device is in compliance with the essential safety requirements and other relevant provisions set out in the European Directive.

FCC-B Radio Frequency Interference Statement

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 the instruction manual, 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 measures listed below:

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

Notice 1

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Notice 2

Shielded interface cables and AC power cord, if any, must be used in order to comply with the emission limits.

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

1) this device may not cause harmful interference, and
2) this device must accept any interference received, including interference that may cause undesired operation.

WEEE Statement

Under the European Union ("EU") Directive on Waste Electrical and Electronic Equipment, Directive 2012/19/EU, products of "electrical and electronic equipment" cannot be discarded as municipal waste anymore and manufacturers of covered electronic equipment will be obligated to take back such products at the end of their useful life.

CONTENTS

1 Overview

Thank you for choosing the MS-98M9, an excellent industrial computer board.

Based on the innovative Intel® Skylake-SP & Cascade Lake-SP Processor, the MS-98M9 is engineered to provide reliable performance for a wide variety of industrial applications.

Specifications

Processor

- 1st / 2nd Gen Intel® Skylake-SP & Cascade Lake-SP Xeon® Processor, Max 205W

PCH

- SKU1: Intel® C622 Express
- SKU2: Intel® C621 Express

Memory

- 6 * 288-pin DDR4 RDIMMs
- DDR4 ECC RDIMMs memory up to 2666MHz
- Max 192GB

Network

- Full SKU
  - LAN1 / LAN2: Intel® I210-AT GbE LAN
  - LAN3 / LAN4: Intel® X557-AT2 10GbE LAN (10GBASE-T transmissions requests thecable grade of Cat 6/Cat 6a or above)
- Basic SKU
  - LAN1 / LAN2: Intel® I210-AT GbE LAN

Storage

- 8 * SATA 6Gb/s ports
  - RAID 0, 1, 5, 10 supported
  - AHCI Mode supported
- 1 * mSATA Slot (Full-size/Half-size, Shared with Mini-PCIe)

Audio

- Realtek® ALC887 High Definition Audio codec (Co-lay ALC888S)

Expansion Slots

- 2 * PCIe x 16 slots
  - PCIE2, PCIE4 (Graphics Card Supported)
- 3 * PCIe x 8 slots
  - PCIE1
  - PCIE3, PCIE5 (Graphics Card Supported)
- 2 * PCIe x 4 slots
  - PCIE6, PCIE7
- 1 * Mini-PCIe Slot (Full-size/Half-size, Shared with mSATA)

Important

- *PCIE1~5 with the latest Intel RSTe it provides a compelling RAID solution for NVMe SSDs via Intel VROC HW key.*

Rear Panel I/O

- 2 * COM ports
- 2 * 10GbE RJ45 ports (Full SKU)
- 2 * GbE RJ45 ports
- 6 * USB 3.2 Gen 1 ports (5V/0.9A)
- 1 * Mouse/Keyboard combo port

Internal I/O

- 1 * System power connector
- 1 * CPU power connector
- 8 * SATA 6Gb/s ports
- 1 * Vertical USB 2.0 port
- 3 * USB 2.0 box headers (6 ports)
- 1 * VROC box header
- 1 * TPM pin header
- 4 * RS232 serial port box headers (COM3~COM6)
- 6 * Serial port power jumpers
- 1 * SMBus box header
- 1 * PMBus box header
- 1 * ME jumper
- 2 * PCIe configure jumper
- 1 * S/PDIF box header
- 1 x 2*6-pin 2.54-pitch Pin-header for Audio (Line-in/Line-Out/Mic-in)
- 1 * Front panel box header
- 1 * Front audio box header
- 1 * CPU fan header
- 6 * System fan headers
- 1 * Chassis intrusion header
- 1 * AT/ATX jumper
- 1 * Clear CMOS jumper
- 1 * LAN LED header
- 2 * GPIO box headers (8 x GPI, 8 x GPO; 5V)

Form Factor

- ATX Size: 305mm (L) x 244mm (W) x 1.6mm (H)

Environment

- Operating Temperature: 0 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 10 ~ 90% RH, non-condensing

Important

- *The product doesn't support ErP standard (S5 Power consumption under 1W).*
- *Please use a power supply which minimum output should be at least 850 W.*

Accessories

- 2 * SATA3.0 cables
- 1 * Dual USB 2.0 cable with bracket
- 1 * Driver & user manual CD
- 1 * I/O shield

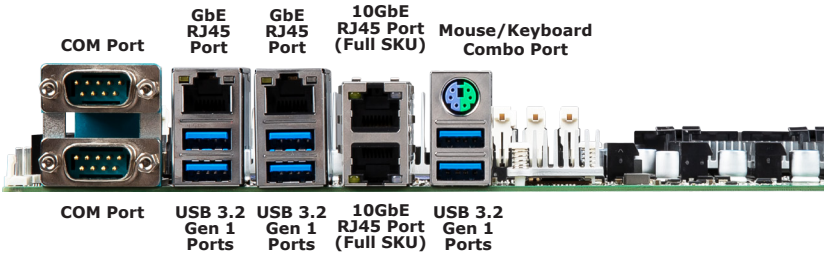
Certification

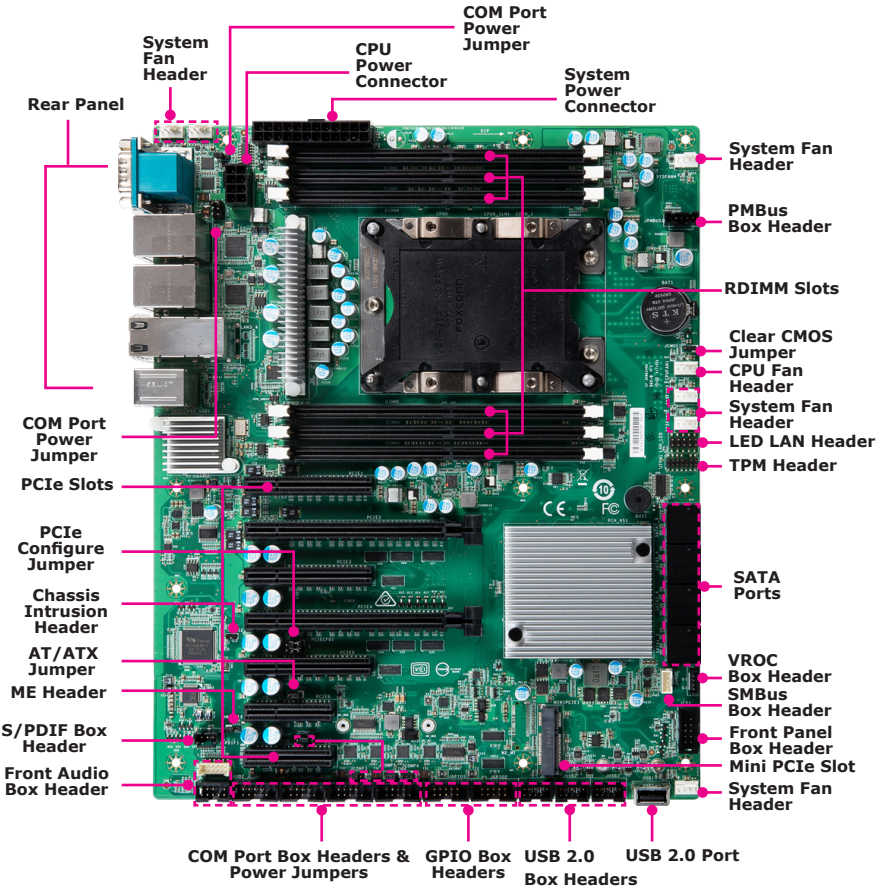
- CE, FCC Class B, BSMI, RCM, VCCI

OS Support

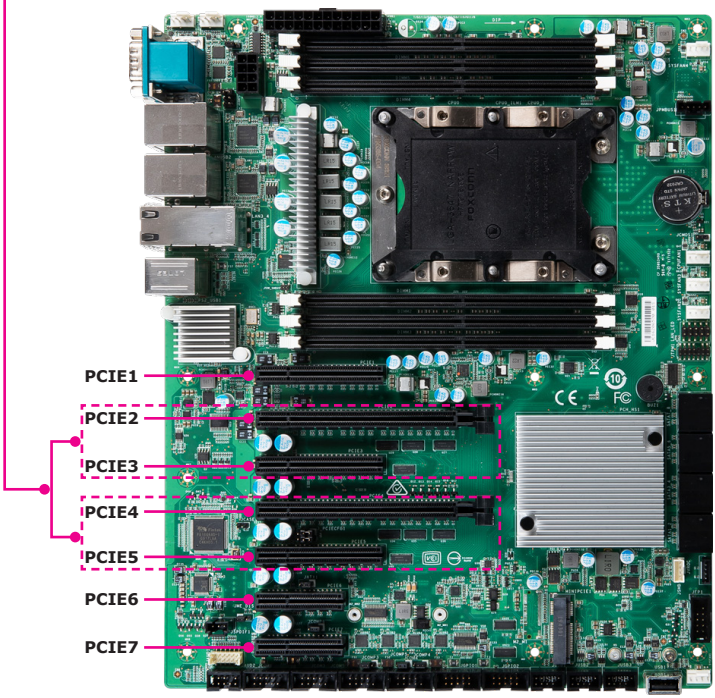
- Skylake-SP
  - Windows Server 2012 R2 (64-bit)
  - Windows Server 2016 (64-bit)
  - Linux Kernel 4.14, Ubuntu 18.04 LTS, Fedora 29
  - Windows 10 IoT Enterprise LTSC/SAC 1809 (64-bit, RS5, Pre-test only)
- Cascade Lake-SP
  - Windows Server 2016 (64-bit)
  - Windows Server 2019 (64-bit)
  - Linux Kernel 4.14, Ubuntu 18.04 LTS, Fedora 29
  - Windows 10 IoT Enterprise LTSC/SAC 1809 (64-bit, RS5, Pre-test only)

Layout


COM Port
GbE RJ45 Port
GbE RJ45 Port
10GbE RJ45 Port (Full SKU)
Mouse/Keyboard Combo Port
COM Port
USB 3.2 Gen 1 Ports
USB 3.2 Gen 1 Ports
10GbE RJ45 Port (Full SKU)
USB 3.2 Gen 1 Ports


COM Port Power Jumper
System Fan Header
CPU Power Connector
System Power Connector
Rear Panel
System Fan Header
PMBus Box Header
RDIMM Slots
Clear CMOS Jumper
CPU Fan Header
System Fan Header
LED LAN Header
TPM Header
COM Port Power Jumper
PCIe Slots
PCIe Configure Jumper
Chassis Intrusion Header
AT/ATX Jumper
ME Header
S/PDIF Box Header
Front Audio Box Header
SATA Ports
VROC Box Header
SMBus Box Header
Front Panel Box Header
Mini PCIe Slot
System Fan Header
COM Port Box Headers & Power Jumpers
GPIO Box Headers
USB 2.0 Box Headers
USB 2.0 Port

2 Slot thickness PCIe Graphics Card Supported	
thickness	Max 40 mm



2 Hardware Setup

This chapter provides you with the information about hardware setup procedures. While doing the installation, be careful in holding the components and follow the installation procedures. For some components, if you install in the wrong orientation, the components will not work properly.
Use a grounded wrist strap before handling computer components. Static electricity may damage the components.

Quick Component Guide

CPU Installation

Use appropriate ground straps, gloves and ESD mats to protect yourself from electrostatic discharge (ESD) while installing the CPU.
Check out Intel's website at **https://www.intel.com/content/www/us/en/support/topics/desktop-server-processor-installation.html** for detailed LGA 3647 CPU installation instructions.

Important

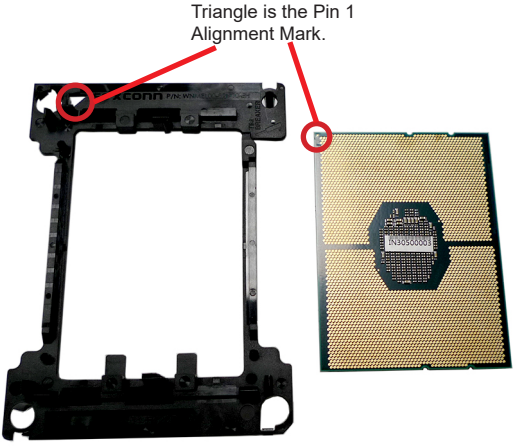
Overheating

Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

Replacing the CPU

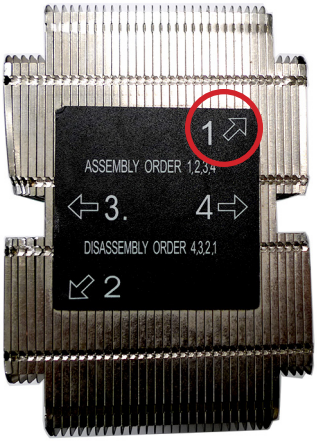
While replacing the CPU, always turn off the power supply or unplug the power supply's power cord from the grounded outlet first to ensure the safety of CPU.

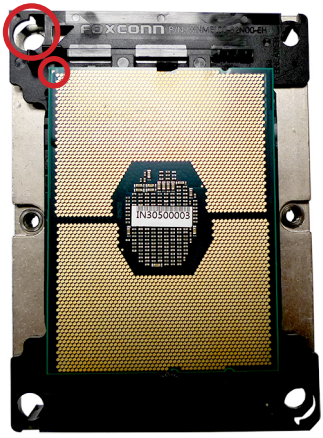
1. Check the CPU and the processor carrier for their Pin 1 Alignment Marks.



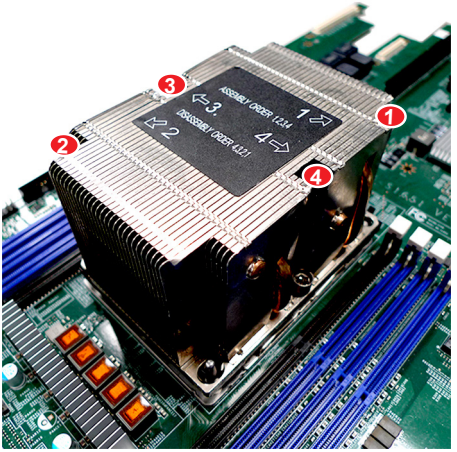
2. Align their Pin 1 Alignment Marks before inserting the CPU into the processor carrier. If installed properly, the CPU will snap into the clips located on the inside ends of the processor carrier.

3. Check the heatsink for #1 clip. Flip the heatsink over and align the CPU's Pin 1 Alignment Mark with the heatsink's #1 clip. Gently engage the CPU and carrier package down. Make sure the attach clips on the carrier grab onto the heatsink and firmly secure the carrier, CPU and heatsink as one Processor Heatsink Module.





4. Place the Processor Heatsink Module on top of the CPU socket with Pin 1 indicators aligned. Finally, secure the Processor Heatsink Module screws in the assigned diagonal sequences.



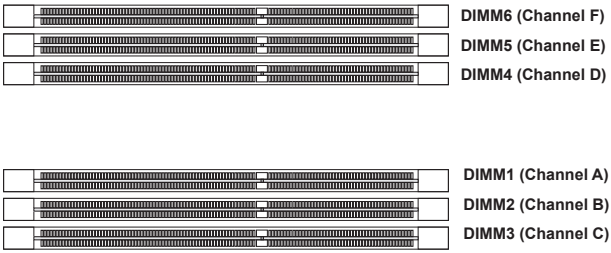
Important

- *Confirm if your CPU cooler is firmly installed before turning on your system.*
- *Do not touch the CPU socket pins to avoid damage.*
- *Whenever CPU is not installed, always protect your CPU socket pins with the plastic cap covered.*
- *Please refer to the documentation in the CPU cooler package for more details about the CPU cooler installation.*
- *Read the CPU status in BIOS.*

Memory

Hexa-Channel Mode

Make sure that you install memory modules of the **same type and density** in different channel DIMM slots.

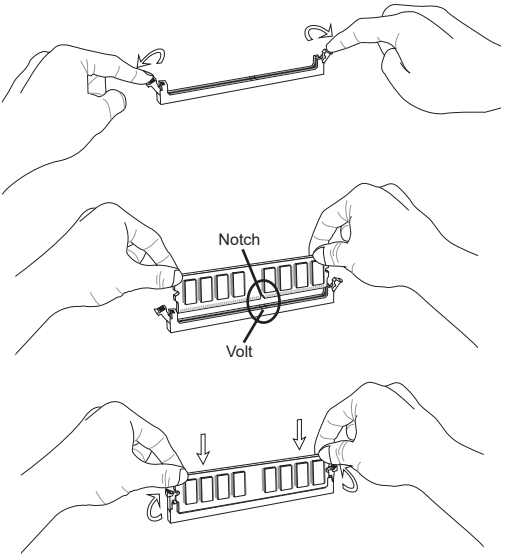


Important

- *Paired memory installation for Max performance.*
- *Populate the same DIMM type in each channel, specifically: 1. Use the same DIMM size; 2. Use the same number of ranks per DIMM.*

Installing Memory Modules

1. The memory module has only one notch on the center and will only fit in the right orientation.
2. Insert the memory module vertically into the DIMM slot. Then push it in until the golden finger on the memory module is deeply inserted in the DIMM slot. The plastic clip at each side of the DIMM slot will automatically close when the memory module is properly seated.
3. Manually check if the memory module has been locked in place by the DIMM slot clips at the sides.



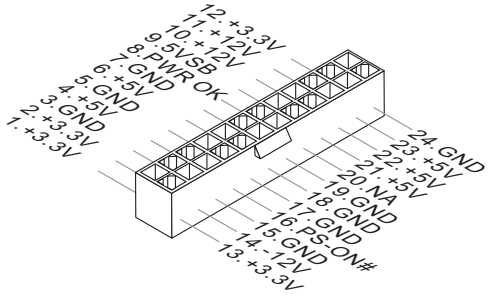
Important

- *You can barely see the golden finger if the memory module is properly inserted in the DIMM slot.*
- *To enable successful system bootup, always insert the memory module into the **DIMM1 first**.*

Power Supply

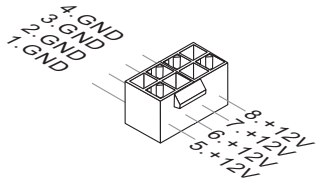
System Power Connector: JPWR1

This connector allows you to connect a power supply. To connect to the power supply, make sure the plug of the power supply is inserted in the proper orientation and the pins are aligned. Then push down the power supply firmly into the connector.



CPU Power Connector: JPWR2

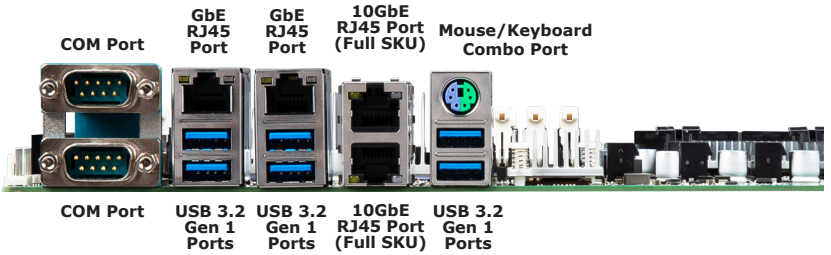
This connector is used to provide power to the CPU.



Important

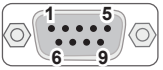
- *Make sure that all power connectors are connected to the power supply to ensure stable operation of the motherboard.*
- *To avoid some issues like system instability, reset and shutdown caused by energy-insufficient power supply, we suggest you should follow Intel Power Supply Design Guide Rev 1.4 list and Intel Document Number 595284 to choose your power supply unit.*

Rear Panel I/O



➤ RS-232/422/485 Serial Port

The serial port is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. It supports barcode scanners, barcode printers, bill printers, credit card machine, etc.



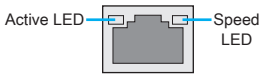
	PIN	SIGNAL	DESCRIPTION
RS232	1	NDCD	Data Carrier Detect
	2	NSIN	Signal In
	3	NSOUT	Signal Out
	4	NDTR	Data Terminal Ready
	5	GND	Signal Ground
	6	NDSR	Data Set Ready
	7	NRTS	Request To Send
	8	NCTS	Clear To Send
	9	0V/5V/12V	Power Pin

	PIN	SIGNAL	DESCRIPTION
RS422	1	422 TXD-	Transmit Data, Negative
	2	422 TXD+	Transmit Data, Positive
	3	422 RXD+	Receive Data, Positive
	4	422 RXD-	Receive Data, Negative
	5	GND	Signal Ground
	6	NC	No Connection
	7	NC	No Connection
	8	NC	No Connection
	9	NC	No Connection

	PIN	SIGNAL	DESCRIPTION
RS485	1	485 TXD-	Transmit Data, Negative
	2	485 TXD+	Transmit Data, Positive
	3	NC	No Connection
	4	NC	No Connection
	5	GND	Signal Ground
	6	NC	No Connection
	7	NC	No Connection
	8	NC	No Connection
	9	NC	No Connection

➤ GbE RJ45 Port

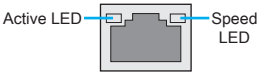
The standard single RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.



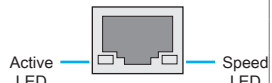
LED	LED Status	Description
Active LED	Off	No link
	Yellow	Linked
	Blinking	Data activity
Speed LED	Off	10 Mbps connection
	Green	100 Mbps connection
	Orange	1 Gbps connection

➤ 10 GbE RJ45 Port

The standard single RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.



LED	LED Status	Description
Active LED	Off	No link
	Yellow	Linked
	Blinking	Data activity
Speed LED	Green	1 Gbps connection
	Orange	10 Gbps connection



LED	LED Status	Description
Active LED	Off	No link
	Yellow	Linked
	Blinking	Data activity
Speed LED	Green	1 Gbps connection
	Orange	10 Gbps connection

➤ USB 3.2 Gen 1 Port

USB 3.2 Gen 1, the SuperSpeed USB 10Gbps, delivers high-speed data transfer for various devices, such as storage devices, hard drives, video cameras, etc.

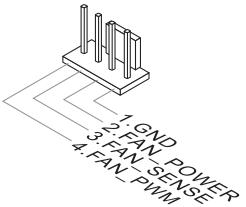
➤ Mouse/Keyboard Combo Port

The standard PS/2® mouse/keyboard DIN connector is for a PS/2® mouse/keyboard.

Connector

CPU/System Fan Header: CPUFAN1, SYSFAN1~6

The fan power connectors support system cooling fan with +12V. When connecting the wire to the connectors, always note that the red wire is the positive and should be connected to the +12V; the black wire is Ground and should be connected to GND. If the motherboard has a System Hardware Monitor chipset onboard, you must use a specially designed fan with speed sensor to take advantage of the CPU fan control.

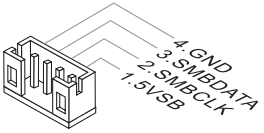


Important

- *Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.*
- *Fan cooler sets with 4-pin PWM FAN available.*

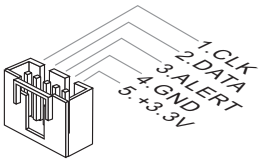
SMBus Box Header: JSMB1

This connector is provided for users to connect System Management Bus (SMBus) interface.



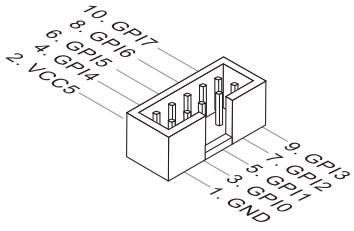
PMBus Box Header: JPMBUS1

The Power System Management Bus connector monitors the power supply, fan, and system temperatures.



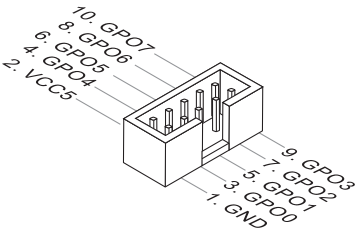
GPI Box Header: JGPIO1

This connector is provided for the General-Purpose Input peripheral module.



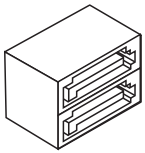
GPO Box Header: JGPIO2

This connector is provided for the General-Purpose Output peripheral module.



Dual Stacked SATA Connector: SATA1_2, SATA3_4, SATA5_6, SATA7_8

This connector is a high-speed Serial ATA interface port. Each connector can connect to two SATA devices.



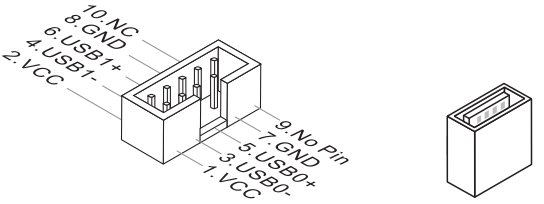
Important

Please do not fold the SATA cable into a 90-degree angle. Otherwise, data loss may occur during transmission.

USB 2.0 Box Header: JUSB1, JUSB2, JUSB3

USB 2.0 Port: USB1

This connector is ideal for connecting USB devices such as keyboard, mouse, or other USB-compatible devices.

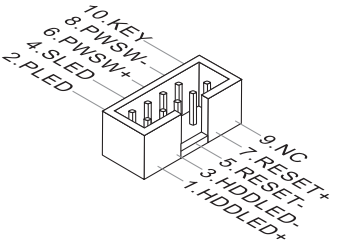


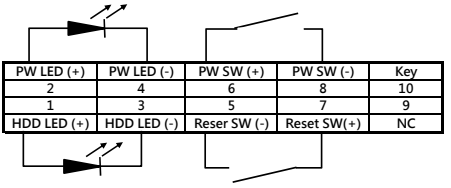
Important

Note that the pins of VCC and GND must be connected correctly to avoid possible damage.

Front Panel Box Header: JFP1

This front panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.



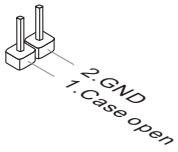


PW LED (+)	PW LED (-)	PW SW (+)	PW SW (-)	Key
2	4	6	8	10
1	3	5	7	9
HDD LED (+)	HDD LED (-)	Reser SW (-)	Reset SW(+)	NC

LED(+)	Voltage(V)	Current(mA)
Power	5	18.51
HDD	5	18.51

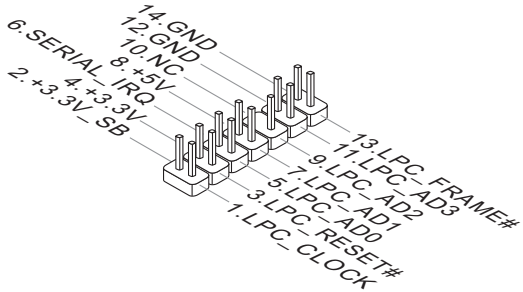
Chassis Intrusion Header: JCASE1

This connector connects to the chassis intrusion switch cable. If the computer case is opened, the chassis intrusion mechanism will be activated. The system will record this intrusion and a warning message will flash on screen. To clear the warning, you must enter the BIOS utility and clear the record.



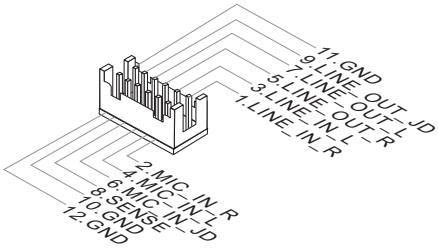
TPM Pin Header: JTPM1

This connector works as LPC debug port and supports TPM modules.



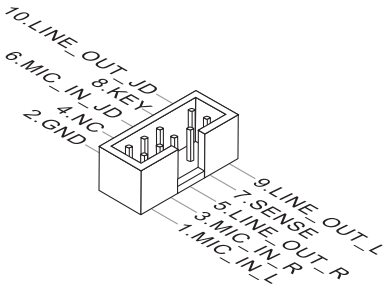
Audio Box Header: JAUD1

This connector allows you to connect the audio cable for Line-in/Line-out/Mic-in jack.



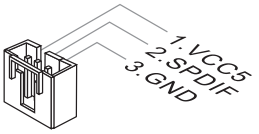
Front Audio Box Header: JAUD2

This connector allows you to connect the front panel audio and is compliant with Intel Front Panel I/O Connectivity Design Guide.



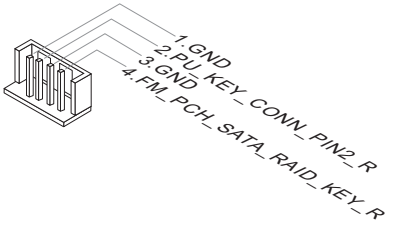
S/PDIF Box Header: JSPDIF1

This pinheader is used to connect S/PDIF (Sony & Philips Digital Interconnect Format) interface for digital audio transmission.



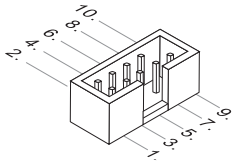
VROC Box Header: JVROC

Intel VROC license key of VMD allows NVMe SSDs to connect via PCIe and directly manage on the CPU for better RAID performance.



RS232 COM Port Box Header: JCOM3, JCOM4, JCOM5, JCOM6

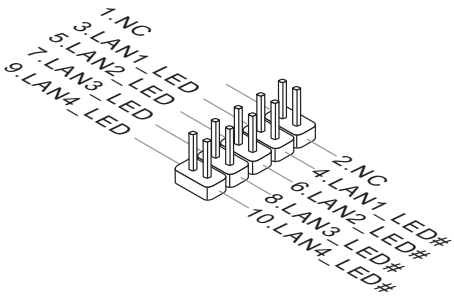
This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach a serial device to it.



PIN	SIGNAL	DESCRIPTION
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	VCC	Voltage selected by COM jumper

LAN LED Header: LAN_LED

This connector is provided for electrical connection to the LAN LEDs.



Jumper

Important

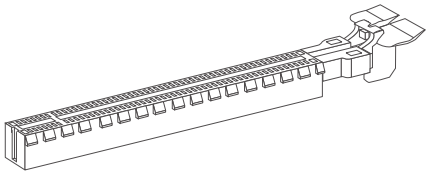
Avoid adjusting jumpers when the system is on; it will damage the motherboard.

Jumper Name	Default Setting	Description	
JCMOS1		1-2: Normal	2-3: Clear CMOS
JATX1		1-2: ATX	2-3: AT
JME_DIS1		1-2: Normal	2-3: ME Disable
JCOMP1		1-2: 5V 3-4: 12V 5-6: RI	
JCOMP2		1-2: 5V	2-3: 12V
JCOMP3 JCOMP4 JCOMP5 JCOMP6		1-2: 5V	2-3: 12V
J_PCIECFG1		1-3: PCIE2 (x 8) PCIE3 (x 8)	2-4: PCIE4 (x 8) PCIE5 (x 8)
		3-5: PCIE2 (x 16) PCIE3 (x 0)	2-4: PCIE4 (x 8) PCIE5 (x 8)
		1-3: PCIE2 (x 8) PCIE3 (x 8)	4-6: PCIE4 (x 16) PCIE5 (x 0)
		3-5: PCIE2 (x 16) PCIE3 (x 0)	4-6: PCIE4 (x 16) PCIE5 (x 0)

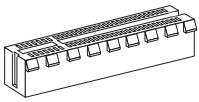
Slot

PCIe (Peripheral Component Interconnect Express) Slot

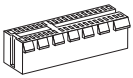
The PCI Express slot supports PCIe interface expansion cards.



PCIe x16 slot



PCIe x8 slot



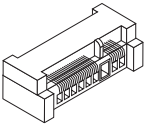
PCIe x4 slot

Important

- *Intel® RST only supports PCIe SSD with UEFI ROM and does not support Legacy ROM.*
- *When adding or removing expansion cards, make sure that you unplug the power supply first. Meanwhile, read the documentation for the expansion card to configure any necessary hardware or software settings for the expansion card, such as jumpers, switches or BIOS configuration.*

Mini-PCIe (Peripheral Component Interconnect Express) Slot

The Mini-PCIe slot is provided for wireless LAN cards, TV tuner cards, Robson NAND Flash cards and other Mini-PCIe cards.



The MINIPCIE1 is also shared to be mSATA slot. The mSATA slot is for mSATA interface solid state drives (SSD).

3 BIOS Setup

This chapter provides information on the BIOS Setup program and allows users to configure the system for optimal use.

Users may need to run the Setup program when:

- An error message appears on the screen at system startup and requests users to run SETUP.
- Users want to change the default settings for customized features.

Important

- *Please note that BIOS update assumes technician-level experience.*
- *As the system BIOS is under continuous update for better system performance, the illustrations in this chapter should be held for reference only.*

Entering Setup

Power on the computer and the system will start POST (Power On Self Test) process. When the message below appears on the screen, press <DEL> or <F2> key to enter Setup.

Press <DEL> or <F2> to enter SETUP

If the message disappears before you respond and you still wish to enter Setup, restart the system by turning it OFF and On or pressing the RESET button. You may also restart the system by simultaneously pressing <Ctrl>, <Alt>, and <Delete> keys.

Important

The items under each BIOS category described in this chapter are under continuous update for better system performance. Therefore, the description may be slightly different from the latest BIOS and should be held for reference only.

Control Keys

← →	Select Screen
↑ ↓	Select Item
Enter	Select
+ -	Change Option
F1	General Help
F7	Previous Values
F9	Optimized Defaults
F10	Save & Reset
Esc	Exit

Getting Help

After entering the Setup menu, the first menu you will see is the Main Menu.

Main Menu

The main menu lists the setup functions you can make changes to. You can use the arrow keys (↑↓) to select the item. The on-line description of the highlighted setup function is displayed at the bottom of the screen.

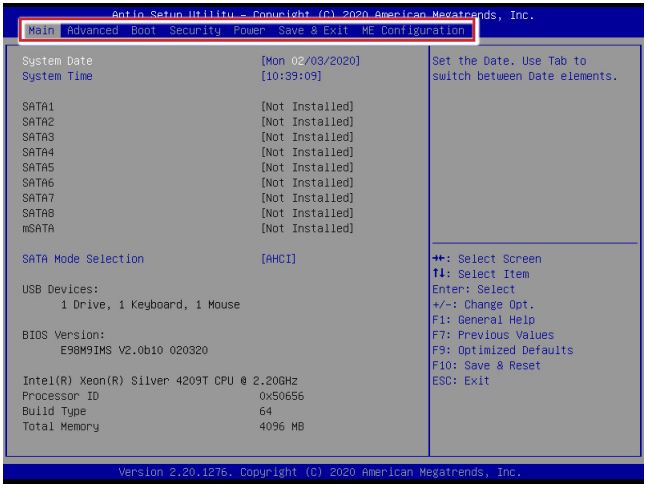
Sub-Menu

If you find a right pointer symbol appears to the left of certain fields that means a sub-menu can be launched from this field. A sub-menu contains additional options for a field parameter. You can use arrow keys (↑↓) to highlight the field and press <Enter> to call up the sub-menu. Then you can use the control keys to enter values and move from field to field within a sub-menu. If you want to return to the main menu, just press the <Esc >.

General Help <F1>

The BIOS setup program provides a General Help screen. You can call up this screen from any menu by simply pressing <F1>. The Help screen lists the appropriate keys to use and the possible selections for the highlighted item. Press <Esc> to exit the Help screen.

The Menu Bar



▸Main

Use this menu for basic system configurations, such as time, date, etc.

▸Advanced

Use this menu to set up the items of special enhanced features.

▸Boot

Use this menu to specify the priority of boot devices.

▸Security

Use this menu to set supervisor and user passwords.

▸Power

Use this menu to specify your settings for power management.

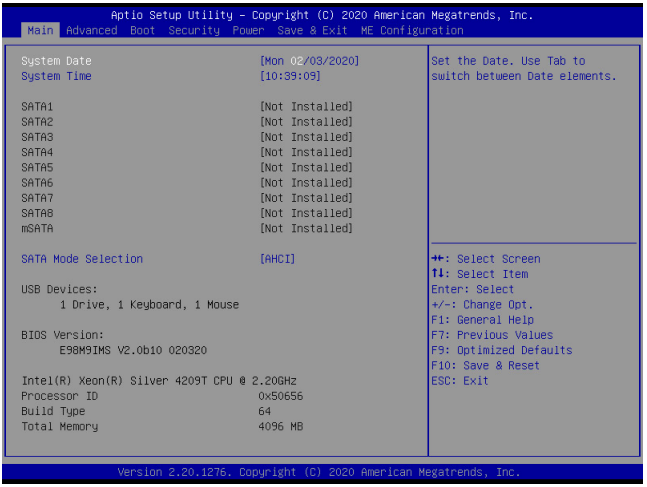
▸Save & Exit

This menu allows you to load the BIOS default values or factory default settings into the BIOS and exit the BIOS setup utility with or without changes.

▸ME Configuration

This menu allows the Server ME configuration setting and information.

Main



▸System Date

This setting allows you to set the system date. The date format is <Day>, <Month> <Date> <Year>.

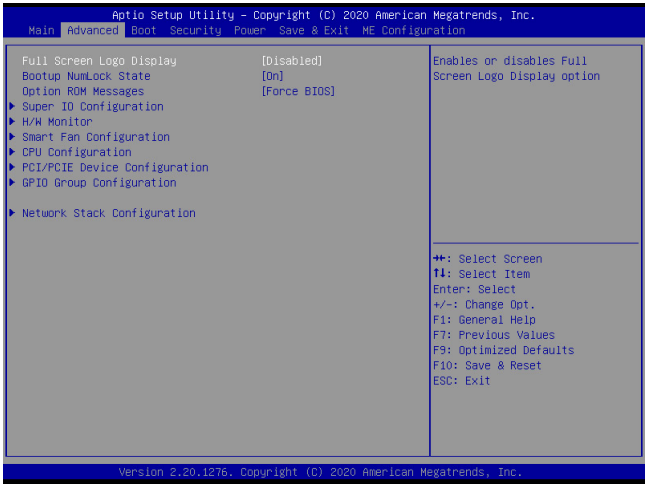
▸System Time

This setting allows you to set the system time. The time format is <Hour> <Minute> <Second>.

▸SATA Mode Selection

This setting specifies the SATA controller mode.

Advanced



▸Full Screen Logo Display

This BIOS feature determines if the BIOS should hide the normal POST messages with the motherboard or system manufacturer's full-screen logo.

When it is enabled, the BIOS will display the full-screen logo during the boot-up sequence, hiding normal POST messages.

When it is disabled, the BIOS will display the normal POST messages, instead of the full-screen logo.

Please note that enabling this BIOS feature often adds 2-3 seconds of delay to the booting sequence. This delay ensures that the logo is displayed for a sufficient amount of time. Therefore, it is recommended that you disable this BIOS feature for a faster boot-up time.

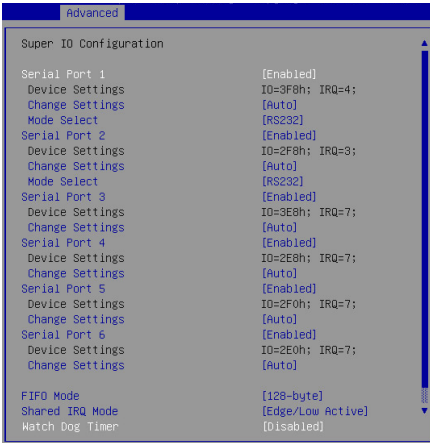
▸Bootup NumLock State

This setting is to set the Num Lock status when the system is powered on. Setting to [On] will turn on the Num Lock key when the system is powered on. Setting to [Off] will allow users to use the arrow keys on the numeric keypad.

▸Option ROM Messages

This item is used to determine the display mode when an optional ROM is initialized during POST. When set to [Force BIOS], the display mode used by AMI BIOS is used. Select [Keep Current] if you want to use the display mode of optional ROM.

▸Super IO Configuration



▸Serial Port 1 ~ Serial Port 6

This setting enables/disables the specified serial port.

▸Change Settings

This setting is used to change the address & IRQ settings of the specified serial port.

▸Mode Select

Select an operation mode for the specified serial port.

▸FIFO Mode

This setting controls the FIFO data transfer mode.

▸Shared IRQ Mode

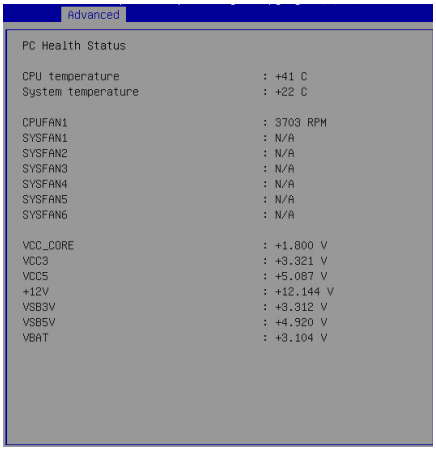
This setting provides the system with the ability to share interrupts among its serial ports.

▸ Watch Dog Timer

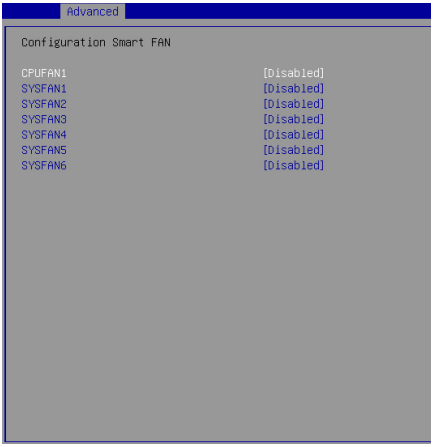
You can enable the system watch-dog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watch dog polls it.

▸H/W Monitor

These items display the current status of all monitored hardware devices/ components such as voltages, temperatures and all fans' speeds.



▸Smart Fan Configuration



▸CPUFAN1, SYSFAN1 ~ SYSFAN6

This setting enables/disables the Smart Fan function. Smart Fan is an excellent feature which will adjust the CPU/system fan speed automatically depending on the current CPU/system temperature, avoiding the overheating to damage your system.

▸CPU Configuration

▸Enable Intel TXT

Intel® Trusted Execution Technology (TXT) is a set of hardware extensions to Intel® processors and chipsets that enhance the digital office platform with security capabilities such as measured launch and protected execution. Intel Trusted Execution Technology provides hardware-based mechanisms that help protect against software-based attacks and protects the confidentiality and integrity of data stored or created on the client PC.

Important

- TXT function is available with graphics card installed on PCIE2~5.

▸VMX

Enable or disable Intel Virtual Machine Extensions (VMX) for IA-32 processors that support Intel® Vanderpool Technology

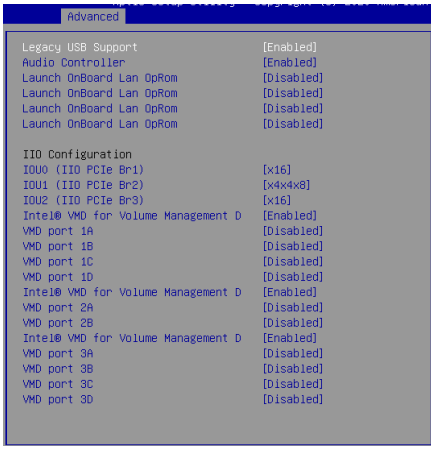
▸Hyper-Threading (ALL)

The processor uses Hyper-Threading technology to increase transaction rates and reduces end-user response times. The technology treats the two cores inside the processor as two logical processors that can execute instructions simultaneously. In this way, the system performance is highly improved. If you disable the function, the processor will use only one core to execute the instructions. Please disable this item if your operating system doesn't support HT Function, or unreliability and instability may occur.

▸Autonomous Core C-State

This setting controls the C-State (CPU Power state). C-State performance indicates the ability to run the processor in lower power states when the PC is idle. This setting enables/disables the C-State Configuration for power saving purposes.

▸PCI/PCIE Device Configuration



▸Legacy USB Support

Set to [Enabled] if you need to use any USB 1.1/2.0 device in the operating system that does not support or have any USB 1.1/2.0 driver installed, such as DOS and SCO Unix.

▸Audio Controller

This setting enables/disables the onboard audio controller.

▸Launch OnBoard LAN OpROM

These settings enable/disable the initialization of the onboard/onchip LAN Boot ROM during bootup. Selecting [Disabled] will speed up the boot process.

▸IOU0 (II0 PCIe Br1)

This item configures the PCIE2 port Bifuraction setting for a PCI-E port specified by the user. The options are x4x4x4x4, x4x4x8, x8x4x4, x8x8, x16, and Auto.

▸IOU1 (II0 PCIe Br2)

This item configures the PCIE1 port Bifuraction setting for a PCI-E port specified by the user. The options are x4x4x4x4 and x4x4x8.

▸IOU2 (II0 PCIe Br3)

This item configures the PCIE4 port Bifuraction setting for a PCI-E port specified by the user. The options are x4x4x4x4, x4x4x8, x8x4x4, x8x8, x16,

and Auto.

▸ **Intel® VMD for Volume Management Device on CPU**

Intel® VMD for Volume Management Device for 1A~1D.

Select Enable to use the Intel Volume Management Device Technology for this stack. The options are Disable and Enable.

*If the item above is set to Enable, the following items will become available for configuration:

CPU PCIE2 PCI-E 3.0 X16 VMD (Available when the device is detected by the system).

Select Enable to use the Intel Volume Management Device Technology for PCIe root ports 1A~1D. The options are Disable and Enable.

Intel® VMD for Volume Management Device for 2A~2B

Select Enable to use the Intel Volume Management Device Technology for this stack. The options are Disable and Enable.

*If the item above is set to Enable, the following items will become available for configuration:

CPU PCIE1 PCI-E 3.0 X8 VMD (Available when the device is detected by the system)

Select Enable to use the Intel Volume Management Device Technology for PCIe root ports 2A&2B. The options are Disable and Enable.

Intel® VMD for Volume Management Device for 3A~3D

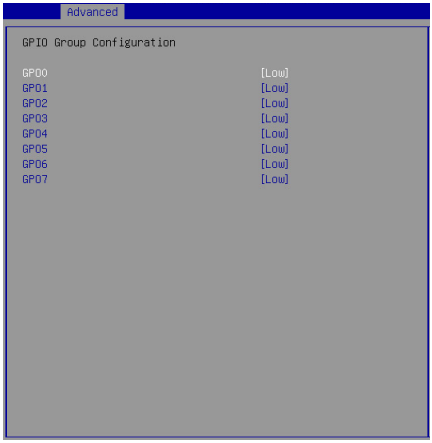
Select Enable to use the Intel Volume Management Device Technology for this stack. The options are Disable and Enable.

*If the item above is set to Enable, the following items will become available for configuration:

CPU PCIE4 PCI-E 3.0 X16 VMD (Available when the device is detected by the system)

Select Enable to use the Intel Volume Management Device Technology for PCIe root ports 3A~3D. The options are Disable and Enable.

▸GPIO Group Configuration

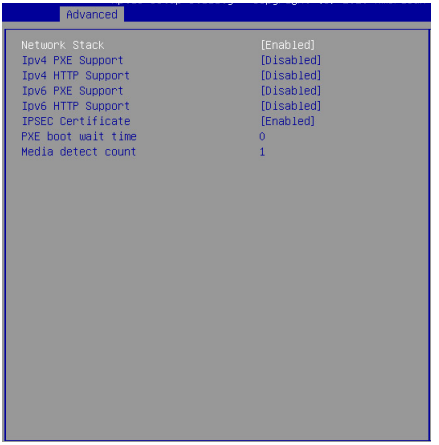


▸GPO0 ~ GPO7

These settings control the operation mode of the specified GPIO.

▸Network Stack Configuration

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS.



▸Network Stack

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS.

▸Ipv4 PXE Support

Select Enabled to enable IPv4 PXE boot support. The options are Disabled and Enabled.

▸Ipv4 HTTP Support

Select Enabled to enable IPv4 HTTP boot support. The options are Disabled and Enabled.

▸Ipv6 PXE Support

Select Enabled to enable IPv6 PXE boot support. The options are Disabled and Enabled.

▸Ipv6 HTTP Support

Select Enabled to enable IPv6 HTTP boot support. The options are Disabled and Enabled.

▸IPSEC Certificate

Select Enabled to enable IPSEC Certificate support. The options are Enable and Disable.

▸PXE boot wait time

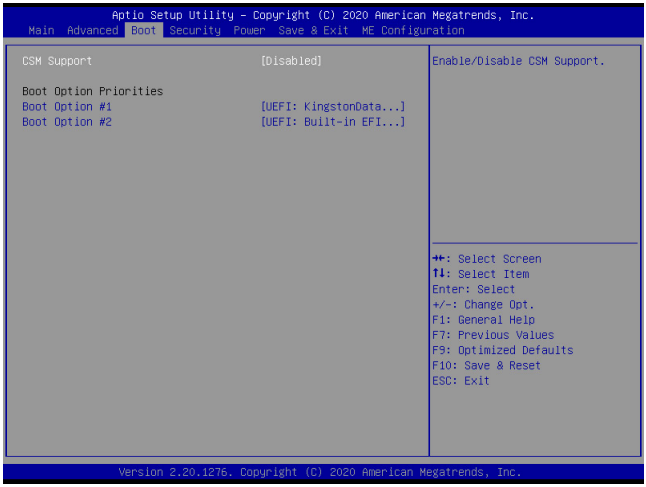
Use this option to specify the wait time to press the ESC key to abort the PXE boot. Press “+” or “-” on your keyboard to change the value. The default setting is 0.

▸Media detect count

Use this option to specify the number of times media will be checked. Press

"+" or "-" on your keyboard to change the value. The default setting is 1.

Boot



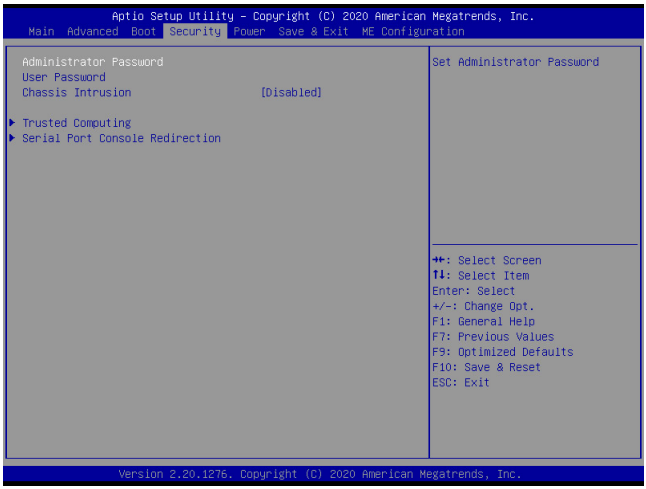
▸CSM Support

This setting enables/disables the support for Compatibility Support Module, a part of the Intel Platform Innovation Framework for EFI providing the capability to support legacy BIOS interfaces.

▸Boot Option Priorities

This setting allows users to set the sequence of boot devices where BIOS attempts to load the disk operating system.

Security



▸Administrator Password

Administrator Password controls access to the BIOS Setup utility.

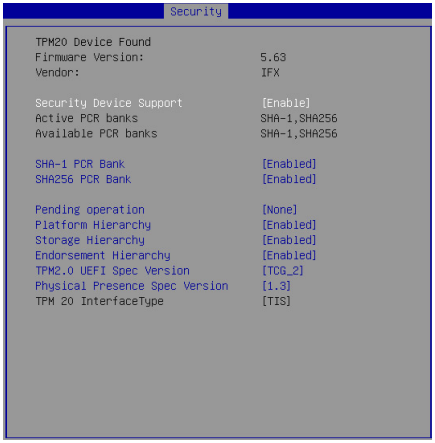
▸User Password

User Password controls access to the system at boot and to the BIOS Setup utility.

▸Chassis Intrusion

The field enables or disables the feature of recording the chassis intrusion status and issuing a warning message if the chassis is once opened.

▸Trusted Computing



▸Security Device Support

This setting enables/disables BIOS support for security device. When set to [Disable], the OS will not show security device. TCG EFI protocol and INT1A interface will not be available.

▸SHA-1 PCR Bank, SHA256 PCR Bank

These settings enable/disable the SHA-1 PCR Bank and SHA256 PCR Bank.

▸Pending Operation

When ***Security Device Support*** is set to [Enable], ***Pending Operation*** will appear. Set this item to [TPM Clear] to clear all data secured by TPM or [None] to discard the selection. It is advised that users should routinely back up their TPM secured data.

▸Platform Hierarchy, Storage Hierarchy, Endorsement Hierarchy

These settings enable/disable the Platform Hierarchy, Storage Hierarchy and Endorsement Hierarchy.

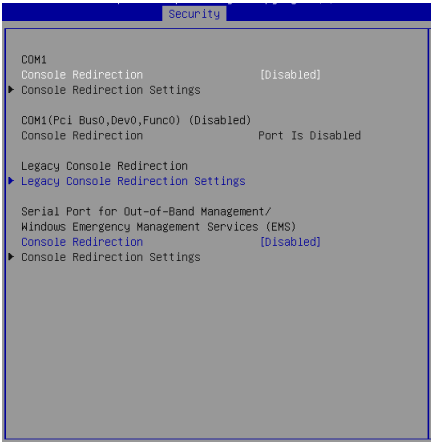
▸TPM2.0 UEFI Spec Version, Physical Presence Spec Version

This settings show the TPM2.0 UEFI Spec Version and Physical Presence Spec Version.

▸TPM2.0 Interface Type

This setting shows the TPM2.0 Interface Type.

▸Serial Port Console Redirection



COM1

▸Console Redirection

Console Redirection operates in host systems that do not have a monitor and keyboard attached. This setting enables/disables the operation of console redirection. When set to [Enabled], BIOS redirects and sends all contents that should be displayed on the screen to the serial COM port for display on the terminal screen. Besides, all data received from the serial port is interpreted as keystrokes from a local keyboard.

▸Console Redirection Settings

▸**Terminal Type**

To operate the system's console redirection, you need a terminal supporting ANSI terminal protocol and a RS-232 null modem cable connected between the host system and terminal(s). This setting specifies the type of terminal device for console redirection.

▸ **Bits per second, Data Bits, Parity, Stop Bits**

This setting specifies the transfer rate (bits per second, data bits, parity, stop bits) of Console Redirection.

▸**Flow Control**

Flow control is the process of managing the rate of data transmission between two nodes. It's the process of adjusting the flow of data from one device to another to ensure that the receiving device can handle all of the incoming data. This is particularly important where the sending device is capable of sending data much faster than the receiving device can receive it.

▸**VT-UTF8 Combo Key Support**

This setting enables/disables the VT-UTF8 combination key support for ANSI/VT100 terminals.

▸**Recorder Mode, Resolution 100x31**

These settings enable/disable the recorder mode and the resolution 100x31.

▸**Putty Keypad**

PuTTY is a terminal emulator for Windows. This setting controls the numeric keypad for use in PuTTY.

Legacy Console Redirection

▸**Legacy Console Redirection Settings**

▸**Redirection COM Port**

This setting specifies the COM port for redirection.

▸**Resolution**

This setting specifies the redirection resolution of legacy OS.

▸**Redirect After POST**

This setting determines whether or not to keep terminals' console redirection running after the POST has booted.

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

▸**Console Redirection**

Console Redirection operates in host systems that do not have a monitor and keyboard attached. This setting enables/disables the operation of console redirection. When set to [Enabled], BIOS redirects and sends all contents that should be displayed on the screen to the serial COM port for display on the terminal screen. Besides, all data received from the serial port is interpreted as keystrokes from a local keyboard.

▸**Console Redirection Settings**

▸**Out-of-Band Mgmt Port**

This setting specifies the Out-of-Band Management Port.

▸**Terminal Type**

To operate the system's console redirection, you need a terminal supporting ANSI terminal protocol and a RS-232 null modem cable connected between the host system and terminal(s). This setting specifies the type of terminal device for console redirection.

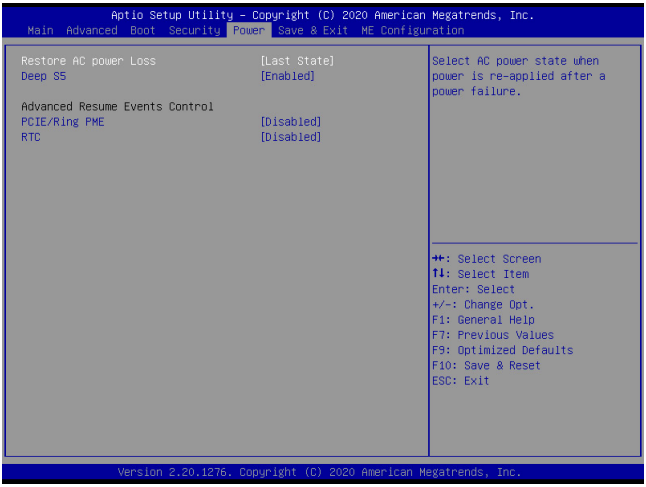
▸ **Bits per second, Data Bits, Parity, Stop Bits**

This setting specifies the transfer rate (bits per second, data bits, parity, stop bits) of Console Redirection.

▸**Flow Control**

Flow control is the process of managing the rate of data transmission between two nodes. It's the process of adjusting the flow of data from one device to another to ensure that the receiving device can handle all of the incoming data. This is particularly important where the sending device is capable of sending data much faster than the receiving device can receive it.

Power



▸Restore AC Power Loss

This setting specifies whether your system will reboot after a power failure or interrupt occurs. Available settings are:

[Power Off]	Leaves the computer in the power off state.
[Power On]	Leaves the computer in the power on state.
[Last State]	Restores the system to the previous status before power failure or interrupt occurred.

▸Deep S5

The setting enables/disables the Deep S5 power saving mode. S5 is almost the same as G3 Mechanical Off, except that the PSU still supplies power, at a minimum, to the power button to allow return to S0. A full reboot is required. No previous content is retained. Other components may remain powered so the computer can “wake” on input from the keyboard, clock, modem, LAN, or USB device.

**** Advanced Resume Events Control ****

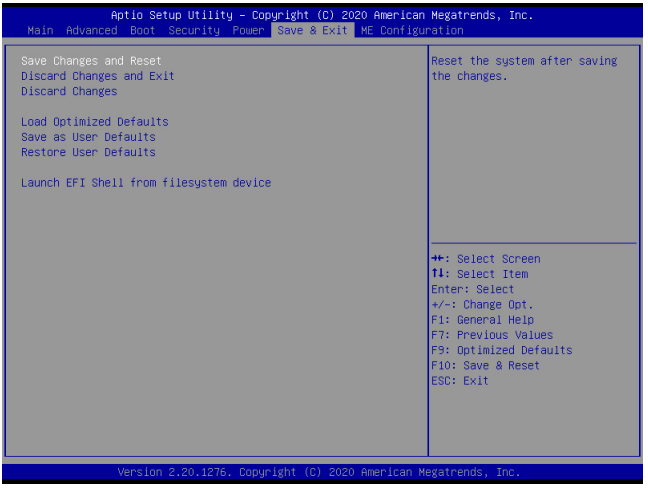
▸PCIE/Ring PME

This field specifies whether the system will be awakened from power saving modes when activity or input signal of onboard PCIE/Ring PME is detected.

▸RTC

When [Enabled], your can set the date and time at which the RTC (real-time clock) alarm awakens the system from suspend mode.

Save & Exit



▸Save Changes and Reset

Save changes to CMOS and reset the system.

▸Discard Changes and Exit

Abandon all changes and exit the Setup Utility.

▸Discard Changes

Abandon all changes.

▸Load Optimized Defaults

Use this menu to load the default values set by the motherboard manufacturer specifically for optimal performance of the motherboard.

▸Save as User Defaults

Save changes as the user's default profile.

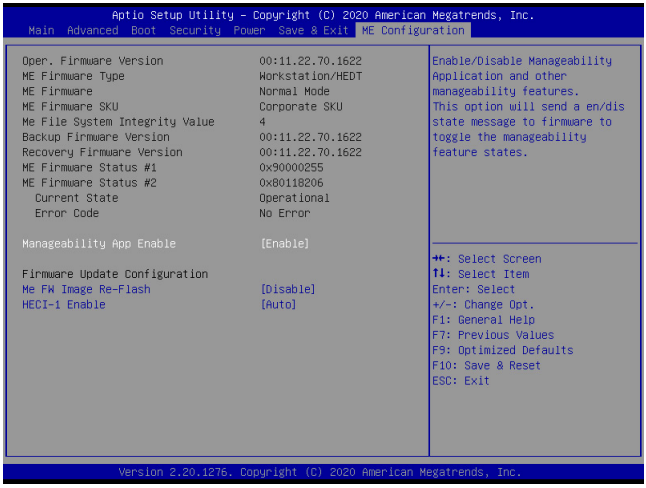
▸Restore User Defaults

Restore the user's default profile.

▸Launch EFI Shell from filesystem device

This setting helps to launch the EFI Shell application from one of the available file system devices.

ME Configuration



▸**Manageability App Enable**

This setting enables/disables the Manageability App.

▸**Firmware Update Configuration**

This setting configures the firmware update.

▸**ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

▸**MECI-1 Enable**

This setting Auto/Enable MECI-1.

This setting is use for flash F32M.NSH when ME is locked, the following steps as below.

1. Set “HECI-1 enable” to “Enable” under BIOS.
2. Set ME Jumper to “ME disable”.
3. Execute F32M.NSH to flash BIOS.
4. Set “HECI-1 enable” to “Auto” under BIOS.
5. Done the Flash F32M.NSH When ME is locked.

Appendix
GPIO WDT Programming

This appendix provides WDT (Watch Dog Timer) and GPIO (General Purpose Input/Output) programming guide.

Abstract

In this document, code examples based on C programming language provided for customer interest. **Inportb**, **Outportb**, **Inportl** and **Outportl** are basic functions used for access IO ports and defined as following.

Inportb: Read a single 8-bit I/O port.
Outportb: Write a single byte to an 8-bit port.
Inportl: Reads a single 32-bit I/O port.
Outportl: Write a single long to a 32-bit port.

General Purposed IO

1. General Purposed IO – GPIO/DIO

The GPIO port configuration addresses are listed in the following table:

Name	IO Port	IO address	Name	IO Port	IO address
N_GPI0	0x12	Bit 0	**N_GPO0**	0x21	Bit 0
N_GPI1	0x12	Bit 1	**N_GPO1**	0x21	Bit 1
N_GPI2	0x12	Bit 2	**N_GPO2**	0x21	Bit 2
N_GPI3	0x42	Bit 3	**N_GPO3**	0x21	Bit 3
N_GPI4	0x12	Bit 4	**N_GPO4**	0x21	Bit 4
N_GPI5	0x12	Bit 5	**N_GPO5**	0x21	Bit 5
N_GPI6	0x12	Bit 6	**N_GPO6**	0x21	Bit 6
N_GPI7	0x12	Bit 7	**N_GPO7**	0x21	Bit 7

Note: GPIO should be accessed through controller device **0x9C** on SMBus. The associated access method in examples (**SMBus_ReadByte**, **SMBus_WriteByte**) are provided in part 3.

1.1 Set output value of GPO

1. Read the value from GPO port.
2. Set the value of GPO address.
3. Write the value back to GPO port.

Example: Set **N_GPO0** output "high"

```
val =SMBus_ReadByte (0x9C, 0x21);  // Read value from N_GPO0 port through SMBus.
val = val | (1<<0);                // Set N_GPO0address (bit 0) to 1 (output "high").
SMBus_WriteByte (0x9C, 0x21, val); // Write back to N_GPO0 port through SMBus.
```

Example: Set **N_GPO1** output "low"

```
val = SMBus_ReadByte (0x9C, 0x21); // Read value from N_GPO1 port through SMBus..
val = val & (~(1<<1));             // Set N_GPO1 address (bit 1) to 0 (output "low").
SMBus_WriteByte (0x9C, 0x21, val); // Write back to N_GPO1 port through SMBus.
```

1.2 Read input value from GPI:

1. Read the value from GPI port.
2. Get the value of GPI address.

Example: Get **N_GPI2** input value.

```
val = SMBus_ReadByte (0x9C, 0x12); // Read value from N_GPI2 port through SMBus.
val = val & (1<<2);                // Read N_GPI2 address (bit 2).
```

```
if (val)    printf ("Input of  N_GPI2  is High");
else        printf ("Input of  N_GPI2  is Low");
```

Example: Get **N_GPI3** input value.

```
val = SMBus_ReadByte (0x9C, 0x42);  // Read value from N_GPI3 port through SMBus.
val = val & (1<<3);                 // Read N_GPI3 address (bit 3).
if (val)    printf ("Input of  N_GPI3  is High");
else        printf ("Input of  N_GPI3  is Low");
```

Watchdog Timer

2. Watchdog Timer – WDT

The base address (WDT_BASE) of WDT configuration registers is 0xA10.

2.1 Set WDT Time Unit

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x08;                       // minute mode. val = val & 0xF7 if second mode
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting
```

2.2 Set WDT Time

```
Outportb (WDT_BASE + 0x06, Time);       // Write WDT time, value 1 to 255.
```

2.3 Enable WDT

```
val = Inportb (WDT_BASE + 0x0A);        // Read current WDT_PME setting
val = val | 0x01;                       // Enable WDT OUT: WDOUT_EN (bit 0) set to 1.
Outportb (WDT_BASE + 0x0A, val);        // Write back WDT setting.
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x20;                       // Enable WDT by set WD_EN (bit 5) to 1.
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting.
```

2.4 Disable WDT

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val & 0xDF;                       // Disable WDT by set WD_EN (bit 5) to 0.
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting.
```

2.5 Check WDT Reset Flag

If the system has been reset by WDT function, this flag will set to 1.

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting.
val = val & 0x40;                       // Check WDTMOUT_STS (bit 6).
if (val)    printf ("timeout event occurred");
else        printf ("timeout event not occurred");
```

2.6 Clear WDT Reset Flag

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x40;                       // Set 1 to WDTMOUT_STS (bit 6);
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting
```

SMBus Access

3. SMBus Access

The base address of SMBus must know before access. The relevant bus and device information are as following.

```
#define IO_SC                0xCF8
#define IO_DA                0xCFC
#define PCIBASEADDRESS       0x80000000
#define PCI_BUS_NUM          0
#define PCI_DEV_NUM          31
#define PCI_FUN_NUM          4
```

3.1 Get SMBus Base Address

```
int SMBUS_BASE;
int DATA_ADDR = PCIBASEADDRESS + (PCI_BUS_NUM<<16) +
                                 (PCI_DEV_NUM<<11) +
                                 (PCI_FUN_NUM<<8);
Outportl (DATA_ADDR + 0x20, IO_SC);
SMBUS_BASE = Inportl (IO_DA) & 0xfffffff0;
```

3.2 SMBus_ReadByte (char DEVID, char offset)

Read the value of OFFSET from SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);
Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID + 1); //out Base + 04, (DEVID + 1)
Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET);   //out Base + 03, OFFSET
Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48);     //out Base + 02, 48H
mdelay (20);                                     //delay 20ms to let data ready
while ((Inportl (SMBUS_BASE) & 0x01) != 0);      //wait SMBus ready
SMB_DATA = Inportb (LOWORD (SMBUS_BASE) + 0x05); //input Base + 05
```

3.3 SMBus_WriteByte (char DEVID, char offset, char DATA)

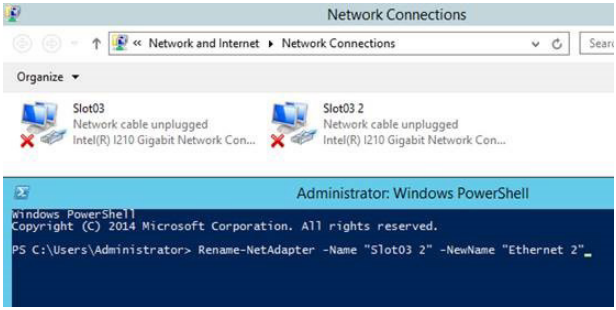
Write DATA to OFFSET on SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);
Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID);    //out Base + 04, (DEVID)
Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET);   //out Base + 03, OFFSET
Outportb (LOWORD (SMBUS_BASE) + 0x05, DATA);     //out Base + 05, DATA
Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48);     //out Base + 02, 48H
mdelay (20);                                     //wait 20ms
```

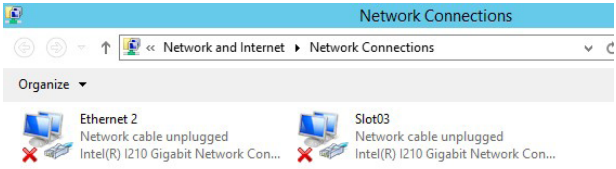
Appendix
How to rename the network adapter

This appendix show you how to rename the network adapter.

Step1. Rename a network adapter, Run the below script in PowerShell.



Step2. Rename-NetAdapter -Name “Slot03 2” –NetName “Ethernet 2”.



Step3. Press F5 in Network Connections.