

Z8NH-D12 Series

Z8NH-D12

Z8PH-D12/IFB



Motherboard

E5040

First Edition V1
September 2009

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Contents

- Notices..... vii
- Safety information viii
- About this guide ix
- Typography x
- Z8NH-D12 Series specifications summary..... xi
- Chapter 1: Product introduction**
 - 1.1 Welcome!** 1-3
 - 1.2 Package contents**..... 1-3
 - 1.3 Serial number label** 1-4
 - 1.4 Special features**..... 1-4
 - 1.4.1 Product highlights 1-4
 - 1.4.2 Innovative ASUS features 1-6
- Chapter 2: Hardware information**
 - 2.1 Before you proceed** 2-3
 - 2.2 Motherboard overview** 2-5
 - 2.2.1 Placement direction 2-5
 - 2.2.2 Screw holes 2-5
 - 2.2.4 Motherboard layouts 2-6
 - 2.2.5 Layout contents..... 2-8
 - 2.3 Central Processing Unit (CPU)** 2-10
 - 2.3.1 Installing the CPU 2-10
 - 2.3.2 Installing the CPU heatsink and fan 2-13
 - 2.4 System memory** 2-15
 - 2.4.1 Overview 2-15
 - 2.4.2 Memory Configurations 2-16
 - 2.4.3 Installing a DIMM 2-17
 - 2.4.4 Removing a DIMM 2-17
 - 2.5 Expansion slots**..... 2-18
 - 2.5.1 Installing an expansion card 2-18
 - 2.5.2 Configuring an expansion card 2-18
 - 2.5.3 Interrupt assignments 2-19
 - 2.5.4 PCI Express x16 slot (x16 link) 2-20
 - 2.5.5 Installing ASMB4 management board..... 2-20

Contents

| | | |
|-----------------------------------|--|-------------|
| 2.6 | Jumpers | 2-21 |
| 2.7 | Connectors | 2-25 |
| 2.7.1 | Rear panel connectors | 2-25 |
| 2.7.2 | Internal connectors | 2-26 |
| Chapter 3: Powering up | | |
| 3.1 | Starting up for the first time | 3-3 |
| 3.2 | Powering off the computer | 3-4 |
| 3.2.1 | Using the OS shut down function | 3-4 |
| 3.2.2 | Using the dual function power switch | 3-4 |
| Chapter 4: BIOS setup | | |
| 4.1 | Managing and updating your BIOS | 4-3 |
| 4.1.1 | AFUDOS utility | 4-3 |
| 4.1.2 | ASUS CrashFree BIOS 3 utility | 4-6 |
| 4.2 | BIOS setup program | 4-7 |
| 4.2.1 | BIOS menu screen | 4-8 |
| 4.2.2 | Menu bar | 4-8 |
| 4.2.3 | Navigation keys | 4-8 |
| 4.2.4 | Menu items | 4-9 |
| 4.2.5 | Sub-menu items | 4-9 |
| 4.2.6 | Configuration fields | 4-9 |
| 4.2.7 | Pop-up window | 4-9 |
| 4.2.8 | Scroll bar | 4-9 |
| 4.2.9 | General help | 4-9 |
| 4.3 | Main menu | 4-10 |
| 4.3.1 | System Time [xx:xx:xx] | 4-10 |
| 4.3.2 | System Date [Day xx/xx/xxxx] | 4-10 |
| 4.3.3 | SATA1—4 | 4-10 |
| 4.3.4 | IDE Configuration | 4-12 |
| 4.3.5 | AHCI Configuration | 4-13 |
| 4.3.6 | System Information | 4-14 |
| 4.4 | Advanced menu | 4-16 |
| 4.4.1 | CPU Configuration | 4-16 |
| 4.4.2 | Chipset Configuration | 4-20 |

Contents

| | | |
|------------|-----------------------------------|-------------|
| 4.4.3 | Legacy Device Configuration | 4-24 |
| 4.4.4 | USB Configuration | 4-25 |
| 4.4.5 | PCI/PnP | 4-26 |
| 4.4.6 | Power On Configuration..... | 4-27 |
| 4.4.7 | Event Log Configuration | 4-28 |
| 4.4.8 | Hardware Monitor | 4-28 |
| 4.4.9 | PCI Express Configuration..... | 4-29 |
| 4.4.10 | ACPI Configuration | 4-30 |
| 4.5 | Server menu | 4-32 |
| 4.5.1 | Remote Access Configuration..... | 4-32 |
| 4.6 | Boot menu | 4-34 |
| 4.6.1 | Boot Device Priority | 4-34 |
| 4.6.2 | Boot Settings Configuration | 4-35 |
| 4.6.3 | Security | 4-36 |
| 4.7 | Exit menu | 4-38 |
| | Exit and Save Changes | 4-38 |
| | Exit and Discard Changes..... | 4-38 |
| | Discard Changes..... | 4-38 |
| | Load Setup Defaults | 4-38 |

Chapter 5: RAID configuration

| | | |
|------------|--|------------|
| 5.1 | Setting up RAID..... | 5-3 |
| 5.1.1 | RAID definitions | 5-3 |
| 5.1.2 | Installing hard disk drives..... | 5-4 |
| 5.1.3 | Setting the RAID item in BIOS | 5-4 |
| 5.1.4 | RAID configuration utilities | 5-4 |
| 5.2 | LSI Software RAID Configuration Utility | 5-5 |
| 5.2.1 | Creating a RAID set | 5-6 |
| 5.2.2 | Adding or viewing a RAID configuration | 5-12 |
| 5.2.3 | Initializing the virtual drives | 5-13 |
| 5.2.4 | Rebuilding failed drives..... | 5-17 |
| 5.2.5 | Checking the drives for data consistency | 5-19 |
| 5.2.6 | Deleting a RAID configuration..... | 5-22 |
| 5.2.7 | Selecting the boot drive from a RAID set..... | 5-23 |
| 5.2.8 | Enabling WriteCache | 5-24 |

Contents

| | | |
|------------|---|-------------|
| 5.3 | Intel® Matrix Storage Manager Option ROM Utility | 5-25 |
| 5.3.1 | Creating a RAID set | 5-26 |
| 5.3.2 | Creating a Recovery set | 5-27 |
| 5.3.3 | Deleting a RAID set | 5-29 |
| 5.3.4 | Resetting disks to Non-RAID | 5-30 |
| 5.3.5 | Recovery Volume Options | 5-31 |
| 5.3.6 | Exiting the Intel® Matrix Storage Manager | 5-32 |
| 5.3.7 | Rebuilding the RAID | 5-32 |
| 5.3.8 | Setting the Boot array in the BIOS Setup Utility..... | 5-34 |

Chapter 6: Driver installation

| | | |
|------------|---|-------------|
| 6.1 | RAID driver installation | 6-3 |
| 6.1.1 | Creating a RAID driver disk | 6-3 |
| 6.1.2 | Windows® OS..... | 6-6 |
| 6.1.3 | Red Hat® Enterprise Linux OS | 6-9 |
| 6.1.4 | SUSE Linux Enterprise Server OS | 6-17 |
| 6.2 | Intel chipset device software installation | 6-19 |
| 6.3 | LAN driver installation..... | 6-23 |
| 6.4 | Display driver installation | 6-27 |
| 6.5 | Mellanox ConnectX DDR PCI Gen2 Channel Adapter driver installation | 6-30 |
| 6.5.1 | Windows operating system | 6-30 |
| 6.5.2 | Red Hat® Enterprise Linux OS | 6-34 |
| 6.6 | Management applications and utilities installation | 6-37 |
| 6.6.1 | Running the support DVD | 6-37 |
| 6.6.2 | Drivers menu..... | 6-37 |
| 6.6.3 | Utilities menu | 6-38 |
| 6.6.4 | Make disk menu..... | 6-38 |
| 6.6.5 | Contact information..... | 6-38 |

Reference information

| | | |
|------------|--|------------|
| A.1 | Z8NH-D12 block diagram..... | A-3 |
| A.2 | Z8PH-D12/IFB block diagram..... | A-4 |

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, and
- 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.

Canadian Department of Communications Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

This class B digital apparatus complies with Canadian ICES-003.

REACH

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

Safety information

Electrical safety

- To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before relocating the system.
- When adding or removing 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.
- Before connecting or removing signal cables from the motherboard, ensure that all power cables are unplugged.
- Seek professional assistance before using an adapter or extension cord. These devices could interrupt the grounding circuit.
- Make sure that your power supply is set to the correct voltage in your area. If you are not sure about the voltage of the electrical outlet you are using, contact your local power company.
- If the power supply is broken, do not try to fix it by yourself. Contact a qualified service technician or your retailer.

Operation safety

- Before installing the motherboard and adding devices on it, carefully read all the manuals that came with the package.
- Before using the product, make sure all cables are correctly connected and the power cables are not damaged. If you detect any damage, contact your dealer immediately.
- To avoid short circuits, keep paper clips, screws, and staples away from connectors, slots, sockets and circuitry.
- Avoid dust, humidity, and temperature extremes. Do not place the product in any area where it may become wet.
- Place the product on a stable surface.
- If you encounter technical problems with the product, contact a qualified service technician or your retailer.



This symbol of the crossed out wheeled bin indicates that the product (electrical, electronic equipment, and mercury-containing button cell battery) should not be placed in municipal waste. Check local regulations for disposal of electronic products.

About this guide

This user guide contains the information you need when installing and configuring the motherboard.

How this guide is organized

This user guide contains the following parts:

- **Chapter 1: Product introduction**
This chapter describes the features of the motherboard and the new technologies it supports.
- **Chapter 2: Hardware information**
This chapter lists the hardware setup procedures that you have to perform when installing system components. It includes description of the switches, jumpers, and connectors on the motherboard.
- **Chapter 3: Powering up**
This chapter describes the power up sequence and ways of shutting down the system.
- **Chapter 4: BIOS setup**
This chapter tells how to change system settings through the BIOS Setup menus. Detailed descriptions of the BIOS parameters are also provided.
- **Chapter 5: RAID configuration**
This chapter provides instructions for setting up, creating, and configuring RAID sets using the available utilities.
- **Chapter 6: Driver installation**
This chapter provides instructions for installing the necessary drivers for different system components.
- **Appendix: Reference information**
This appendix includes additional information that you may refer to when configuring the motherboard.

Where to find more information

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

1. **ASUS websites**
The ASUS website provides updated information on ASUS hardware and software products. Refer to the ASUS contact information.
2. **Optional documentation**
Your product package may include optional documentation, such as warranty flyers, that may have been added by your dealer. These documents are not part of the standard package.

Conventions used in this guide

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



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



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



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



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

Typography

Bold text

Indicates a menu or an item to select.

Italics

Used to emphasize a word or a phrase.

<Key>

Keys enclosed in the less-than and greater-than sign means that you must press the enclosed key.

Example: <Enter> means that you must press the Enter or Return key.

<Key1+Key2+Key3>

If you must press two or more keys simultaneously, the key names are linked with a plus sign (+).

Example: <Ctrl+Alt+D>

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: **format A:/S**

Z8NH-D12 Series specifications summary

| Model Name | | Z8NH-D12 | Z8PH-D12/IFB |
|---|---|---|---|
| Processor Support / System Bus | | 2 * socket 1366 Quad-Core Intel® Xeon® W5500 Series (130W) Quad-Core Intel® Xeon® X5500 Series (95W) Quad-Core Intel® Xeon® E5500 Series (80W) Quad-Core Intel® Xeon® L5500 Series (60W/38W) QPI 4.8 / 5.86 / 6.4 GT/s | |
| Core Logic | | Intel® 5500 chipset IOH Intel® ICH10R I/O Controller | Intel® 5520 chipset IOH Mellanox ConnectX MT25408 DDR 20Gbps controller" |
| Form Factor | | 6.3" x 16.7" | |
| ASUS Features | Fan Speed Control | V | V |
| | Rack Ready (Rack and Pedestal dual use) | V | V |
| | ASWM | V | V |
| Memory | Total Slots | 12 (3-channel per CPU, 6 DIMM per CPU) | |
| | Capacity | Maximum up to 96GB (RDIMM) Maximum up to 48GB (UDIMM) | |
| | Memory Type | DDR3 800/1066/1333 Reg DIMM/ Unbuffered DIMM with ECC | |
| | Memory Size | 1GB, 2GB, 4GB, 8GB* (RDIMM) 1GB, 2GB, 4GB (UDIMM) | |
| Expansion Slots (follow SSI Location #) | Total PCI/PCI-X/PCI-E Slots | 1 | 1 |
| | Slot Location 6 | 1 * PCI-E x16 (Gen2 x16 Link) | |
| Storage | SATA Controller | Intel® ICH10R: 4 SATA2 300MB/s ports Intel Matrix Storage (for Windows only) (Support software RAID 0, 1, 10 & 5) LSI® MegaRAID (for Linux/Windows) (Support software RAID 0, 1, 10) | |
| Networking | LAN | 2 * Intel 82574L + 1 * Management LAN | |
| | | | 1 * Single Port DDR Infiniband 20Gbps with CX4 interface |
| Graphic | VGA | Aspeed AST2050 8MB | |

Z8NH-D12 Series specifications summary

| | | | |
|------------------------|-------------------------------|---|---|
| Onboard I/O Connectors | PSU Connector | 2 * 20-pin 12V power connector 1 * 4-pin Molex connector for hard disk drive | |
| | USB Connectors | 2 (One for internal Type A USB connector) | |
| | Fan Header | 4 * 4pin (4pin FAN Only) | |
| | SMBus | 2 | 2 |
| | Front LAN LED | 2 | 2 |
| Rear I/O Connectors | External Serial Port | 1 | 1 |
| | External USB Port | 2 | 2 |
| | VGA Port | 1 | 1 |
| | RJ-45 | 2 + 1 Management Port | |
| Management Solution | Software | ASWM | |
| | Out of Band Remote Management | Optional ASMB4-iKVM for KVM-over-IP support | |
| Monitoring | CPU Temperature | V | V |
| | FAN RPM | V | V |
| Environment | | Operation temperature: 10℃—35℃ Non operation temperature: -40℃—70℃ Non operation humidity: 20%—90% (Non condensing) | |

Specifications are subject to change without notice.



- The 20-pin proprietary power connectors are not compatible with SSI power supply. USE THE PROPRIETARY POWER SUPPLY ONLY; otherwise you may damage the motherboard.
- The 4-pin Molex connector is designed for hard disk drive only. DO NOT connect other 4-pin power connectors of the power supply unit (PSU) to this connector.



DO NOT touch the Northbridge chipset! The Northbridge chipset may become overheated. Remember to provide sufficient air flow to keep the system stable.

This chapter describes the motherboard features and the new technologies it supports.

1 Product introduction

Chapter summary

1

| | | |
|-----|---------------------------|-----|
| 1.1 | Welcome! | 1-3 |
| 1.2 | Package contents..... | 1-3 |
| 1.3 | Serial number label | 1-4 |
| 1.4 | Special features..... | 1-4 |

1.1 Welcome!

Thank you for buying an ASUS® Z8NH-D12 Series motherboard!

The motherboard delivers a host of new features and latest technologies, making it another standout in the long line of ASUS quality motherboards!

Before you start installing the motherboard, and hardware devices on it, check the items in your package with the list below.

1.2 Package contents

Check your motherboard package for the following items.

| | | Standard Bulk Pack |
|----------------|------------|--------------------|
| | | Z8NH-D12 Series |
| Application CD | Support CD | 1 |
| Documentation | User Guide | 1 |
| Packing Qty. | | 10pcs per carton |



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

1.3 Serial number label

Before requesting support from the ASUS Technical Support team, you must take note of the motherboard's serial number containing 13 characters **xxS2xxxxxxxxxx** shown as the figure below. With the correct serial number of the product, ASUS Technical Support team members can then offer a quicker and satisfying solution to your problems.



1.4 Special features

1.4.1 Product highlights

Latest processor technology

This motherboard supports the latest Intel Xeon 5500 series processors in LGA 1366 package with integrated memory controller to support 3-channel (6 DIMM per CPU) DDR3 memory. Intel Xeon 5500 series processor supports Intel QuickPath Interconnect (QPI) with a system bus of up to 6.4GT/s and a max bandwidth of up to 25.6GB/s. Intel Xeon 5500 series processor is the one of the most powerful and energy-efficient CPUs in the world.

Intel Turbo Boost

Intel Turbo Boost dynamically reroute power to improve performance. The processor will automatically overclock as long as the CPU temperature is allowed.

Intel Hyper Threading

The thread-level parallelism on each processor makes more efficient use of the processor resources, higher processing throughput and improved performance on today's multi-threaded software.

Intel® EM64T

The motherboard supports Intel® processors with the Intel® EM64T (Extended Memory 64 Technology). The Intel® EM64T feature allows your computer to run on 64-bit operating systems and access larger amounts of system memory for faster and more efficient computing.

DDR3 memory support

The Z8NH-D12 Series supports UDIMM and RDIMM DDR3 memory that features data transfer rates of 1333/1066 MHZ to meet the higher bandwidth requirements of server and workstation applications. The 3-channel DDR3 architecture boosts system performance, eliminating bottlenecks with peak bandwidth of up to 17GB/s. Furthermore, the supply voltage for the memory is reduced from 1.8 V for DDR2 to just 1.5V for DDR3. This voltage reduction limits the power consumption and heat generation of DDR3 which makes it an ideal memory solution.

PCle 2.0

This motherboard supports the latest PCIe 2.0 device for twice the current speed and bandwidth. This enhances system performance while still providing backward compatibility to PCIe 1.0 devices.

82574L LAN Solution

The motherboard comes with dual Gigabit LAN controllers and ports which provide a total solution for your networking needs. The onboard Intel 82574L Gigabit LAN controllers use the PCI Express interface and could achieve network throughput close to Gigabit bandwidth.

Enhanced Intel SpeedStep Technology (EIST)

The Enhanced Intel SpeedStep Technology (EIST) intelligently manages the CPU resources by automatically adjusting the CPU voltage and core frequency depending on the CPU loading and system speed or power requirement.

Serial ATA II technology



The motherboard supports the Serial ATA II 3 Gb/s technology through the Serial ATA interface and Intel ICH10R chipset. The Serial ATA II specification provides twice the bandwidth of the current Serial ATA products with a host of new features, including Native Command Queuing (NCQ), Power Management (PM) Implementation Algorithm, and Hot Swap. Serial ATA allows thinner, more flexible cables with lower pin count and reduced voltage requirements.

USB 2.0 technology

The motherboard implements the Universal Serial Bus (USB) 2.0 specification, dramatically increasing the connection speed from the 12 Mbps bandwidth on USB 1.1 to a fast 480 Mbps on USB 2.0. USB 2.0 is backward compatible with USB 1.1.

Temperature, fan, and voltage monitoring

The CPU temperature is monitored to prevent overheating and damage. The system fan rotations per minute (RPM) is monitored for timely failure detection. The chip monitors the voltage levels to ensure stable supply of current for critical components.

100% Japan-made Conductive Polymer Capacitors



This motherboard uses all high-quality conductive polymer capacitors for durability, improved lifespan, and enhanced thermal capacity.

1.4.2 Innovative ASUS features

ASUS EPU

With current trends leaning towards power efficiency, the Z8NH-D12 Series is equipped with the ASUS exclusive EPU technology to provide total system power saving by detecting current CPU loadings and intelligently moderating power in real-time.

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

2 Hardware information

Chapter summary

2

| | | |
|-----|-------------------------------------|------|
| 2.1 | Before you proceed | 2-3 |
| 2.2 | Motherboard overview | 2-5 |
| 2.3 | Central Processing Unit (CPU) | 2-10 |
| 2.4 | System memory | 2-15 |
| 2.5 | Expansion slots..... | 2-18 |
| 2.6 | Jumpers | 2-21 |
| 2.7 | Connectors | 2-25 |

2.1 Before you proceed

Take note of the following precautions before you install motherboard components or change any motherboard settings.

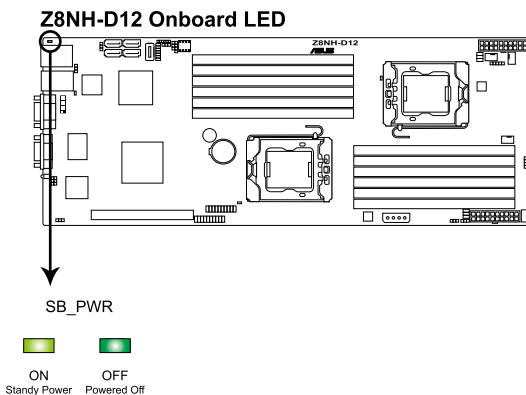


- Unplug the power cord from the wall socket before touching any component.
- Use a grounded wrist strap or touch a safely grounded object or a metal object, such as the power supply case, before handling components to avoid damaging them due to static electricity.
- Hold components by the edges to avoid touching the ICs on them.
- Whenever you uninstall any component, place it on a grounded antistatic pad or in the bag that came with the component.
- Before you install or remove any component, ensure that the power supply is switched off or the power cord is detached from the power supply. Failure to do so may cause severe damage to the motherboard, peripherals, and/or components.

Onboard LED

1. Standby Power LED

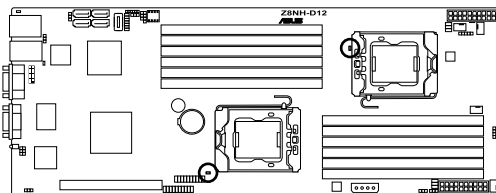
The motherboard comes with a standby power LED. The green LED lights up to indicate that the system is ON, in sleep mode, or in soft-off mode. This is a reminder that you should shut down the system and unplug the power cable before removing or plugging in any motherboard component. The illustration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



2. CPU warning LED (ERR_CPU1, ERR_CPU2)

The CPU warning LEDs light up to indicate that an impending failure of the corresponding CPU.

Z8NH-D12 ERR CPU LED



2.2 Motherboard overview

Before you install the motherboard, study the configuration of your chassis to ensure that the motherboard fits into it.

To optimize the motherboard features, we highly recommend that you install it in an SSI EEB 1.1 compliant chassis.



Ensure to unplug the chassis power cord before installing or removing the motherboard. Failure to do so can cause you physical injury and damage motherboard components!

2.2.1 Placement direction

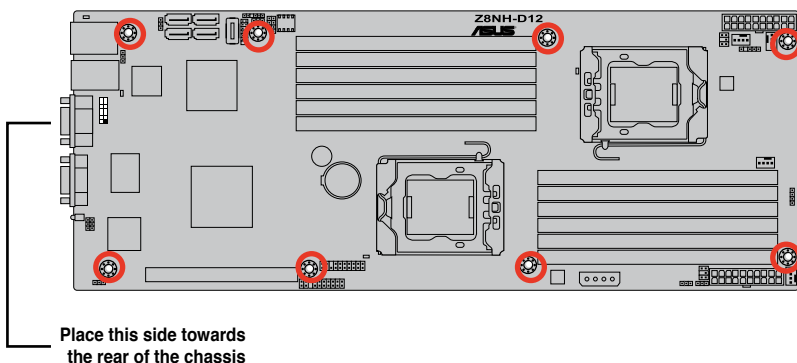
When installing the motherboard, ensure that you place it into the chassis in the correct orientation. The edge with external ports goes to the rear part of the chassis as indicated in the image below.

2.2.2 Screw holes

Place eight (8) screws into the holes indicated by circles to secure the motherboard to the chassis.

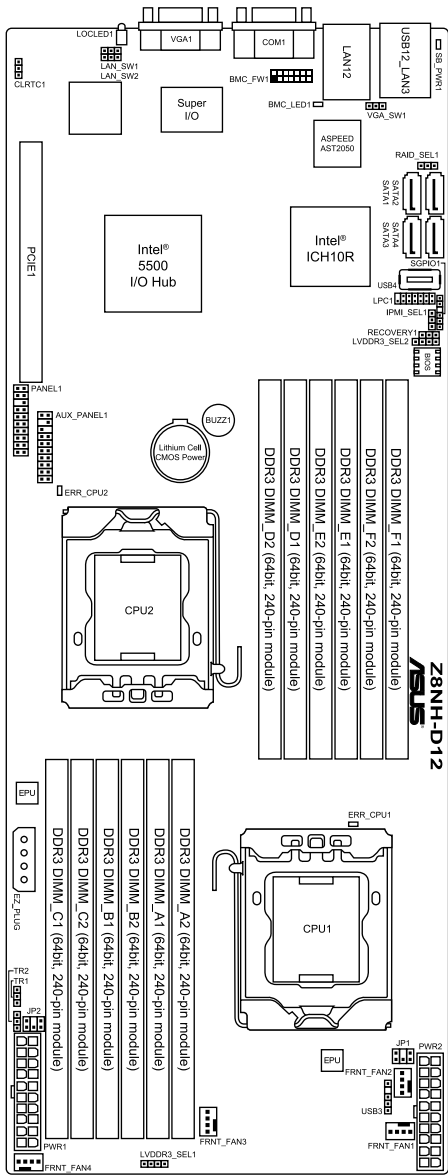


DO NOT overtighten the screws! Doing so can damage the motherboard.

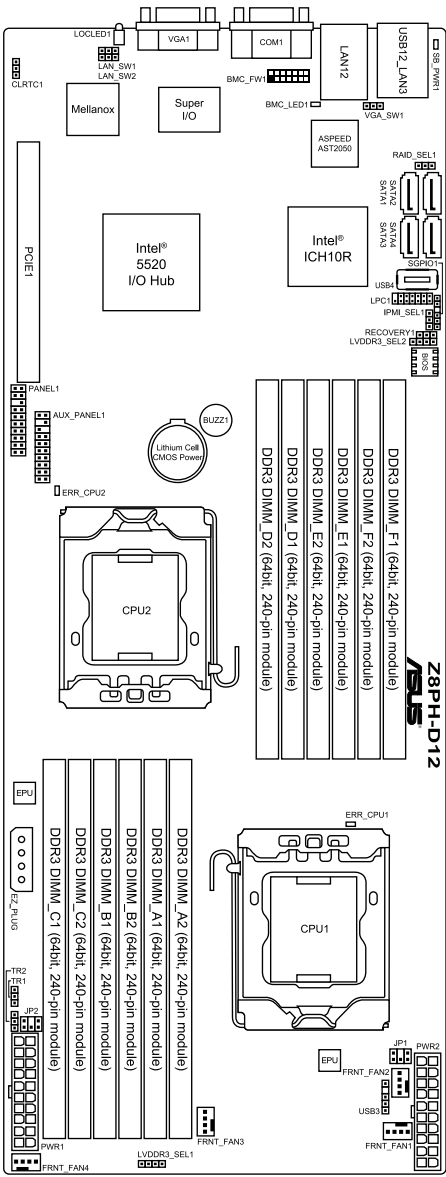


2.2.4 Motherboard layouts

Z8NH-D12



Z8PH-D12/IFB



2.2.5 Layout contents

| Slots/Socket | | Page |
|--------------|-----------------------|------|
| 1. | CPU sockets | 2-10 |
| 2. | DDR3 sockets | 2-15 |
| 3. | PCI Express x 16 slot | 2-20 |

| Jumpers | | Page |
|---------|--|------|
| 1. | Clear RTC RAM (CLRTC1) | 2-21 |
| 2. | VGA controller setting (3-pin VGA_SW1)) | 2-22 |
| 3. | DDR3 voltage control setting (4-pin LVDDR3_SEL1; LVDDR3_SEL2) | 2-22 |
| 4. | LAN controller setting (3-pin LAN_SW1, LAN_SW2) | 2-23 |
| 5. | Intel ICH10R SATA port S/W RAID setting (3-pin RAID_SEL1) | 2-23 |
| 6. | Force BIOS recovery setting (3-pin RECOVERY1) | 2-24 |

| Rear panel connectors | | Page |
|-----------------------|-----------------------------|------|
| 1. | RJ-45 port for iKVM | 2-25 |
| 2. | USB 2.0 ports 1 and 2 | 2-25 |
| 3. | LAN 1 (RJ-45) port | 2-25 |
| 4. | LAN 2 (RJ-45) port | 2-25 |
| 5. | Serial (COM1) port | 2-25 |
| 6. | Video Graphics Adapter port | 2-25 |
| 7. | Location LED | 2-25 |

| Internal connectors | | Page |
|---------------------|--|------|
| 1. | Serial ATA connectors (7-pin SATA1, SATA2, SATA3, SATA4) | 2-26 |
| 2. | USB connector (5-1 pin USB3, A-Type USB4) | 2-27 |
| 3. | Thermal sensor cable connectors (3-pin TR1, TR2) | 2-27 |
| 4. | Front fan connectors (4-pin FRNT_FAN1, FRNT_FAN2, FRNT_FAN3, FRNT_FAN4) | 2-28 |
| 5. | LPC debug card connector (14-1 pin LPC1) | 2-29 |
| 6. | Serial General Purpose Input/Output connector (6-1 pin SGPIO1) | 2-29 |
| 7. | BMC header (BMC_FW1) | 2-30 |
| 8. | Power Supply SMBus connectors (6-1 pin JP1; JP2) | 2-30 |
| 9. | Proprietary power connectors (20-pin PWR1, 20-pin PWR2, 4-pin PWR3) | 2-31 |
| 10. | System panel connector (20-1 pin PANEL1) | 2-32 |
| 11. | Auxiliary panel connector (20-2 pin AUX_PANEL1) | 2-33 |

2.3 Central Processing Unit (CPU)

The motherboard comes with dual surface mount LGA 1366 Socket designed for the Intel® Xeon 5500 series CPU in the Land Grid Array (LGA) package.



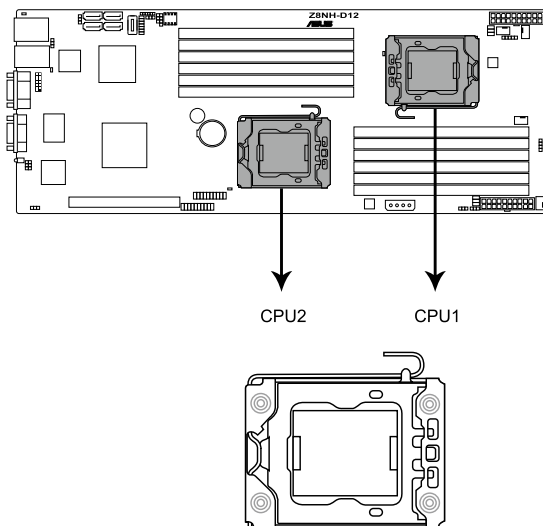
- Upon purchase of the motherboard, ensure that the PnP cap is on the socket and the socket contacts are not bent. Contact your retailer immediately if the PnP cap is missing, or if you see any damage to the PnP cap/socket contacts/motherboard components. ASUS shoulders the repair cost only if the damage 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 Socket 1366.
- 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.

2.3.1 Installing the CPU

To install a CPU:

1. Locate the CPU socket on the motherboard.

Z8NH-D12 CPU LGA1366 Socket

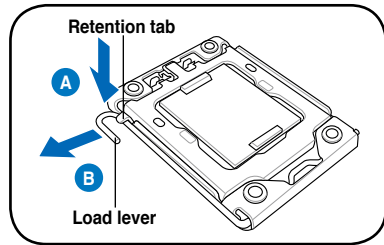


Before installing the CPU, ensure that the socket box is facing toward you and the load lever is on your left.

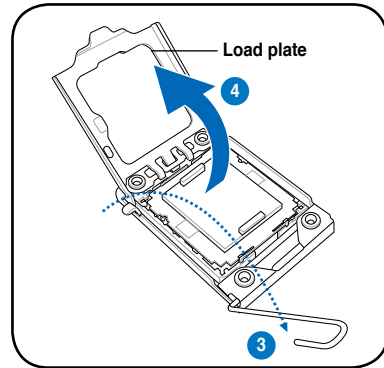
2. Press the load lever with your thumb (A), then move it to the left (B) until it is released from the retention tab.



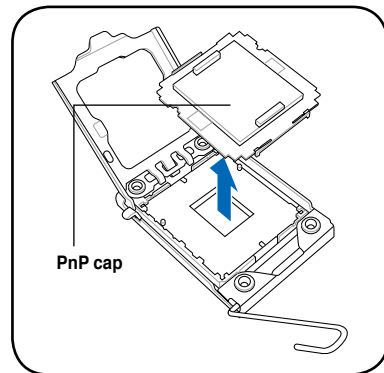
To prevent damage to the socket pins, do not remove the PnP cap unless you are installing a CPU.



3. Lift the load lever in the direction of the arrow to a 135° angle.
4. Lift the load plate with your thumb and forefinger to a 100° angle.



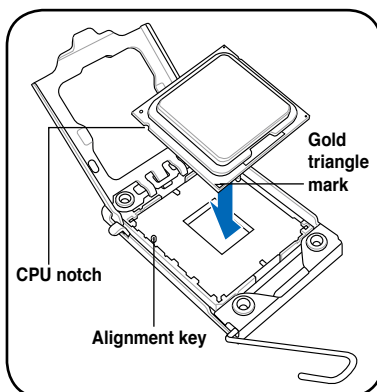
5. Remove the PnP cap from the CPU socket.



6. Position the CPU over the socket, ensuring that the gold triangle is on the bottom-left corner of the socket, and then fit the socket alignment key into the CPU notch.



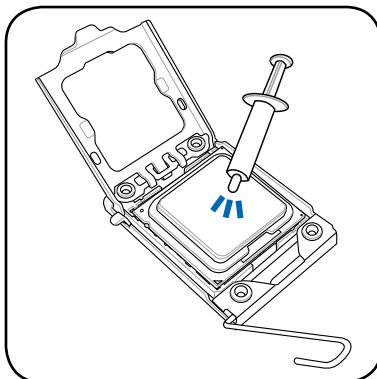
The CPU fits in only one correct orientation. DO NOT force the CPU into the socket to prevent bending the connectors on the socket and damaging the CPU!



7. Apply some Thermal Interface Material to the exposed area of the CPU that the heatsink will be in contact with, ensuring that it is spread in an even thin layer.



Some heatsinks come with pre-applied Thermal Interface Material. If so, skip this step.



The Thermal Interface Material is toxic. DO NOT eat the Thermal Interface Material. If it gets into your eyes or touches your skin, ensure that you wash it off immediately and seek professional medical help.



To prevent contaminating the Thermal Interface Material, DO NOT spread the Thermal Interface Material with your finger directly.

2.3.2 Installing the CPU heatsink and fan

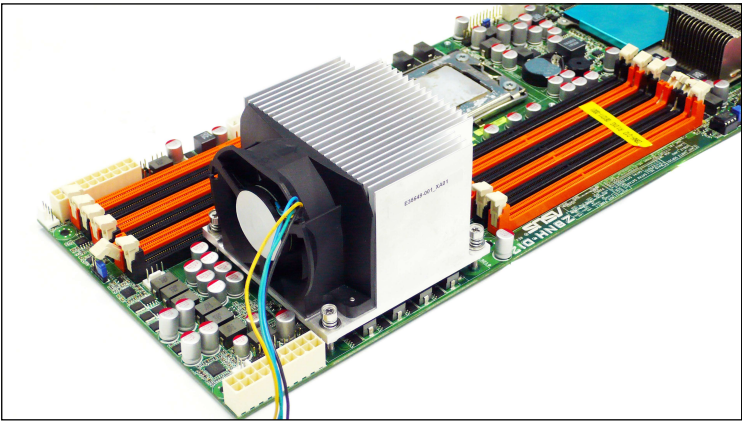
The Intel Xeon 5500 series processors require a specially designed heatsink to ensure optimum thermal condition and performance.



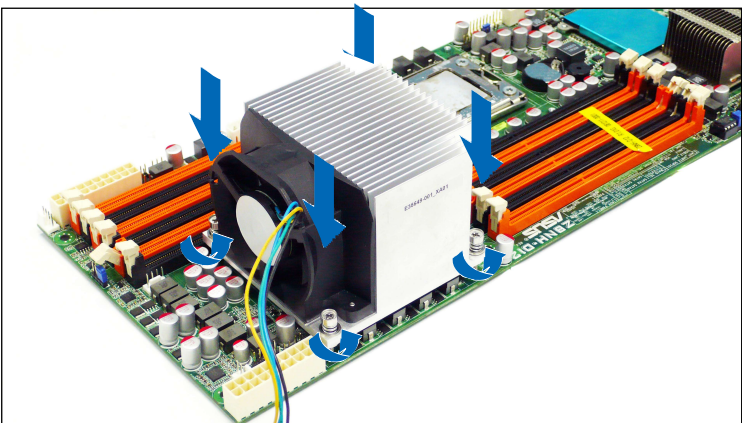
- Ensure to use qualified heatsink assembly only.
- Ensure that you have applied the thermal grease to the top of the CPU before installing the heatsink and fan.

Follow these steps to install the CPU heatsink and fan.

1. Orient and place the heatsink on top of the installed CPU, ensuring that the screw holes are matched with the heatsink standoffs.

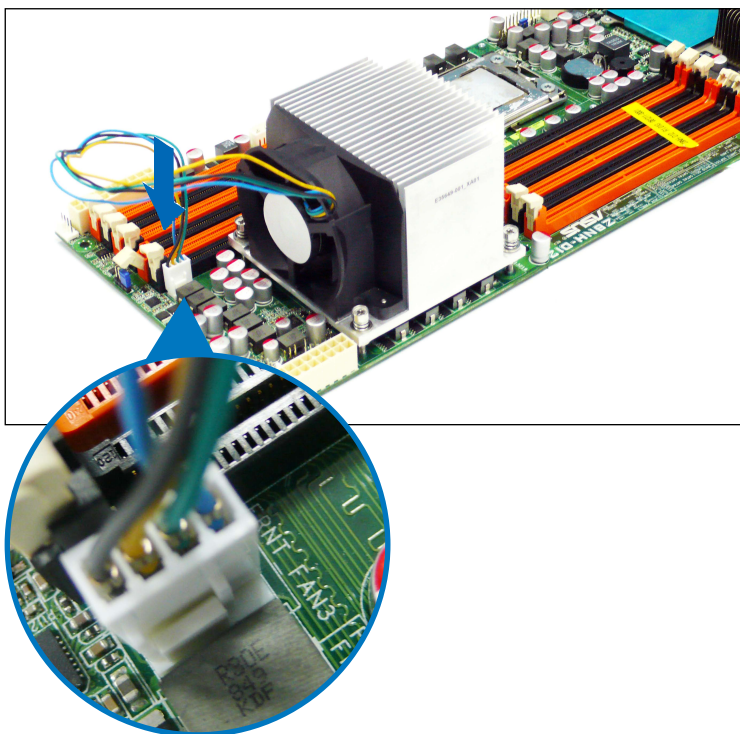


2. Use a Phillips screwdriver to tighten the four heatsink screws in a diagonal sequence.



Ensure that the heatsink is not skewed or tilted, otherwise the CPU will overheat.

3. Connect the fan cable to any of the the 4-pin connectors.



3. Repeat steps 1 to 3 to install the other heatsink if you have installed a second CPU, then connect the fan cable to another 4-pin connector.

2.4 System memory

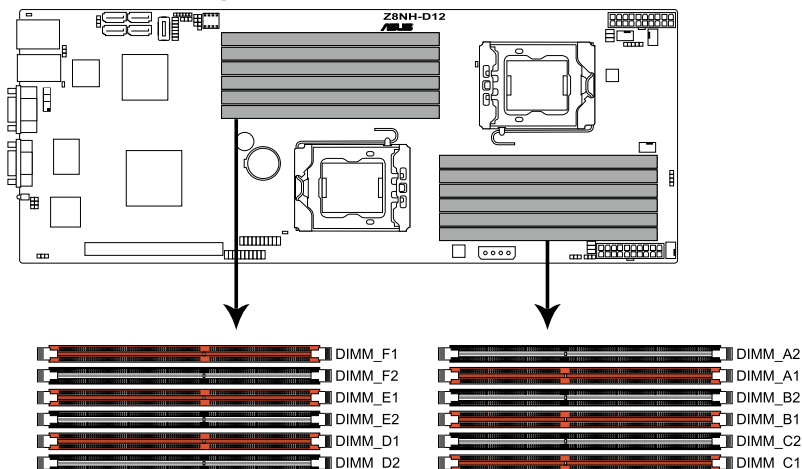
2.4.1 Overview

The motherboard comes with twelve (12) Double Data Rate 3 (DDR3) Dual Inline Memory Modules (DIMM) sockets.

A DDR3 module has the same physical dimensions as a DDR2 DIMM but is notched differently to prevent installation on a DDR2 DIMM socket. DDR3 modules are developed for better performance with less power consumption.

The figure illustrates the location of the DDR3 DIMM sockets:

Z8NH-D12 240-pin DDR3 DIMM sockets



2.4.2 Memory Configurations

You may install 1 GB, 2 GB, 4 GB, or 8GB registered ECC/unbuffered ECC DDR3 DIMMs into the DIMM sockets using the memory configurations in this section.



Always install DIMMs with the same CAS latency. For optimum compatibility, it is recommended that you obtain memory modules from the same vendor.

Memory population table

| CPU 1 Configuration | | | | | | |
|---------------------|---------|---------|---------|---------|---------|---------|
| | DIMM_A2 | DIMM_A1 | DIMM_B2 | DIMM_B1 | DIMM_C2 | DIMM_C1 |
| 1 DIMMs | -- | ● | -- | -- | -- | -- |
| 2 DIMMs | -- | ● | -- | ● | -- | -- |
| 3 DIMMs | -- | ● | -- | ● | -- | ● |
| 4 DIMMs | ● | ● | -- | ● | -- | ● |
| 6 DIMMs | ● | ● | ● | ● | ● | ● |
| CPU 2 Configuration | | | | | | |
| | DIMM_D2 | DIMM_D1 | DIMM_E2 | DIMM_E1 | DIMM_F2 | DIMM_F1 |
| 1 DIMMs | -- | ● | -- | -- | -- | -- |
| 2 DIMMs | -- | ● | -- | ● | -- | -- |
| 3 DIMMs | -- | ● | -- | ● | -- | ● |
| 4 DIMMs | ● | ● | -- | ● | -- | ● |
| 6 DIMMs | ● | ● | ● | ● | ● | ● |

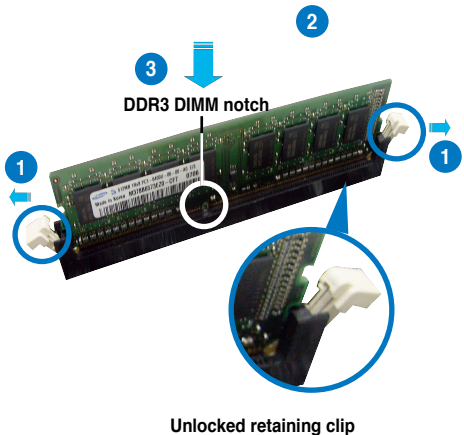
2.4.3 Installing a DIMM



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

To install a DIMM:

1. Unlock a DIMM socket by pressing the retaining clips outward.
2. Align a DIMM on the socket such that the notch on the DIMM matches the break on the socket.
3. Firmly insert the DIMM into the socket until the retaining clips snap back in place and the DIMM is properly seated.



- A DDR3 DIMM is keyed with a notch so that it fits in only one direction. DO NOT force a DIMM into a socket to avoid damaging the DIMM.
- The DDR3 DIMM sockets do not support DDR and DDR2 DIMMs. DO NOT install DDR or DDR2 DIMMs to the DDR3 DIMM sockets.

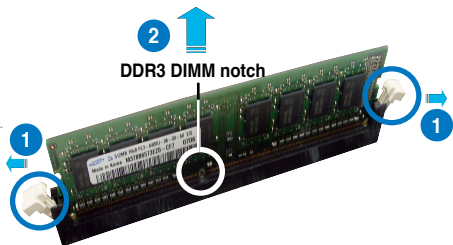
2.4.4 Removing a DIMM

To remove a DIMM:

1. Simultaneously press the retaining clips outward to unlock the DIMM.



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. Remove the DIMM from the socket.

2.5 Expansion slots

In the future, you may need to install expansion cards. The following sub-sections describe the slots and the expansion cards that they support.



Ensure to unplug the power cord before adding or removing expansion cards. Failure to do so may cause you physical injury and damage motherboard components.

2.5.1 Installing an expansion card

To install an expansion card:

1. Before installing the expansion card, read the documentation that came with it and make the necessary hardware settings for the card.
2. Remove the system unit cover (if your motherboard is already installed in a chassis).
3. Remove the bracket opposite the slot that you intend to use. Keep the screw for later use.
4. Align the card connector with the slot and press firmly until the card is completely seated on the slot.
5. Secure the card to the chassis with the screw you removed earlier.
6. Replace the system cover.

2.5.2 Configuring an expansion card

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

1. Turn on the system and change the necessary BIOS settings, if any. See Chapter 4 for information on BIOS setup.
2. Assign an IRQ to the card. Refer to the tables on the next page.
3. Install the software drivers for the expansion card.



When using PCI cards on shared slots, ensure that the drivers support “Share IRQ” or that the cards do not need IRQ assignments. Otherwise, conflicts will arise between the two PCI groups, making the system unstable and the card inoperable.

2.5.3 Interrupt assignments

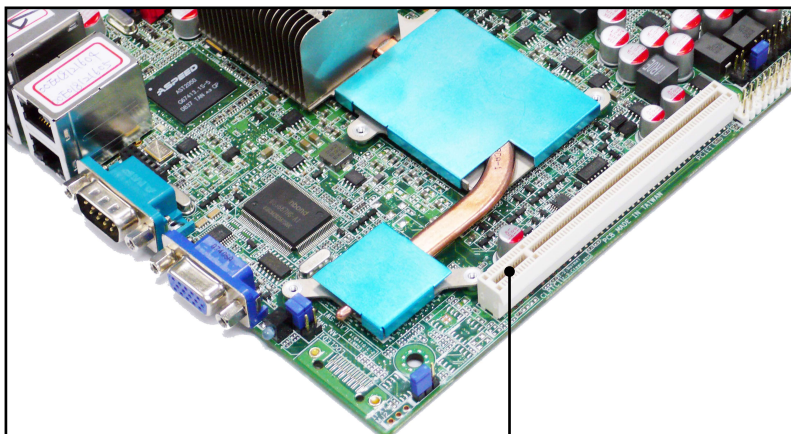
Standard Interrupt assignments

| IRQ | Priority | Standard function |
|-----|----------|-----------------------------|
| 0 | 1 | System Timer |
| 1 | 2 | Keyboard Controller |
| 2 | - | Programmable Interrupt |
| 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.

2.5.4 PCI Express x16 slot (x16 link)

The onboard PCI Express x16 slot provides x16 link to Intel 5500 I/O Hubchipset. This slot supports VGA cards and various server class high performance add-on cards. It also supports a special riser card with two PCI Express x16 (x8 link) slots for 1U server system.

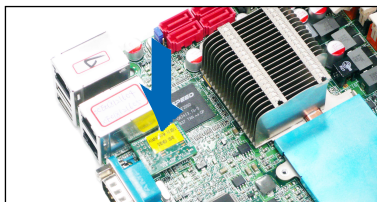
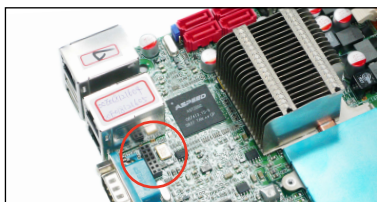


PCIEx16 slot (x16 link)

2.5.5 Installing ASMB4 management board

Follow the steps below to install an optional ASMB4 management board on your motherboard.

1. Locate the BMC_FW1 header on the motherboard.
2. Orient and press the ASMB4 management card in place.



2.6 Jumpers

1. Clear RTC RAM (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.

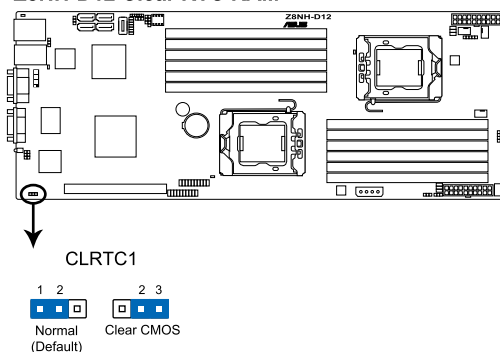


Except when clearing the RTC RAM, never remove the cap on CLRTC jumper default position. Removing the cap will cause system boot failure!



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.

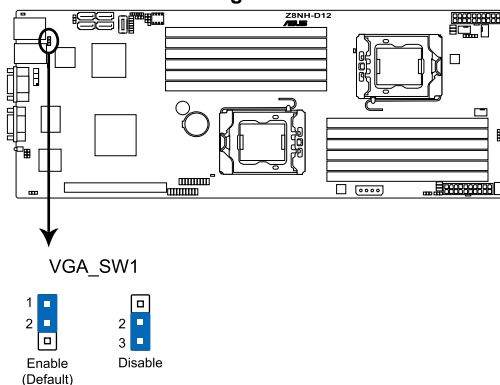
Z8NH-D12 Clear RTC RAM



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.

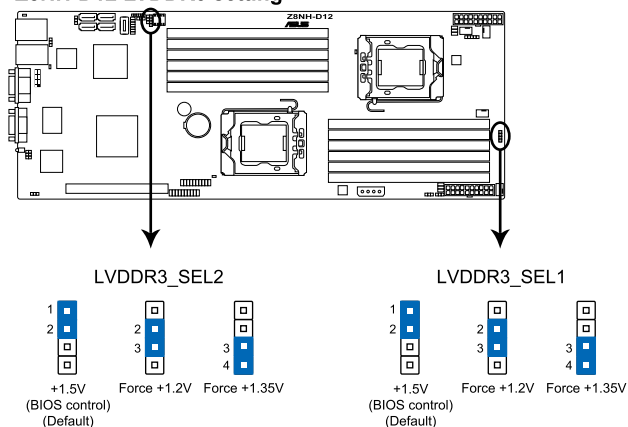
Z8NH-D12 VGA setting



3. DDR3 voltage control setting (4-pin LVDDR3_SEL1; LVDDR3_SEL2)

These jumpers allow you to adjust the DIMM voltage. Set to pins 1–2 to select 1.5V BIOS control, pins 2–3 to select 1.2V Force or 3–4 to select 1.35V Force.

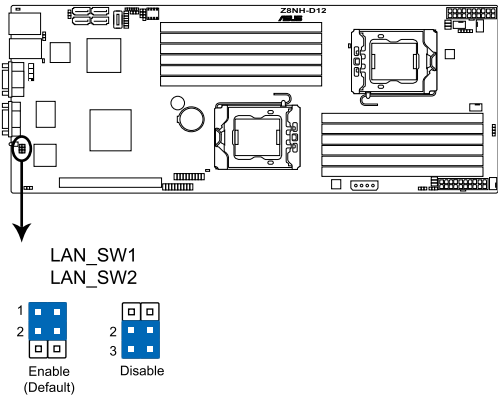
Z8NH-D12 LVDDR3 setting



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

These jumpers allow you to enable or disable the onboard Intel® Intel 82574L Gigabit LAN controllers. Set to pins 1–2 to activate the Gigabit LAN feature.

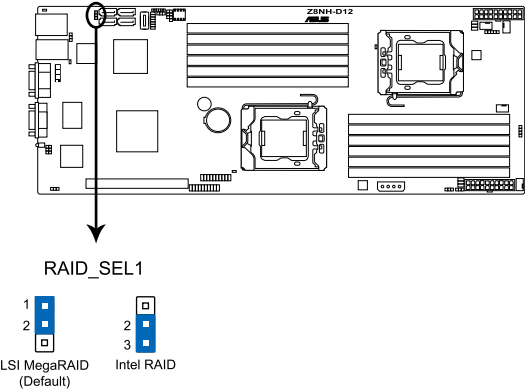
Z8NH-D12 LAN setting



5. Intel® ICH10R SATA port S/W RAID setting (3-pin RAID_SEL1)

This jumper allows you to select the Serial ATA RAID configuration utility to use when you create disk arrays. Place the jumper caps on pins 1–2 if you want to use the LSI Logic Embedded SATA RAID Setup Utility (default); otherwise, place the jumper caps on pins 2–3 to use the Intel® Matrix Storage Manager (IMSM).

Z8NH-D12 RAID setting



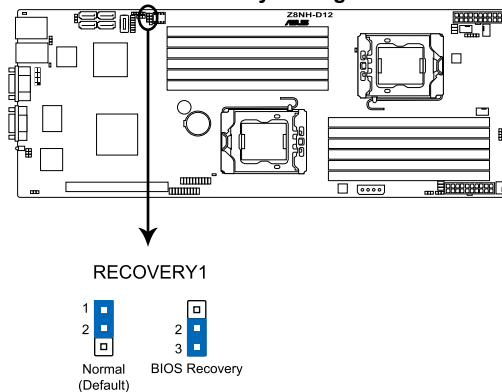
6. Force BIOS recovery setting (3-pin RECOVERY1)

This jumper allows you to quickly update or recover the BIOS settings when it becomes corrupted.

To update the BIOS:

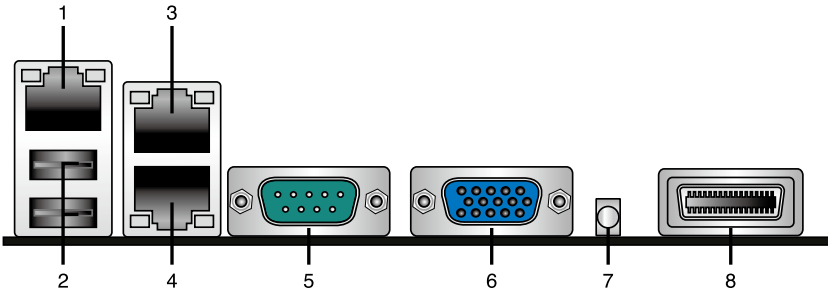
1. Prepare a USB flash disk that contains the original or latest BIOS for the motherboard (XXXXXX.ROM) and the AFUDOS.EXE utility.
2. Set the jumper to pins 2–3.
3. Insert the USB flash and turn on the system to update the BIOS.
4. Shut down the system.
5. Set the jumper back to pins 1–2.
6. Turn on the system.

Z8NH-D12 BIOS recovery setting



2.7 Connectors

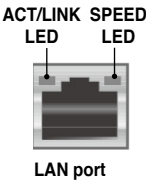
2.7.1 Rear panel connectors



1. **RJ-45 port for iKVM.** This RJ-45 port functions only when you install ASMB4 management card.
2. **USB 2.0 ports 1 and 2.** These two 4-pin Universal Serial Bus (USB) ports are available for connecting USB 2.0 devices.
3. **LAN 2 (RJ-45) port.** This port allows Gigabit connection to a Local Area Network (LAN) through a network hub. Refer to the table below for the LAN port LED indications.
4. **LAN 1 (RJ-45) port.** This port allows Gigabit connection to a Local Area Network (LAN) through a network hub. Refer to the table below for the LAN port LED indications.

LAN port LED indications

| Activity/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 |



5. **Serial (COM1) port.** This 9-pin communication port is for pointing devices or other serial devices.
6. **Video Graphics Adapter port.** This port is for a VGA monitor or other VGA-compatible devices.
7. **Location LED.** This LED lights up for you to conveniently locate the system in error.
8. **InfiniBand (IFX1).** This port allows connection with a CX4 cable to an InfiniBand switch.

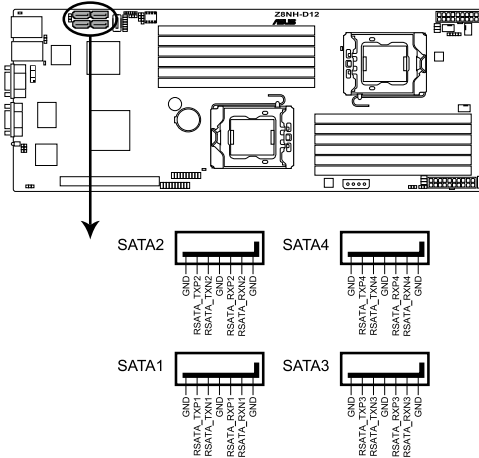
2.7.2 Internal connectors

1. Serial ATA connectors (7-pin SATA1, SATA2, SATA3, SATA4)

Supported by the Intel® ICH10R chipset, these connectors are for the Serial ATA signal cables for Serial ATA hard disk drives that allows up to 3Gb/s of data transfer rate.

If you installed Serial ATA hard disk drives, you can create a RAID 0, RAID 1, RAID 10, or RAID 5 configuration.

Z8NH-D12 SATA connectors

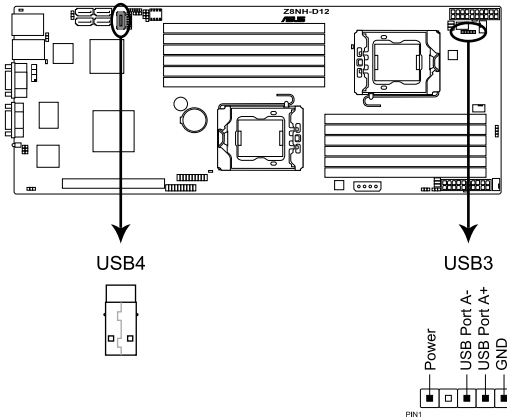


The actual data transfer rate depends on the speed of Serial ATA hard disks installed.

2. USB connector (5-1 pin USB3; A-Type USB4)

These connectors are for USB 2.0 ports. Connect the USB module cables to connectors USB3, then install the modules to a slot opening at the back of the system chassis. These USB connectors comply with USB 2.0 specification that supports up to 480 Mbps connection speed.

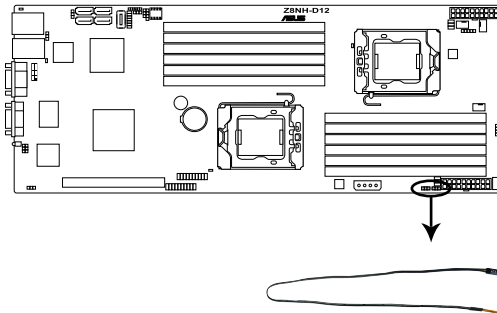
Z8NH-D12 USB 2.0 connectors



3. Thermal sensor cable connectors (3-pin TR1, TR2)

These connectors are for temperature monitoring. Connect the thermal sensor cables to these connectors and place the other ends to the devices, which you want to monitor temperature.

Z8NH-D12 Thermal sensor cable connectors



4. Front fan connectors

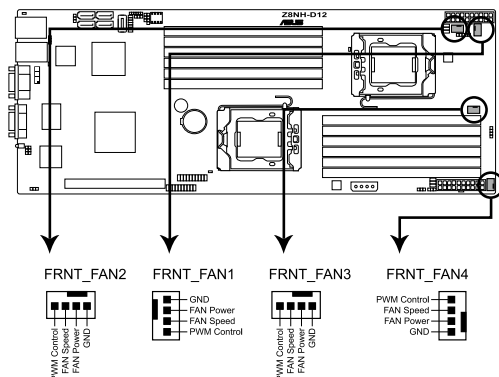
(4-pin FRNT_FAN1, FRNT_FAN2, FRNT_FAN3, FRNT_FAN4)

The fan connectors support cooling fans of 350 mA–740 mA (8.88 W max.) or a total of 3.15 A–6.66 A (53.28 W max.) at +12V. Connect the fan cables to the fan connectors on the motherboard, ensuring that the black wire of each cable matches the ground pin of the connector.



- DO NOT forget to connect the fan cables to the fan connectors. Insufficient air flow inside the system may damage the motherboard components.
- These are not jumpers! DO NOT place jumper caps on the fan connectors!
- All fans feature the ASUS Smart Fan technology.

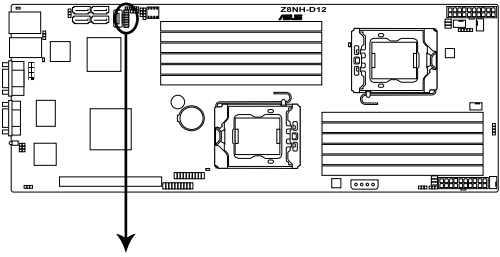
Z8NH-D12 FAN connectors



5. **LPC debug card connector (14-1 pin LPC1)**

This is a low pin count interface used to plug in the LPC debug card.

Z8NH-D12 LPC connector



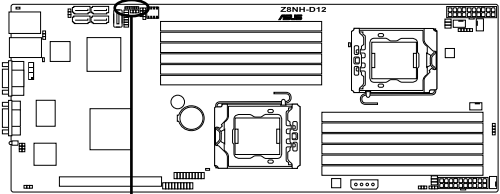
LPC1

| | |
|----------|----------|
| Pin 1 | |
| LCK | GND |
| PLTRST | LFRAME_N |
| LPC_LAD0 | LPC_LAD1 |
| LPC_LAD2 | LPC_LAD3 |
| PLTRST | GND |
| +3.3V | +3.3V |
| | +3.3V |

6. **Serial General Purpose Input/Output connector (6-1 pin SGPIO1)**

This connector is used for the SGPIO peripherals for the LSI MegaRAID and Intel Matrix RAID SATA LED.

Z8NH-D12 SGPIO connector



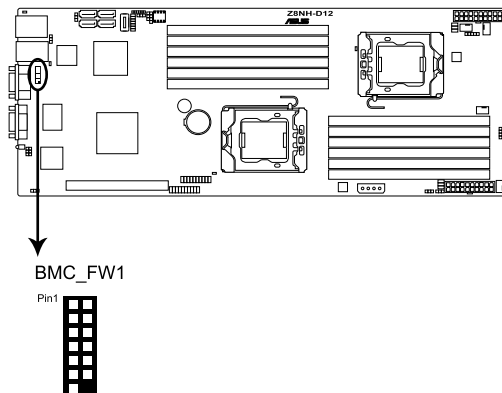
SGPIO1

| | | | | | |
|-----------------|-----------------|-----|-------------|------------|--|
| | | | | | |
| SGPIO_SDATAOUT0 | SGPIO_SDATAOUT1 | GND | SGPIO_SLOAD | SGPIO_SCLK | |

7. BMC header (BMC_FW1)

The BMC connector on the motherboard supports an ASUS® Server Management Board 4 Series (ASMB4).

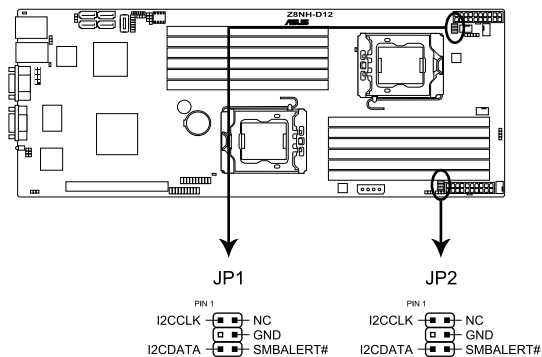
Z8NH-D12 BMC connector



8. Power Supply SMBus connectors (6-1 pin JP1; JP2)

These connectors allow you to connect SMBus (System Management Bus) to the power supply unit to read PSU information. Devices communicate with an SMBus host and/or other SMBus devices using the SMBus interface.

Z8NH-D12 JP connector



9. Proprietary power connectors (20-pin PWR1, 20-pin PWR2, 4-pin PWR3)

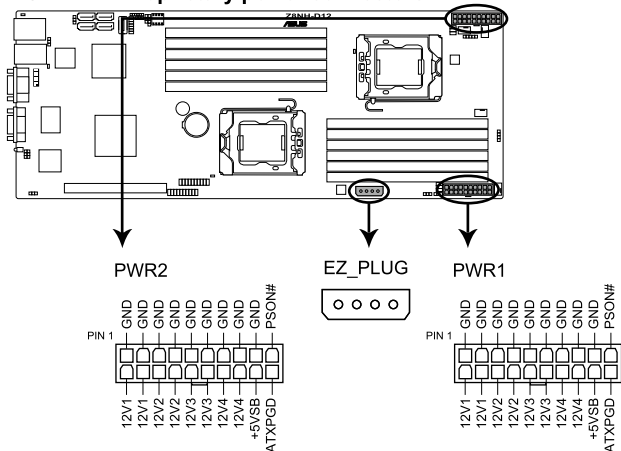
These connectors are for Proprietary power supply plugs. The power supply plugs are designed to fit these connectors in only one orientation. Orient the connectors and push down firmly until they completely fit.

The 4-pin EZ_PLUG is designed for hard disk drives power supply. **DO NOT** connect other 4-pin power connectors of the power supply unit (PSU) to this connector.



- Connect either one of the 20-pin power connectors to boot up the system.
- Use of a PSU with a higher power output is recommended when configuring a system with more power-consuming devices. The system may become unstable or may not boot up if the power is inadequate.
- **USE THE PROPRIETARY POWER SUPPLY ONLY;** otherwise you may damage the motherboard. Ensure that your PSU can provide at least the minimum power required by your system.

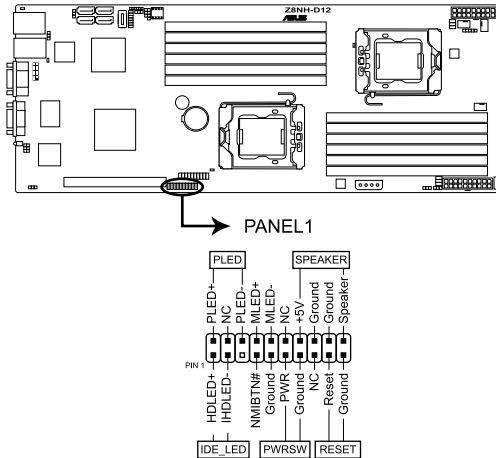
Z8NH-D12 Proprietary power connectors



10. System panel connector (20-pin PANEL1)

This connector supports several chassis-mounted functions.

Z8NH-D12 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 Hardware monitor 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 HDDLED)

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

5. Proprietary 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.

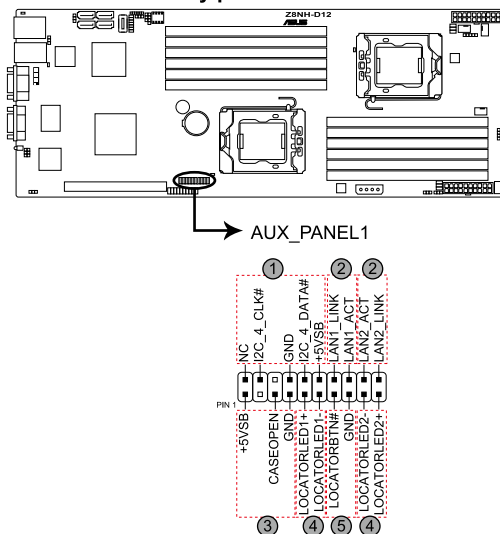
6. Reset button (2-pin RESET)

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

11. Auxiliary panel connector (20-pin AUX_PANEL1)

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

Z8NH-D12 Auxiliary panel connector



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 Gigabit LAN activity LEDs on the front panel.

3. Chassis intrusion (4-1 pin CHASSIS)

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 short CASEOPEN and GND pin by jumper cap to disable the function.

4. Locator LED (2-pin LOCATORLED1 and 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.

5. 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.

This chapter describes the power up sequence, and ways of shutting down the system.

Powering up 3

Chapter summary

3

| | | |
|-----|-------------------------------------|-----|
| 3.1 | Starting up for the first time..... | 3-3 |
| 3.2 | Turning off the computer..... | 3-4 |

3.1 Starting up for the first time

1. After making all the connections, replace the system case cover.
2. Ensure that all switches are off.
3. Connect the power cord to the power connector at the back of the system chassis.
4. Connect the power cord to a power outlet that is equipped with a surge protector.
5. Turn on the devices in the following order:
 - a. Monitor
 - b. External SCSI devices (starting with the last device on the chain)
 - c. System power
6. After applying power, the system power LED on the system front panel case lights up. For systems with Proprietary power supplies, the system LED lights up when you press the Proprietary power button. If your monitor complies with “green” standards or if it has a “power standby” feature, the monitor LED may light up or switch between orange and green after the system LED turns on.

The system then runs the power-on self-test or POST. While the tests are running, the BIOS beeps or additional messages appear on the screen. If you do not see anything within 30 seconds from the time you turned on the power, the system may have failed a power-on test. Check the jumper settings and connections or call your retailer for assistance.

7. At power on, hold down the key to enter the BIOS Setup. Follow the instructions in Chapter 4.

3.2 Powering off the computer

3.2.1 Using the OS shut down function

If you are using Windows® 2000/2003 Server:

1. Click **Start** then click **Shut Down**.
2. Select **Shut Down** from the **What do you want the computer to do?** list box.
3. Select **Shutdown Event Tracker**.
4. Ensure that the **Planned** check box is checked.
5. Select **shutdown** from the list box.
6. If necessary, key in comments.
7. Click **OK**.

3.2.2 Using the dual function power switch

While the system is ON, pressing the power switch for less than four seconds puts the system to sleep mode or to soft-off mode, depending on the BIOS setting.

Pressing the power switch for more than four seconds lets the system enter the soft-off mode regardless of the BIOS setting. Refer to section **4.5 Power Menu** in Chapter 4 for details.

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

4 BIOS setup

Chapter summary

4

| | | |
|-----|---------------------------------------|------|
| 4.1 | Managing and updating your BIOS | 4-3 |
| 4.2 | BIOS setup program | 4-7 |
| 4.3 | Main menu | 4-10 |
| 4.4 | Advanced menu | 4-16 |
| 4.5 | Server menu | 4-32 |
| 4.6 | Boot menu | 4-34 |
| 4.7 | Exit menu | 4-38 |

4.1 Managing and updating your BIOS

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

1. **AFUDOS utility** (Updates the BIOS in DOS mode using a bootable USB flash disk drive.)
2. **ASUS CrashFree BIOS 3** (To recover the BIOS using a bootable USB flash disk drive when the BIOS file fails or gets corrupted.)

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 ASUS Update or AFUDOS utilities.

4.1.1 AFUDOS utility

The AFUDOS utility allows you to update the BIOS file in DOS environment using a bootable USB flash disk drive with the updated BIOS file. This utility also allows you to copy the current BIOS file that you can use as backup when the BIOS fails or gets corrupted during the updating process.

Copying the current BIOS

To copy the current BIOS file using the AFUDOS utility:



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

1. Copy the AFUDOS utility (afudos.exe) from the motherboard support CD to the bootable USB flash disk drive you created earlier.
2. Boot the system in DOS mode, then at the prompt type:

```
afudos /o[filename]
```

where the [filename] is any user-assigned filename not more than eight alphanumeric characters for the main filename and three alphanumeric characters for the extension name.

```
A:\>afudos /oOLD BIOS1 .rom
```

Main filename

Extension name

3. Press <Enter>. The utility copies the current BIOS file to the USB flash disk drive.

```
A:\>afudos /oOLDBIOS1.rom
AMI Firmware Update Utility - Version 1.19(ASUS V2.07(03.11.24BB))
Copyright (C) 2002 American Megatrends, Inc. All rights reserved.
Reading flash ..... done
Write to file..... ok
A:\>
```

The utility returns to the DOS prompt after copying the current BIOS file.

Updating the BIOS file

To update the BIOS file using the AFUDOS 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.



Write the BIOS filename on a piece of paper. You need to type the exact BIOS filename at the DOS prompt.

2. Copy the AFUDOS utility (afudos.exe) from the motherboard support CD to the bootable USB flash disk drive you created earlier.
3. Boot the system in DOS mode, then at the prompt, type:

afudos /i[filename]

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

```
A:\>afudos /i8036A0.ROM
```

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

```
A:\>afudos /i8036A0.ROM
AMI Firmware Update Utility - Version 1.19(ASUS V2.07(03.11.24BB))
Copyright (C) 2002 American Megatrends, Inc. All rights reserved.

WARNING!! Do not turn off power during flash BIOS
Reading file ..... done
Reading flash ..... done

Advance Check .....
Erasing flash ..... done
Writing flash ..... 0x0008CC00 (9%)
```



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.

```
A:\>afudos /i8036A0.ROM
AMI Firmware Update Utility - Version 1.19 (ASUS V2.07 (03.11.24BB))
Copyright (C) 2002 American Megatrends, Inc. All rights reserved.

WARNING!! Do not turn off power during flash BIOS
Reading file ..... done
Reading flash ..... done

Advance Check .....
Erasing flash ..... done
Writing flash ..... done
Verifying flash .... done

Please restart your computer

A:\>
```

4.1.2 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. Remove any floppy disk from the floppy disk drive and turn the system on.
2. Insert the USB flash drive with the original or updated BIOS file to one USB port on the system.
3. 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.

4.2 BIOS setup program

This motherboard supports a programmable firmware chip that you can update using the provided utility described in section **4.1 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.

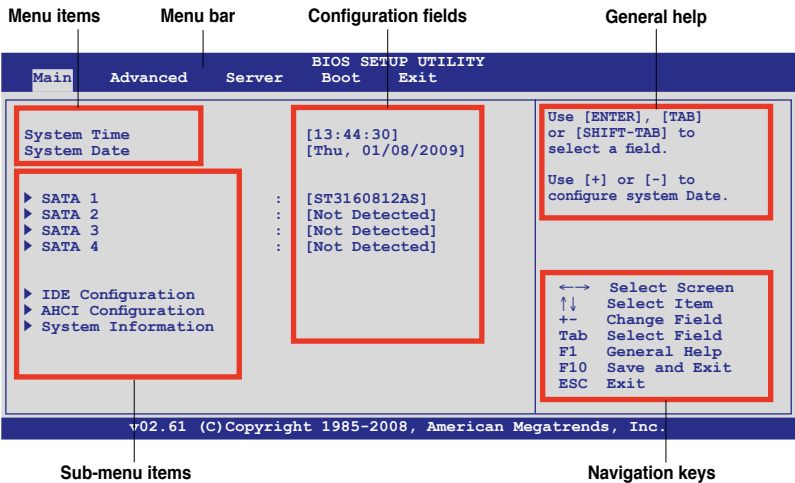
If you wish to enter Setup after POST, restart the system by pressing <Ctrl+Alt+Delete>, or by pressing the reset button on the system chassis. You can also restart by turning the system off and then back on. Do this last option only if the first two failed.

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. Select the **Load Setup Defaults** item under the Exit Menu. See section **4.8 Exit Menu**.
 - 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 at www.asus.com to download the latest BIOS file for this motherboard.
-

4.2.1 BIOS menu screen



4.2.2 Menu bar

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

| | |
|-----------------|---|
| Main | For changing the basic system configuration |
| Advanced | For changing the advanced system settings |
| Server | For changing the advanced server settings |
| Boot | For changing the system boot configuration |
| Exit | For selecting the exit options and loading default settings |

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

4.2.3 Navigation keys

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

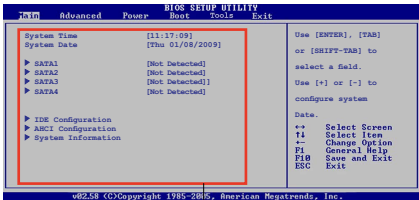


Some of the navigation keys differ from one screen to another.

4.2.4 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 (Advanced, Power, Boot, and Exit) on the menu bar have their respective menu items.



Main menu items

4.2.5 Sub-menu items

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

4.2.6 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.

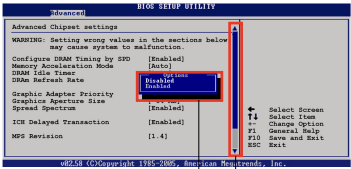
A configurable field is enclosed in brackets, and is highlighted when selected. To change the value of a field, select it then press <Enter> to display a list of options. Refer to 4.2.7 Pop-up window.

4.2.7 Pop-up window

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

4.2.8 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.



Pop-up window

Scroll bar

4.2.9 General help

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

The BIOS automatically detects the values opposite the dimmed items (Device, Vendor, Size, LBA Mode, Block Mode, PIO Mode, Async DMA, Ultra DMA, and S.M.A.R.T. monitoring). These values are not user-configurable. These items show N/A if no IDE device is installed in the system.

Type [Auto]

Allows you to select the type of device connected to the system.

Configuration options: [Not Installed] [Auto] [CDROM] [ARMD]

LBA/Large Mode [Auto]

Enables or disables the LBA mode. Setting to [Auto] enables the LBA mode if the device supports this mode, and if the device was not previously formatted with LBA mode disabled. Configuration options: [Disabled] [Auto]

Block (Multi-Sector Transfer) M [Auto]

Enables or disables data multi-sectors transfers. When set to [Auto], the data transfer from and to the device occurs multiple sectors at a time if the device supports multi-sector transfer feature. When set to [Disabled], the data transfer from and to the device occurs one sector at a time.

Configuration options: [Disabled] [Auto]

PIO Mode [Auto]

Allows you to select the data transfer mode.

Configuration options: [Auto] [0] [1] [2] [3] [4]

DMA Mode [Auto]

Sets the DMA mode.

Configuration options: [Auto] [SWDMA0] [SWDMA1] [SWDMA2] [MWDMA0] [MWDMA1] [MWDMA2] [UDMA0] [UDMA1] [UDMA2] [UDMA3] [UDMA4] [UDMA5]

SMART Monitoring [Auto]

Sets the Smart Monitoring, Analysis, and Reporting Technology.

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

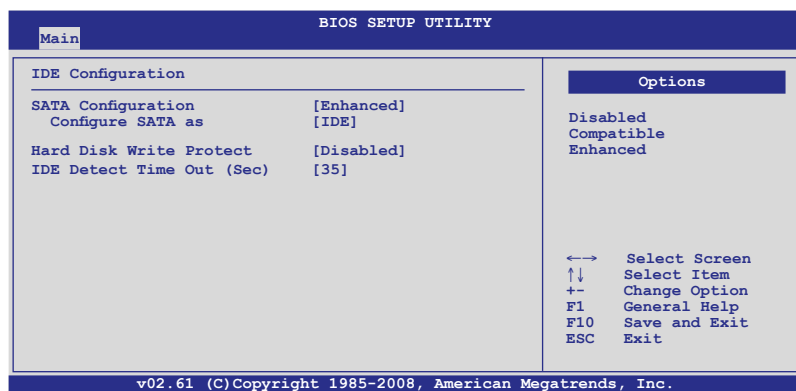
32Bit Data Transfer [Enabled]

Enables or disables 32-bit data transfer.

Configuration options: [Disabled] [Enabled]

4.3.4 IDE Configuration

The items in this menu allow you to set or change the configurations for the IDE devices installed in the system. Select an item then press <Enter> if you wish to configure the item.



SATA Configuration [Enhanced]

Configuration options: [Disabled] [Compatible] [Enhanced]

Configure SATA as [IDE]

Sets the configuration for the Serial ATA connectors supported by the Southbridge chip. Configuration options: [IDE] [RAID] [AHCI]



- If you want to use the Serial ATA hard disk drives as Parallel ATA physical storage devices, keep the default setting [IDE].
- If you want the Serial ATA hard disk drives to use the Advanced Host Controller Interface (AHCI), set this item to [AHCI]. The AHCI allows the onboard storage driver to enable advanced Serial ATA features that increases storage performance on random workloads by allowing the drive to internally optimize the order of commands.
- If you want to create a LSI MegaRAID, or the Intel® Matrix Storage Technology configuration from the Serial ATA hard disk drives, set this item to [RAID].

Hard Disk Write Protect [Disabled]

Disables or enables device write protection. This will be effective only if the device is accessed through BIOS. Configuration option: [Disabled] [Enabled]

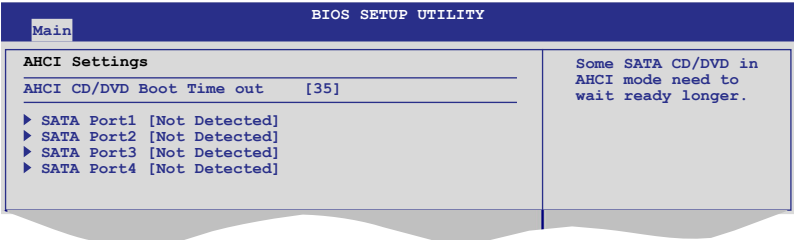
IDE Detect Time Out (Sec) [35]

Selects the time out value for detecting ATA/ATAPI devices.

Configuration options: [0] [5] [10] [15] [20] [25] [30] [35]

4.3.5 AHCI Configuration

This menu is the section for AHCI configuration.

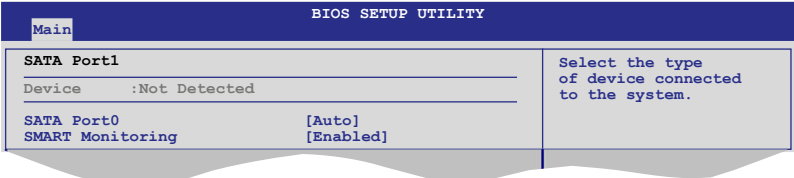


AHCI CD/DVD Boot Time out [35]

Selects the boot time out value for SATA CD/DVD devices in AHCI mode.
Configuration options: [0] [5] [10] [15] [20] [25] [30] [35]

SATA Port1–4 [XXXX]

Displays the status of auto-detection of SATA devices.



SATA Port0 [Auto]

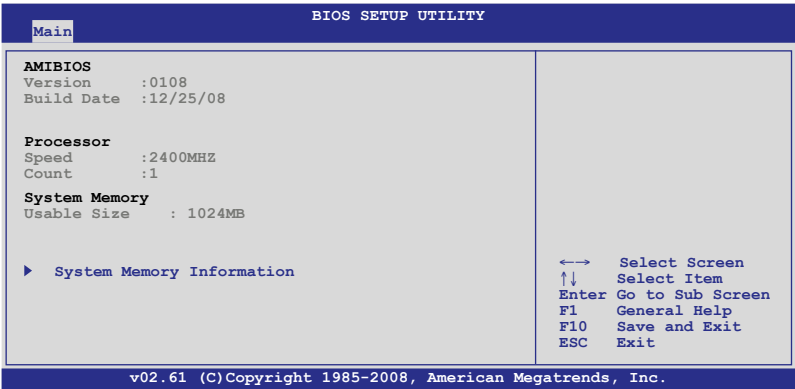
Allows you to select the type of device connected to the system.
Configuration options: [Auto] [Not Installed]

SMART Monitoring [Enabled]

Allows you to set the Self-Monitoring, Analysis and Reporting Technology.
Configuration options: [Disabled] [Enabled]

4.3.6 System Information

This menu gives you an overview of the general system specifications. The BIOS automatically detects the items in this menu.



AMIBIOS

Displays the auto-detected BIOS information.

Processor

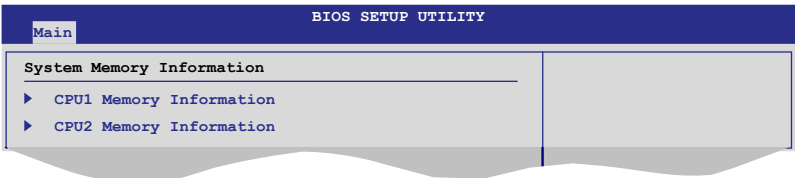
Displays the auto-detected CPU specification.

System Memory

Displays the auto-detected system memory.

System Memory Information

Displays system memory information.



CPU1/2 Memory Configuration

Allows you to check information of installed memory (6 DIMMs per CPU).

CPU1/2 Memory Configuration

Displays the auto-detected memory specification.

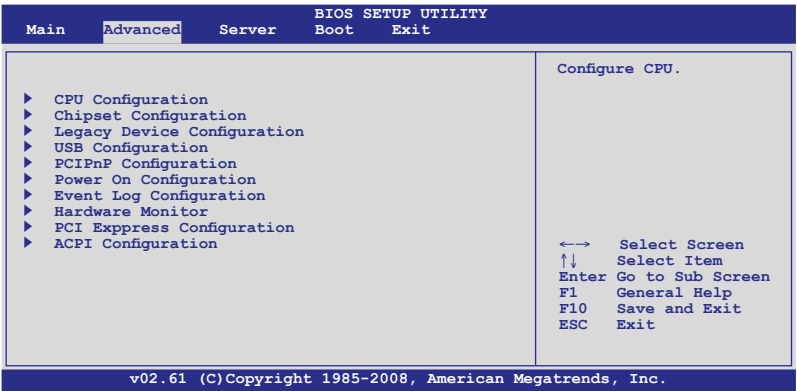
| BIOS SETUP UTILITY | |
|---------------------------|-----|
| Main | |
| CPU1 Memory Configuration | |
| Speed | N/A |
| DIMM_A1 | N/A |
| DIMM_A2 | N/A |
| DIMM_B1 | N/A |
| DIMM_B2 | N/A |
| DIMM_C1 | N/A |
| DIMM_C2 | N/A |

4.4 Advanced menu

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

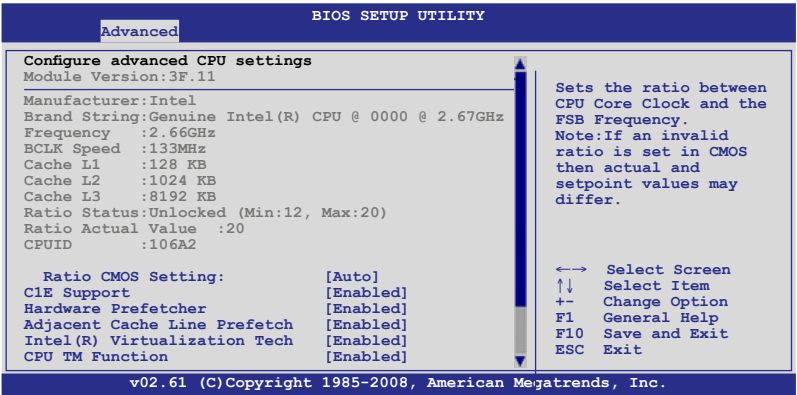


Take caution when changing the settings of the Advanced menu items. Incorrect field values can cause the system to malfunction.

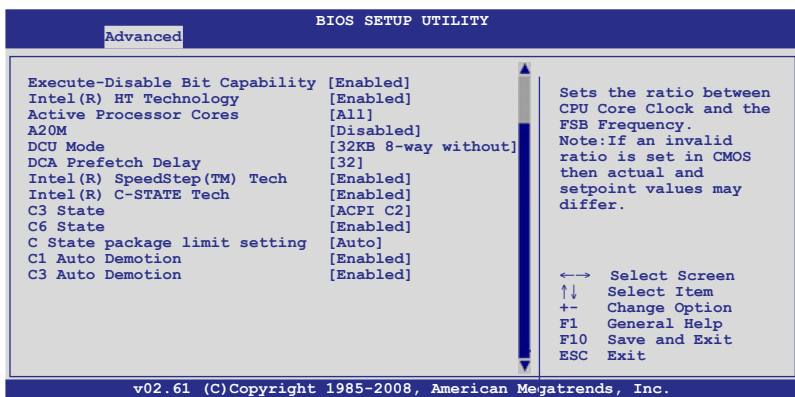


4.4.1 CPU Configuration

The items in this menu show the CPU-related information that the BIOS automatically detects. Some items may not appear if your CPU does not support the related functions.



Scroll down for more items.



Ratio CMOS Setting [Auto]

Allows you to adjust the ratio between CPU Core Clock and BCLK Frequency. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [12.0] [13.0] [14.0] [15.0] [16.0] [17.0] [18.0] [19.0] [20.0]

C1E Support [Enabled]

Allows you to enable or disable Enhanced Halt State support.

Configuration options: [Disabled] [Enabled]

Hardware Prefetcher [Enabled]

Allows you to enable or disable the Hardware Prefetcher function.

Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch [Enabled]

Allows you to enable or disable the Adjacent Cache Line Prefetch function.

Configuration options: [Disabled] [Enabled]

Intel(R) Virtualization Tech [Enabled]

The Intel® Virtualization Technology allows a hardware platform to run multiple operating systems separately and simultaneously, enabling one system to virtually function as several systems. Configuration options: [Disabled] [Enabled]

CPU TM Function [Enabled]

This function enables the overheated CPU to throttle the clock speed to cool down.

Configuration options: [Disabled] [Enabled]

Execute-Disable Bit Capability [Enabled]

Allows you to enable or disable the No-Execution Page Protection Technology. Setting this item to [Disabled] forces the XD feature flag to always return to zero (0). Configuration options: [Disabled] [Enabled]

Intel(R) HT Technology [Enabled]

Allows you to enable or disable the Intel Hyper-Threading Technology function. When disabled, only one thread per activated core is enabled. Configuration options: [Enabled] [Disabled]

Active Processor Cores [All]

Allows you to choose the number of CPU cores to activate in each processor package. Configuration options: [All] [1] [2]

A20M [Disabled]

Legacy OSes and APs may need A20M enabled. Configuration options: [Disabled] [Enabled]

DCU Mode [32KB 8-way without]

Allows you to select the mode for the Data Cache. Configuration options: [32KB 8-way without ECC] [16KB 4-way with ECC]

DCA Prefetch Delay [32]

Allows you to select the time delay in bus clocks from snoop to prefetch. Configuration options: [8] [16] [24] [32] [40]—[104] [112] [120]

Intel(R) SpeedStep (TM) Tech [Enabled]

When set to [Disabled], the CPU runs at its default speed. When set to [Enabled], the CPU speed is controlled by the operating system. Configuration options: [Disabled] [Enabled]

Intel(R) C-STATE Tech [Enabled]

The Intel® C-State Technology allows the CPU to save more power under idle mode. Enable this item only when you install a C-State Technology-supported CPU. Configuration options: [Disabled] [Enabled]



The following items appear only when you set the **Intel(R) C-STATE Tech** item to [Enabled].

C3 State [ACPI C2]

Allows you to select Nehalem C state action.

Configuration options: [Disabled] [ACPI C2] [ACPI C3]

C6 State [Enabled]

Allows you to select Nehalem C state action.

Configuration options: [Disabled] [Enabled]

C State package limit setting [Auto]

We recommend that you set this item to [Auto] for BIOS to automatically detect the C-State mode supported by your CPU.

Configuration options: [Auto] [C1] [C3] [C6] [C7]

C1 Auto Demotion [Enabled]

When this item is enabled, the CPU will conditionally demote C3/C6/C7 requests to C1 based on the uncore auto-demote information.

Configuration options: [Disabled] [Enabled]

C3 Auto Demotion [Enabled]

When this item is enabled, the CPU will conditionally demote C6/C7 requests to C3 based on the uncore auto-demote information.

Configuration options: [Disabled] [Enabled]

4.4.2 Chipset Configuration

The Chipset configuration menu allows you to change advanced chipset settings. Select an item then press <Enter> to display the sub-menu.

| BIOS SETUP UTILITY | |
|---|---|
| Advanced | |
| Advanced Chipset Settings | Configure CPU Bridge features. |
| WARNING: Setting wrong values in below sections may cause system to malfunction. | |
| <ul style="list-style-type: none">▶ CPU Bridge Configuration▶ NorthBridge Configuration▶ SouthBridge Configuration▶ Intel VT-d Configuration | <ul style="list-style-type: none">←→ Select Screen↑↓ Select ItemEnter Go to Sub ScreenF1 General HelpF10 Save and ExitESC Exit |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

CPU Bridge Configuration

| BIOS SETUP UTILITY | |
|--|--|
| Advanced | |
| CPU Bridge Chipset Configuration | To transition the CSI links to full-speed or leave them in slow-mode. |
| CPU Revision :B0 | |
| Current CSI Frequency :4.800GT | |
| Current Memory Frequency :1066 Mhz | |
| CSI Links Speed [Full-Speed] | |
| CSI Frequency [Auto] | |
| CSI Isochronous [Disabled] | |
| CSI L0s [Disabled] | |
| CSI L1 [Disabled] | |
| Memory Frequency [Auto] | |
| Memory Mode [Independent] | |
| Memory ECC Function [Enabled] | |
| Double Rate Refresh [Auto] | |
| Demand Scrubbing [Enabled] | |
| Patrol Scrubbing [Disabled] | |
| NUMA Aware [Auto] | |
| Page Policy [Closed] | |
| | <ul style="list-style-type: none">←→ Select Screen↑↓ Select Item+ - Change OptionF1 General HelpF10 Save and ExitESC Exit |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

Scroll down for more items.

| | |
|--|-------------------|
| Adaptive Page [Disabled] | ←→ Select Screen |
| Data Scramble [Enabled] | ↑↓ Select Item |
| Split Below 4GB [Disabled] | + - Change Option |
| Channel Interleaving [6:1] | F1 General Help |
| Rank Interleaving [4:1] | F10 Save and Exit |
| | ESC Exit |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

CSI Links Speed [Full-Speed]

Allows you to set the speed of CSI Links.

Configuration options: [Slow-Mode] [Full-Speed]

CSI Frequency [Auto]

Allows you to set the CSI frequency.

Configuration options: [Auto] [4.800GT] [5.866GT] [6.400GT]

CSI Isochronous [Disabled]

Configuration options: [Disabled] [Enabled]

CSI L0s [Disabled]

Configuration options: [Disabled] [Enabled]

CSI L1 [Disabled]

Configuration options: [Disabled] [Enabled]

Memory Frequency [Auto]

You may allow the system to detect DDR3 memory frequency via SPD or designate a specific frequency.

Configuration options: [Auto] [Force DDR-800] [Force DDR-1066]
[Force DDR-1333]

Memory Mode [Independent]

Allows you to set Memory channel mode.

Configuration options: [Independent] [Channel Mirroring] [Lockstep] [Sparing]

Memory ECC Function [Enabled]

Allows you to enable or disable Memory ECC function.

Configuration options: [Disabled] [Enabled]

Double Rate Refresh [Auto]

Configuration options: [Disabled] [Auto]

Demand Scrubbing [Enabled]

Enables or disables the ECC demand scrub.

Configuration options: [Disabled] [Enabled]

Patrol Scrubbing [Disabled]

Enables or disables the ECC patrol scrub.

Configuration options: [Disabled] [Enabled]

NUMA Aware [Auto]

Configuration options: [Disabled] [Enabled]

Page Poilcy [Closed]

Configuration options: [Closed] [Open]

Adaptive Page [Disabled]

Configuration options: [Disabled] [Enabled]

Data Scramble [Disabled]

Configuration options: [Disabled] [Enabled]

Split Below 4 GB [Disabled]

Configuration options: [Disabled] [Auto]

Channel Interleaving [6:1]

Allows you to set the channel interleaving setting.

Configuration options: [1:1] [2:1] [4:1] [6:1]

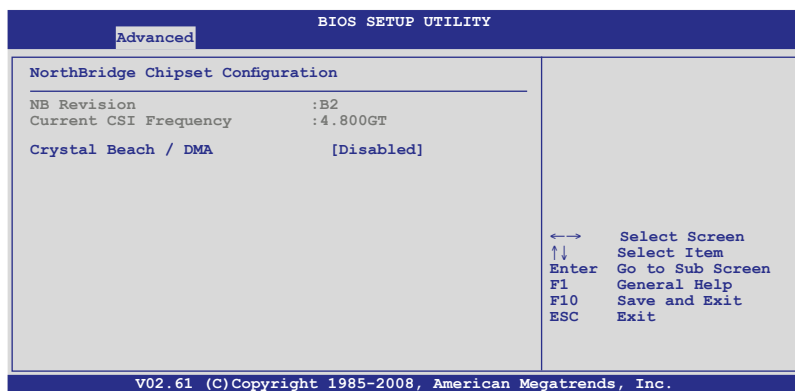
Rank Interleaving [4:1]

Allows you to set the rank interleaving setting.

Configuration options: [1:1] [2:1] [4:1]

North Bridge Configuration

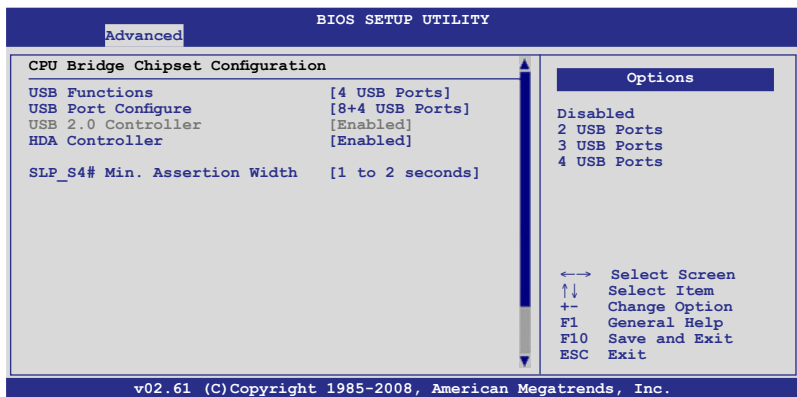
The North Bridge Configuration menu shows the auto-detected Northbridge values.



Crystal Beach / DMA [Disabled]

Configuration options: [Disabled] [Auto]

South Bridge Configuration



USB Functions [4 USB Ports]

Allows you to configure the amount of USB ports to be enabled.

Configuration options: [Disabled] [2 USB Ports] [3 USB Ports] [4 USB Ports]

USB Port Configure [8+4 USB Ports]

This item disappears when you set the **USB Functions** item to [Disabled].

Configuration options: [6+6 USB Ports] [8+4 USB Ports]

USB 2.0 Controller [Enabled]

Allows you to enable or disable the USB 2.0 controller. This item become unconfigurable if you set the **USB Functions** item to [10 USB Ports] or [12 USB Ports]. Configuration options: [Enabled] [Disabled]

HDA Controller [Enabled]

Allows you to enable or disable the High Definition Audio controller.

Configuration options: [Enabled] [Disabled]

SLP_S4# Min. Assertion Width [1 to 2 seconds]

Configuration options: [4 to 5 seconds] [3 to 4 seconds] [2 to 3 seconds]

[1 to 2 seconds]

Intel VT-d Configuration

| BIOS SETUP UTILITY | |
|--|---|
| Advanced | |
| Inel VT-d [Disabled] | <div>Options</div> <div>Disabled Enabled</div> <div>←→ Select Screen ↑↓ Select Item +- Change Option F1 General Help F10 Save and Exit ESC Exit</div> |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

Configuration options: [Disabled] [Enabled]

4.4.3 Legacy Device Configuration

| BIOS SETUP UTILITY | |
|---|---|
| Advanced | |
| <div>Legacy Device Configuration</div> <div>Serial Port1 Address [3F8/IRQ4] Serial Port2 Address [2F8/IRQ3]</div> | <div>Allows BIOS to Enable or Disable Floppy Controller.</div> <div>←→ Select Screen ↑↓ Select Item +- Change Option F1 General Help F10 Save and Exit ESC Exit</div> |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

Serial Port1 Address [3F8/IRQ4]

Allows you to select the Serial Port1 base address.

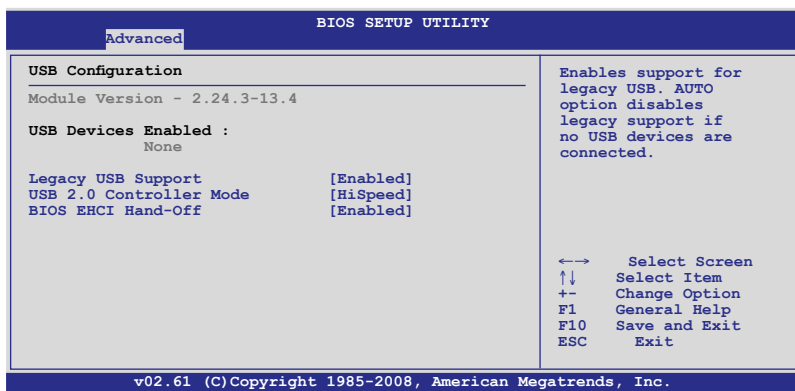
Configuration options: [Disabled] [3F8/IRQ4] [3E8/IRQ4] [2E8/IRQ3]

Serial Port2 Address [2F8/IRQ3]

Allows you to select the Serial Port2 base address.

Configuration options: [Disabled] [2F8/IRQ3] [3E8/IRQ4] [2E8/IRQ3]

4.4.4 USB Configuration



The following item appears only when you set **USB Function** to [Enabled].

Legacy USB Support [Enabled]

Allows you to enable or disable support for legacy USB devices. Setting to [Auto] allows the system to detect the presence of USB devices at startup. If detected, the USB controller legacy mode is enabled. If no USB device is detected, the legacy USB support is disabled. Configuration options: [Disabled] [Enabled] [Auto]



The following item appears only when you set **USB Function** to [Enabled].

USB 2.0 Controller Mode [HiSpeed]

Allows you to set the USB 2.0 controller to HiSpeed (480Mbps) or FullSpeed (12Mbps). Configuration options: [FullSpeed] [HiSpeed]

BIOS EHCI Hand-Off [Enabled]

Enables or disables the BIOS EHCI hand-off support.
Configuration options: [Disabled] [Enabled]

4.4.5 PCIPnP

The PCIPnP menu items allow you to change the advanced settings for PCI/PnP devices.



Take caution when changing the settings of the PCI/PnP Configuration menu items. Incorrect field values can cause the system to malfunction.

Advanced

BIOS SETUP UTILITY

Advanced PCI/PnP Settings

WARNING: Setting wrong values in below sections may cause system to malfunction.

Plug And Play O/S

[No]

PCI Option ROM Scan Order

[Bus 0 First]

Onboard Option ROM Priority

[High]

Onboard LAN1 Boot

[PXE]

Onboard LAN2 Boot

[PXE]

NO: lets the BIOS configure all the devices in the system.

YES: lets the operating system configure Plug and Play (PnP) devices not required for boot if your system has a Plug and Play operating system.

←→

Select Screen

↑↓

Select Item

+−

Change Option

F1

General Help

F10

Save and Exit

ESC

Exit

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Plug And Play O/S [No]

When set to [No], BIOS configures all the devices in the system. When set to [Yes] and if you install a Plug and Play operating system, the operating system configures the Plug and Play devices not required for boot.
Configuration options: [No] [Yes]

PCI Option ROM Scan Order [Bus 0 First]

Allows you to select the PCI option ROM scanning order. The scanning of the option ROM will start from the lowest bus, device, function number if you set this item to [Bus 0 First]; the scanning starts from the highest bus, device, function number if you set this item to [Bus N First].
Configuration options: [Bus 0 First] [Bus N First]

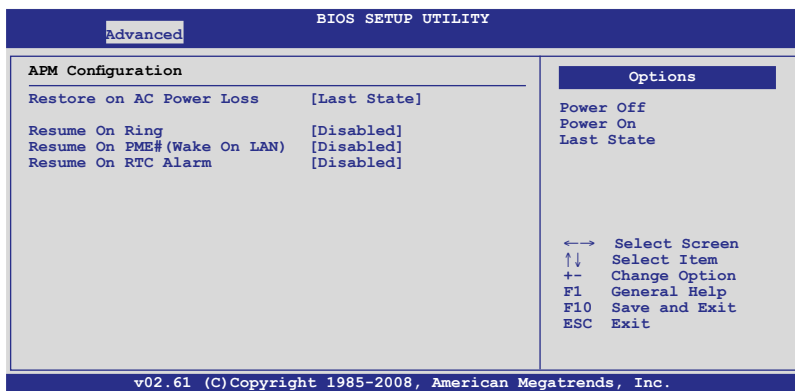
Onboard Option ROM Priority [High]

Allows you to select the onboard option ROM priority.
Configuration options: [Normal] [High]

Onboard LAN1/2 Boot [PXE]

Allows you to configure the onboard LAN1/2 boot mode.
Configuration: [Disabled] [PXE] [iSCSI]

4.4.6 Power On Configuration



Restore on 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]

Resume On Ring [Disabled]

When set to [Enabled], the system enables RI to generate a wake event while the computer is in Soft-off mode. Configuration options: [Disabled] [Enabled]

Resume On PME# (Wake On LAN) [Disabled]

When set to [Enabled], the system enables PME to generate a wake event while the computer is in Soft-off mode. Configuration options: [Disabled] [Enabled]

Resume On RTC Alarm [Disabled]

Allows you to enable or disable RTC to generate a wake-up event.

Configuration options: [Disabled] [Enabled]



The following items appear only when the **Resume On RTC Alarm** item is set to [Enabled].

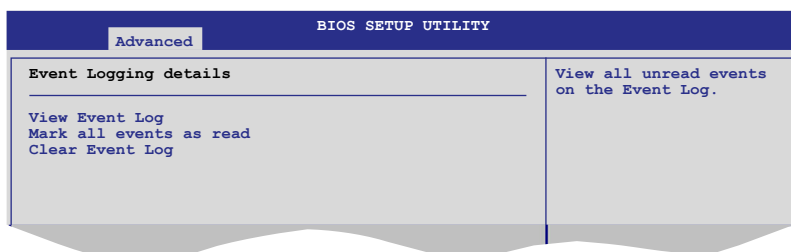
RTC Alarm Date [15]

To set the alarm date, highlight this item and press the <+> or <-> key to make the selection.

System Time [12:30:30]

Use the <ENTER>, <TAB> or <SHIFT-TAB> key to select a field. Use the <+> or <-> key to configure alarm time.

4.4.7 Event Log Configuration



View Event Log

Press <Enter> to read all the unread event log.

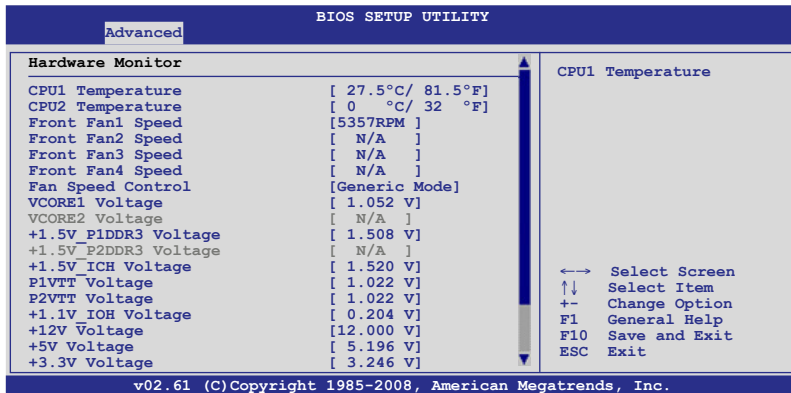
Mark all events as read

Press <Enter> to mark all the events as read.

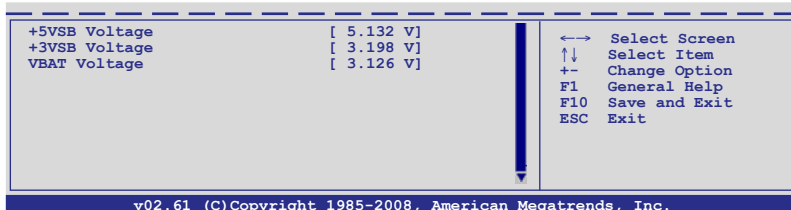
Clear Event Log

Press <Enter> to clear all events on the event log.

4.4.8 Hardware Monitor



Scroll down for more items.



CPU1/2 Temperature [xxx°C/xxx°F]

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

Front Fan1–4 Speed [xxxxRPM] or [Ignored] / [N/A]

The onboard hardware monitor automatically detects and displays the speed of CPU fans, front fans, and rear fans in rotations per minute (RPM). If the fan is not connected to the motherboard, the field shows [N/A].

Fan Speed Control [Generic Mode]

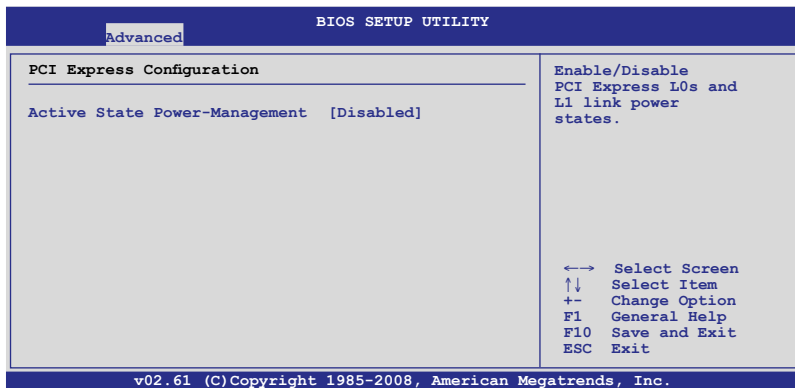
Allows you to configure the ASUS Smart Fan feature that smartly adjusts the fan speeds for more efficient system operation.

Configuration options: [Full Speed Mode] [Whisper Mode] [Generic Mode] [High Density Mode]

VCORE1/2 Voltage, +1.5V_P1/2DDR3 Voltage, +1.5V_ICH Voltage, P1/2VTT Voltage, +1.1V_IOH Voltage, +12V Voltage, +5V Voltage, +3.3V Voltage, +5VSB Voltage, +3VSB Voltage, VBAT Voltage

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

4.4.9 PCI Express Configuration

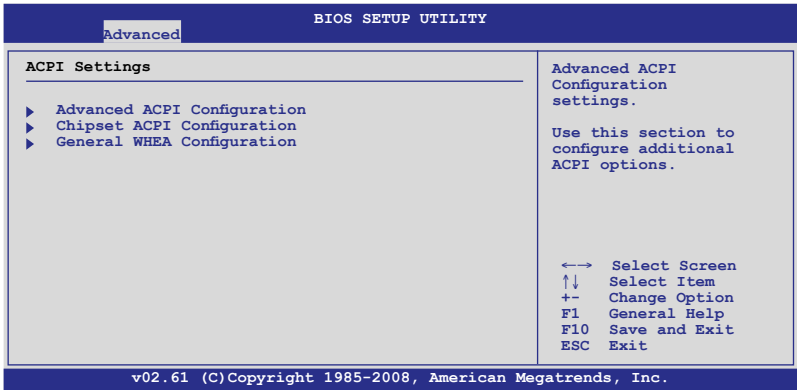


Active State Power-Management [Disabled]

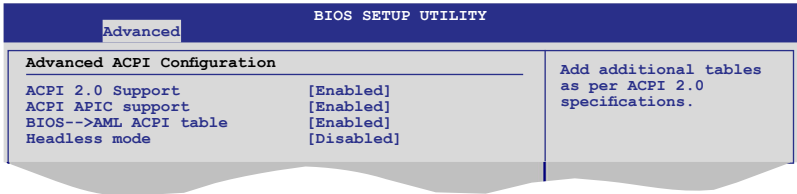
Enables or disables the PCI Express L0s and L1 link power states.

Configuration options: [Disabled] [Enabled]

4.4.10 ACPI Configuration



Advanced ACPI Configuration



ACPI 2.0 Support [Enabled]

Specifies the Advanced Configuration and Power Interface (ACPI) version supported. Configuration options: [Disabled] [Enabled]

ACPI APIC Support [Enabled]

Allows you to enable or disable the Advanced Configuration and Power Interface (ACPI) support in the Advanced Programmable Interrupt Controller (APIC). When set to [Enabled], the ACPI APIC table pointer is included in the RSDT pointer list. Configuration options: [Disabled] [Enabled]

BIOS-->AML ACPI table [Enabled]

Allows you to include the BIOS-->AML exchange table pointer to (X)RSDT pointer list. Configuration options: [Disabled] [Enabled]

Headless mode [Disabled]

Allows you to enable or disable the Headless operation mode through ACPI. Configuration options: [Disabled] [Enabled]

Chipset ACPI Configuration

| BIOS SETUP UTILITY | |
|---------------------------------|---------------------|
| Advanced | |
| South Bridge ACPI Configuration | Options |
| Energy Lake Feature | [Disabled] |
| APIC ACPI SCI IRQ | [Disabled] |
| USB Device Wakeup From S3/S4 | [Disabled] |
| High Performance Event Timer | [Disabled] |
| | Enabled Disabled |

Energy Lake Feature [Disabled]

Allows you to enable or disable the Energy Lake feature.

Configuration options: [Enabled] [Disabled]

APIC ACPI SCI IRQ [Disabled]

Allows you to enable or disable the APIC ACPI SCI IRQ feature.

Configuration options: [Disabled] [Enabled]

USB Device Wakeup From S3/S4 [Disabled]

Allows you to enable or disable the USB device wakeup from S3/S4 feature.

Configuration options: [Disabled] [Enabled]

High Performance Event Timer [Disabled]

Allows you to enable or disable the High Performance Event Timer feature.

Configuration options: [Disabled] [Enabled]

General WHEA Configuration

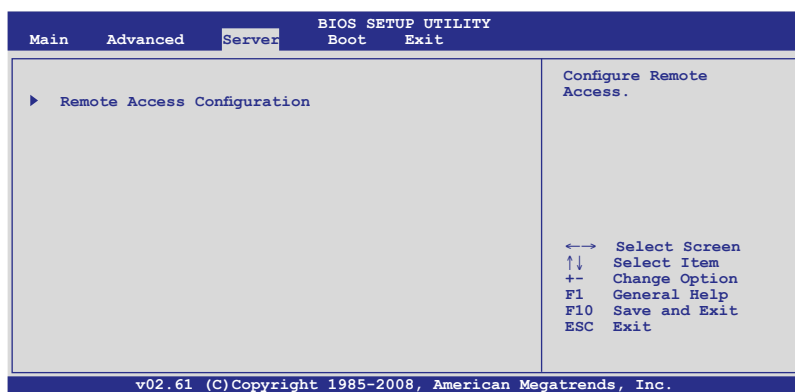
| BIOS SETUP UTILITY | |
|----------------------------|--|
| Advanced | |
| General WHEA Configuration | |
| WHEA Support | [Enabled] |
| | Enable or disable Windows Hardware Error Architecture. |

WHEA Support [Enabled]

Allows you to enable or disable the Windows Hardware Error Architecture (WHEA) support.

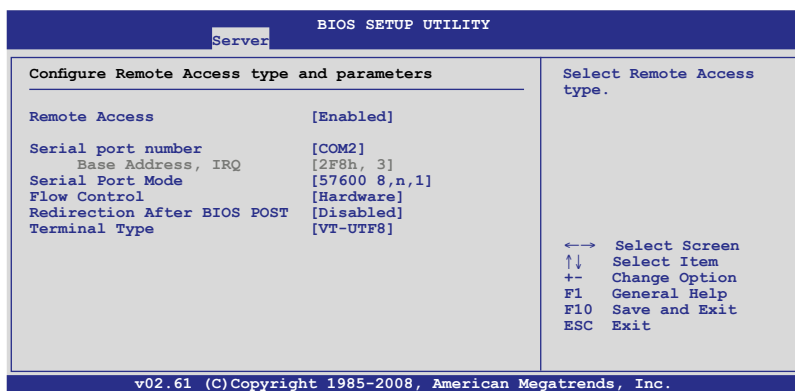
Configuration options: [Disabled] [Enabled]

4.5 Server menu



4.5.1 Remote Access Configuration

The items in this menu allows you to configure the Remote Access features. Select an item then press <Enter> to display the configuration options.



Remote Access [Enabled]

Enables or disables the remote access feature.

Configuration options: [Disabled] [Enabled]



The following items appear only when **Remote Access** is set to [Enabled].

Serial port number [COM2]

Selects the serial port for console redirection.

Configuration options: [COM1] [COM2]

Base Address. IRQ [2F8h, 3]

This item is not user-configurable and changes with the configuration of **Serial port number**.

Serial Port Mode [57600 8,n,1]

Sets the Serial port mode.

Configuration options: [115200 8,n,1] [57600 8,n,1] [38400 8,n,1] [19200 8,n,1] [09600 8,n,1]

Flow Control [Hardware]

Allows you to select the flow control for console redirection.

Configuration options: [None] [Hardware] [Software]

Redirection After BIOS POST [Disabled]

Sets the redirection mode after the BIOS Power-On Self-Test (POST). Some operating system may not work when set to [Always].

Configuration options: [Disabled] [Boot Loader] [Always]

Terminal Type [VT-UTF8]

Allows you to select the target terminal type.

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

4.6 Boot menu

The Boot menu items allow you to change the system boot options. Select an item then press <Enter> to display the sub-menu.

| BIOS SETUP UTILITY | |
|---|--|
| Main Advanced Server | Boot Exit |
| <div>Boot Settings</div> <div>▶ Boot Device Priority</div> <div>▶ Boot Settings Configuration</div> <div>▶ Security</div> | <div>Specifies the Boot Device Priority sequence.</div> <div>A virtual floppy disk drive (Floppy Drive B:) may appear when you set the CD-ROM drive as the first boot device.</div> <div>←→ Select Screen</div> <div>↑↓ Select Item</div> <div>Enter Go to Sub Screen</div> <div>F1 General Help</div> <div>F10 Save and Exit</div> <div>ESC Exit</div> |
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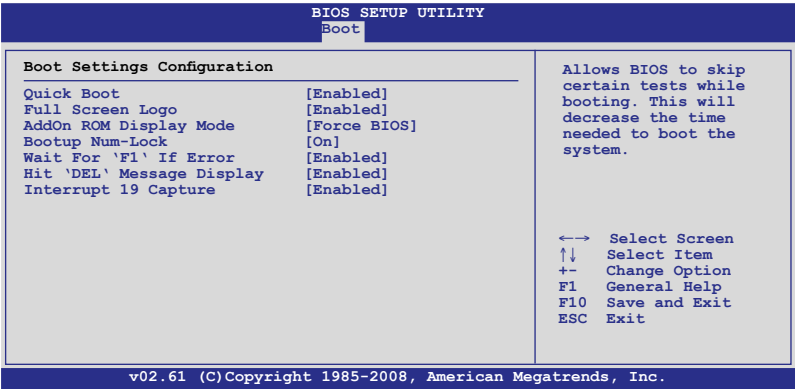
4.6.1 Boot Device Priority

| BIOS SETUP UTILITY | |
|---|---|
| | Boot |
| <div>Boot Device Priority</div> <div>1st Boot Device [Removable Dev.]</div> <div>2nd Boot Device [ATAPI CD-ROM]</div> <div>3rd Boot Device [Hard Drive]</div> <div>4th Boot Device [Network:IBA GE Slo]</div> <div>5th Boot Device [Network:IBA GE Slo]</div> | <div>Specifies the Boot Device Priority sequence.</div> <div>A device enclosed in parenthesis has been disabled in the corresponding type menu.</div> <div>←→ Select Screen</div> <div>↑↓ Select Item</div> <div>+− Change Option</div> <div>F1 General Help</div> <div>F10 Save and Exit</div> <div>ESC Exit</div> |
| v02.61 (C)Copyright 1985-2008, American Megatrends, Inc. | |

1st—xxth Boot Device [XXXXXXX]

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. Configuration options: [xxxxx Drive] [Disabled]

4.6.2 Boot Settings Configuration



Quick Boot [Enabled]

Enabling this item allows the BIOS to skip some power on self tests (POST) while booting to decrease the time needed to boot the system. When set to [Disabled], BIOS performs all the POST items.

Configuration options: [Disabled] [Enabled]

Full Screen Logo [Enabled]

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

Configuration options: [Disabled] [Enabled]



Set this item to [Enabled] to use the ASUS MyLogo2™ feature.

AddOn ROM Display Mode [Force BIOS]

Allows you to set the display mode for Options ROM.

Configuration options: [Force BIOS] [Keep Current]

Bootup Num-Lock [On]

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

Configuration options: [Off] [On]

Wait For 'F1' If Error [Enabled]

When set to [Enabled], the system waits for the <F1> key to be pressed when error occurs. Configuration options: [Disabled] [Enabled]

Hit 'DEL' Message Display [Enabled]

When set to [Enabled], the system displays the message "Press DEL to run Setup" during POST. Configuration options: [Disabled] [Enabled]

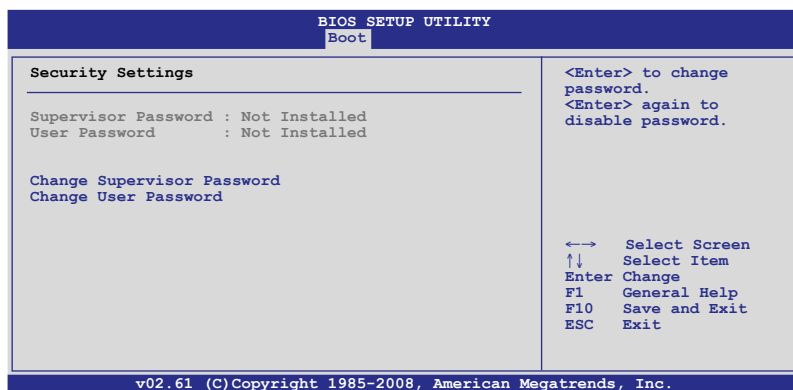
Interrupt 19 Capture [Enabled]

When set to [Enabled], this function allows the option ROMs to trap Interrupt 19.

Configuration options: [Disabled] [Enabled]

4.6.3 Security

The Security menu items allow you to change the system security settings. Select an item then press <Enter> to display the configuration options.



Change Supervisor Password

Select this item to set or change the supervisor password. The **Supervisor Password** item on top of the screen shows the default **Not Installed**. After you set a password, this item shows **Installed**.

To set a Supervisor Password:

1. Select the **Change Supervisor Password** item and press <Enter>.
2. From the password box, type a password composed of at least six letters and/or numbers, then press <Enter>.
3. Confirm the password when prompted.

The message "Password Installed" appears after you successfully set your password.

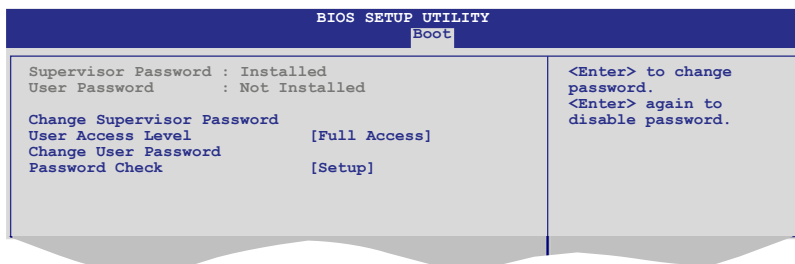
To change the supervisor password, follow the same steps as in setting a user password.

To clear the supervisor password, select the **Change Supervisor Password** then press <Enter>. The message "Password Uninstalled" appears.



If you forget your BIOS password, you can clear it by erasing the CMOS Real Time Clock (RTC) RAM. See section **2.6 Jumper** for information on how to erase the RTC RAM.

After you have set a supervisor password, the other items appear to allow you to change other security settings.



User Access Level [Full Access]

This item allows you to select the access restriction to the Setup items.

Configuration options: [No Access] [View Only] [Limited] [Full Access]

[No Access] prevents user access to the Setup utility.

[View Only] allows access but does not allow change to any field.

[Limited] allows changes only to selected fields, such as Date and Time.

[Full Access] allows viewing and changing all the fields in the Setup utility.

Change User Password

Select this item to set or change the user password. The **User Password** item on top of the screen shows the default **Not Installed**. After you set a password, this item shows Installed.

To set a User Password:

1. Select the **Change User Password** item and press <Enter>.
2. On the password box that appears, type a password composed of at least six letters and/or numbers, then press <Enter>.
3. Confirm the password when prompted.

The message "Password Installed" appears after you set your password successfully.

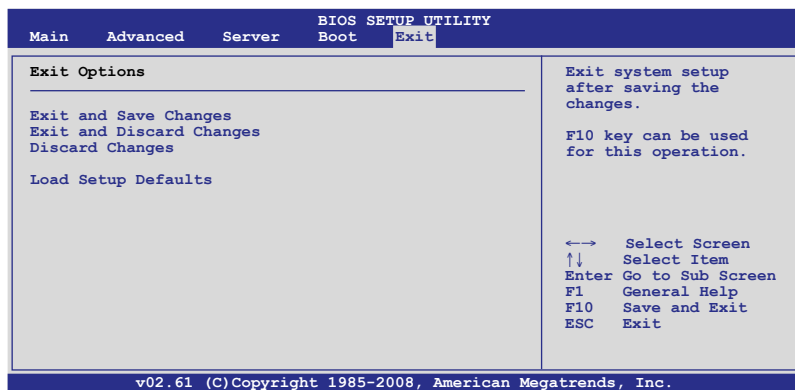
To change the user password, follow the same steps as in setting a user password.

Password Check [Setup]

When set to [Setup], BIOS checks for user password when accessing the Setup utility. When set to [Always], BIOS checks for user password both when accessing Setup and booting the system. Configuration options: [Setup] [Always]

4.7 Exit menu

The Exit menu items allow you to load the optimal or failsafe default values for the BIOS items, and 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.

Exit and Save Changes

Once you are finished making your selections, choose this option from the Exit menu to ensure the values you selected are saved to the CMOS RAM. An onboard backup battery sustains the CMOS RAM so it stays on even when the PC is turned off. When you select this option, a confirmation window appears. Select **YES** to save changes and exit.



If you attempt to exit the Setup program without saving your changes, the program prompts you with a message asking if you want to save your changes before exiting. Press <Enter> to save the changes while exiting.

Exit and Discard Changes

Select this option only if you do not want to save the changes that you made to the Setup program. If you made changes to fields other than System Date, System Time, and Password, the BIOS asks for a confirmation before exiting.

Discard Changes

This option allows you to discard the selections you made and restore the previously saved values. After selecting this option, a confirmation appears. Select **YES** to discard any changes and load the previously saved values.

Load Setup Defaults

This option allows you to load the default values for each of the parameters on the Setup menus. When you select this option or if you press <F5>, a confirmation window appears. Select **YES** to load default values. Select **Exit & Save Changes** or make other changes before saving the values to the non-volatile RAM.

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

5 RAID configuration

Chapter summary

5

| | | |
|-----|--|------|
| 5.1 | Setting up RAID..... | 5-3 |
| 5.2 | LSI Software RAID Configuration Utility | 5-5 |
| 5.3 | Intel® Matrix Storage Manager Option ROM Utility | 5-25 |

5.1 Setting up RAID

The motherboard comes with the following RAID solutions:

The motherboard comes with the Intel® ICH10R southbridge controller that supports the following SATA RAID solutions:

- **LSI Software RAID Configuration Utility** (default) with RAID 0, RAID 1, and RAID 10 support (for both Linux and Windows OS).
- **Intel Matrix Storage Manager** with RAID 0, RAID 1, RAID 10, and RAID 5 support (for Windows OS only).

5.1.1 RAID definitions

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

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

RAID 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 CD to a floppy disk before you install an operating system to the selected hard disk drive.

5.1.2 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.

5.1.3 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® ICH10R chipset. To do this:

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



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

5.1.4 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 **LSI Logic Embedded SATA RAID Setup Utility** or the **Intel® Matrix Storage Manager** if you installed Serial ATA hard disk drives on the Serial ATA connectors supported by the Intel® ICH10R chipset.

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

5.2 LSI Software RAID Configuration Utility

The LSI MegaRAID software RAID configuration utility allows you to create RAID 0, RAID 1, or RAID 10 set(s) from SATA hard disk drives connected to the SATA connectors supported by the motherboard southbridge chip.

To enter the LSI MegaRAID software RAID configuration utility

1. Turn on the system after installing all the SATA hard disk drives.
2. During POST, the LSI MegaRAID software RAID configuration utility automatically detects the installed SATA hard disk drives and displays any existing RAID set(s). Press <Ctrl> + <M> to enter the utility.

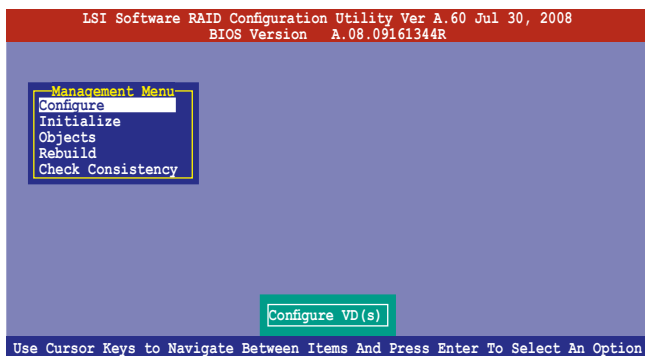
```
LSI MegaRAID Software RAID BIOS Version A.08 09161344R
LSI SATA RAID Found at PCI Bus No: Dev No:1F
Device present at Port 0      ST3160812AS      152114MB
Device present at Port 1      ST3160812AS      152114MB
Device present at Port 2      ST3160812AS      152114MB
Device present at Port 3      ST3160812AS      152114MB
Press Ctrl-M or Enter to run LSI Software RAID Setup Utility.
```



- The LSI MegaRAID software RAID configuration utility automatically configures to RAID 1 when the SATA to RAID Mode is enabled.
- The RAID setup screens shown in this section are for reference only and may not exactly match the items on your screen due to the controller version difference.
- When you create RAID sets with the LSI MegaRAID software RAID configuration utility, the boot priority of the SATA optical drive has to be manually adjusted. Otherwise, the system will not boot from the connected SATA ODD.

3. The utility main window appears. Use the arrow keys to select an option from the **Management Menu** and then press <Enter>. Refer to the Management Menu descriptions on the next page.

At the bottom of the screen is the legend box. The keys on the legend box allow you to navigate through the setup menu options or execute commands. The keys on the legend box vary according to the menu level.



| Menu | Description |
|--------------------------|---|
| Configure | Allows you to create RAID 0, RAID 1 or RAID 10 set using the Easy Configuration or the New Configuration command. This menu also allows you to view, add, or clear RAID configurations or select the boot drive |
| Initialize | Allows you to initialize the virtual drives of a created RAID set |
| Objects | Allows you to initialize virtual drives or change the virtual drive parameters |
| Rebuild | Allows you to rebuild failed drives |
| Check Consistency | Allows you to check the data consistency of the virtual drives of a created RAID set |

5.2.1 Creating a RAID set

The LSI Software RAID Configuration Utility allows you to create a RAID 0, RAID 1, or RAID 10 set using two types of configurations: **Easy** and **New**.

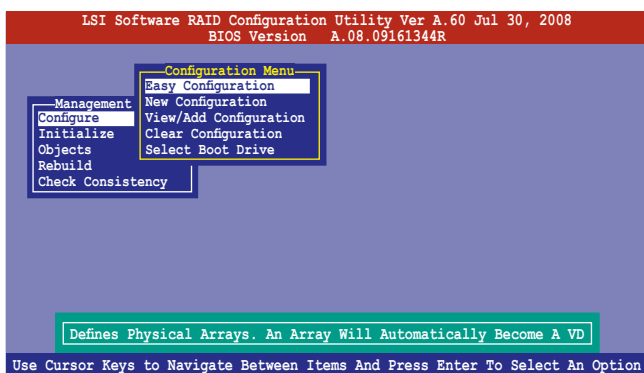
In **Easy Configuration**, the virtual drive parameters are set automatically.

In **New Configuration**, you manually set the virtual drive parameters.

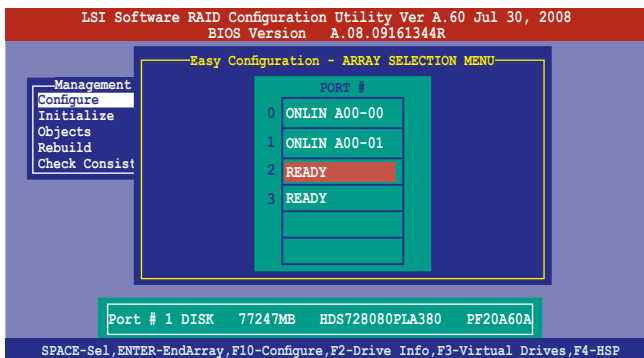
Using Easy Configuration

To create a RAID set using the **Easy Configuration** option

1. From the **Management Menu**, select **Configure > Easy Configuration**, and then press <Enter>.

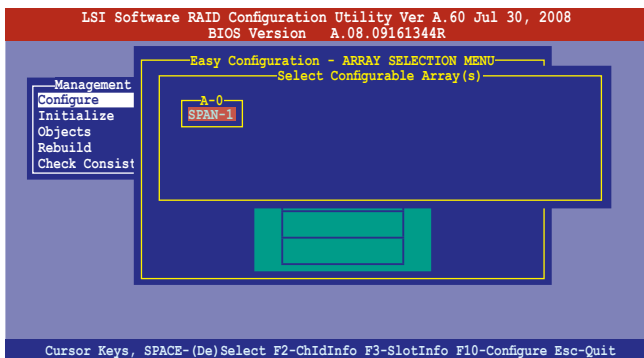


- The **ARRAY SELECTION MENU** displays the available drives connected to the SATA ports. Use the up/down arrow key to select the drives you want to include in the RAID set, and then press <Space>. When selected, the drive indicator changes from **READY** to **ONLIN A[X]-[Y]**, where X is the array number, and Y is the drive number.

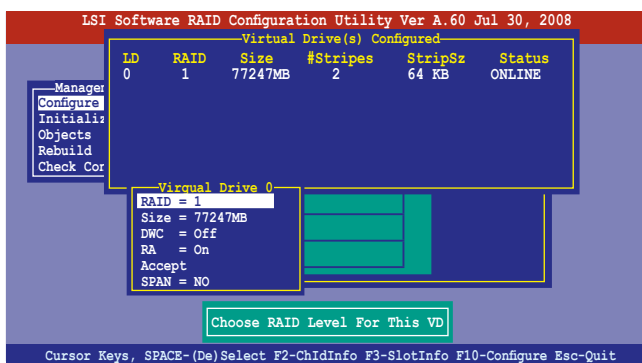


- The information of the selected hard disk drive displays at the bottom of the screen.
- You need at least two identical hard disk drives when creating a RAID 1 set.
- You need at least four identical hard disk drives when creating a RAID 10 set.

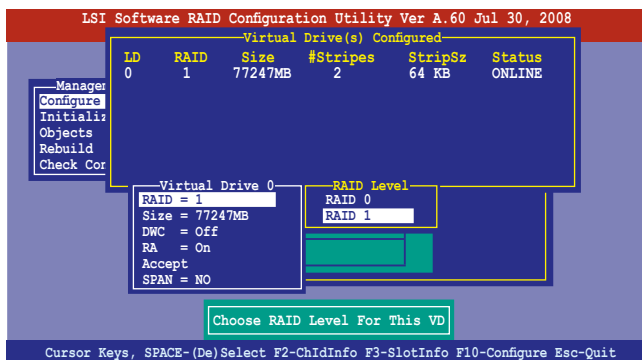
- Select all the drives required for the RAID set, and then press <F10> to configure array setting.
- Press <Space> to select the configurable array.



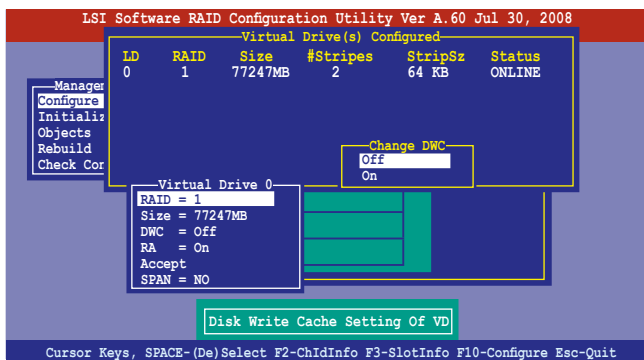
- Press <F10> again, the virtual drive information appears including a **Virtual Drive** menu that allows you to change the virtual drive parameters.



- Select **RAID** from the **Virtual Drive** sub-menu, and then press <Enter>.
- Select the **RAID** level from the menu, and then press <Enter>.

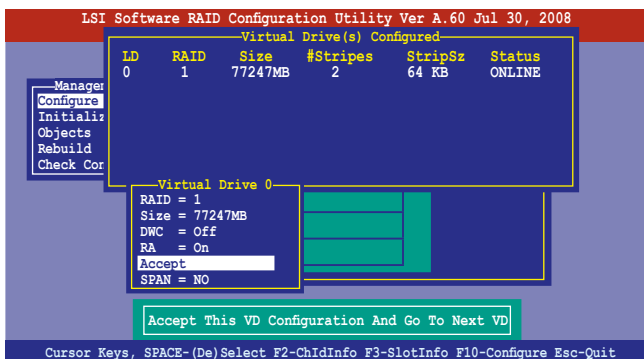


8. When creating a **RAID 1** or a **RAID 10** set, select **DWC** from the **Virtual Drive** menu, and then press <Enter>.
- When creating a **RAID 0** set, proceed to step 10.
9. Select **On** to enable the **Disk Write Cache** setting, and then press <Enter>.

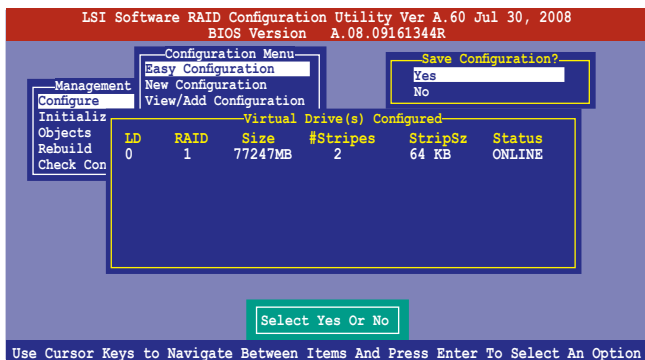


Enabling DWC can improve the performance, but with the risk of data loss.

10. When finished setting the selected virtual drive configuration, select **Accept** from the menu, and then press <Enter>.



11. Follow step 2 to 10 to configure additional virtual drives.
12. Press <Esc> to finish RAID configuration. When prompted to save configuration, select **Yes** from the menu, and then press <Enter>.



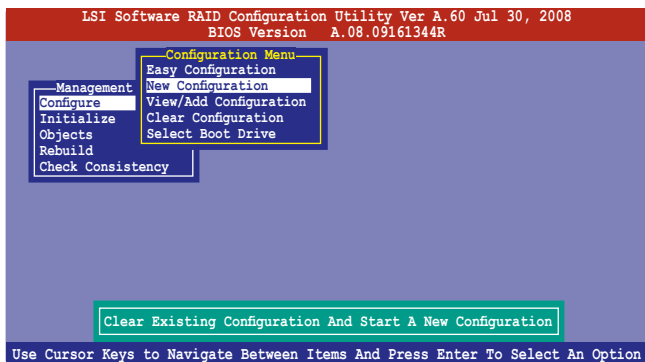
Using New Configuration



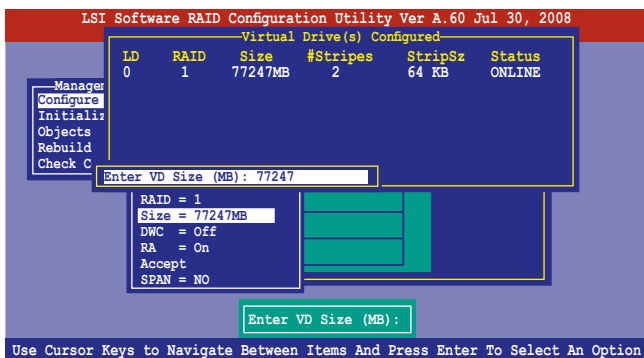
When a RAID set already exists, using the **New Configuration** command erases the existing RAID configuration data. If you do not want to delete the existing RAID set, use the **View/Add Configuration** command to view or create another RAID configuration.

To create a RAID set using the **New Configuration** option

1. From the **Management Menu**, select **Configure > New Configuration**, and then press <Enter>.



2. Follow step 2 to 7 of the previous section: **Using Easy Configuration.**
3. Select **Size** from the **Virtual Drive** menu, and then press <Enter>.
4. Key-in the desired virtual drive size, and then press <Enter>.



5. Follow step 8 to 12 of the previous section: **Using Easy Configuration** to create the RAID set.

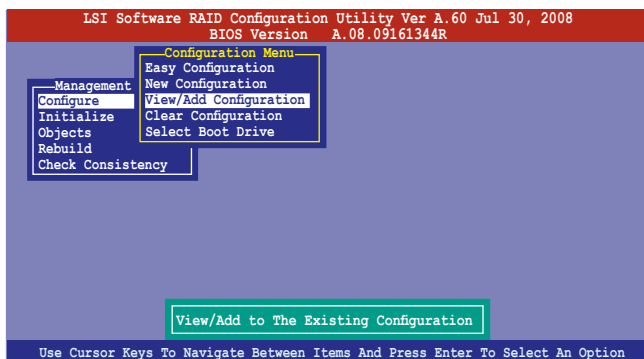
5.2.2 Adding or viewing a RAID configuration

You can add a new RAID configuration or view an existing configuration using the **View/Add Configuration** command.

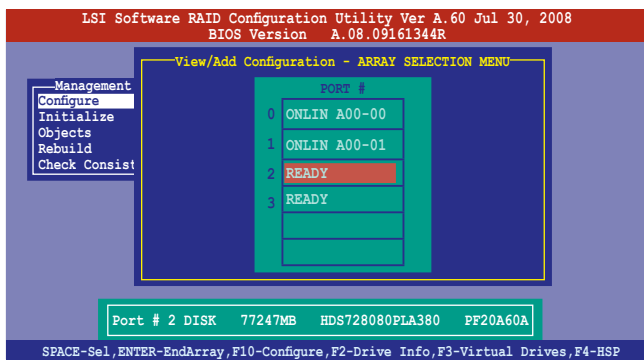
Adding a new RAID configuration

To add a new RAID configuration:

1. From the **Management Menu**, select **Configure > View/Add Configuration**, and then press <Enter>.



2. The **ARRAY SELECTION MENU** displays the available drives connected to the SATA ports. Select the drive(s) you want to include in the RAID set, then press <Space>. When selected, the drive indicator changes from **READY** to **ONLIN A[X]-[Y]**, where X is the array number, and Y is the drive number.



The information of the selected hard disk drive displays at the bottom of the screen.

3. Follow step 3 to 12 of section **5.2.1 Creating a RAID set: Using Easy Configuration** to add a new RAID set.

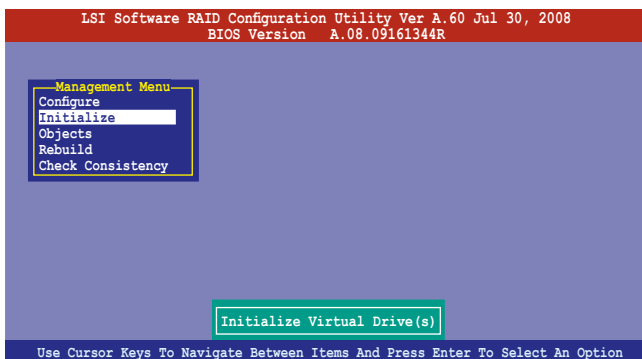
5.2.3 Initializing the virtual drives

After creating the RAID set(s), you must initialize the virtual drives. You may initialize the virtual drives of a RAID set(s) using the **Initialize** or **Objects** command on the **Management Menu**.

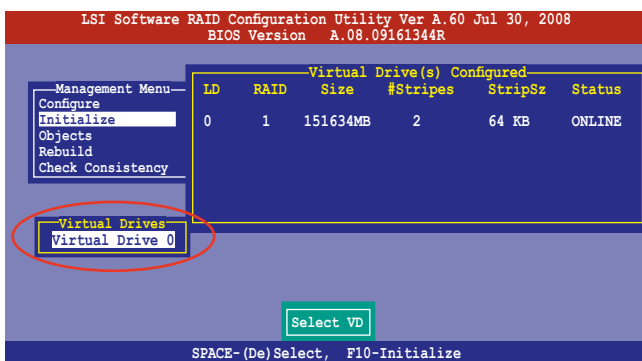
Using the Initialize command

To initialize the virtual drive using the Initialize command

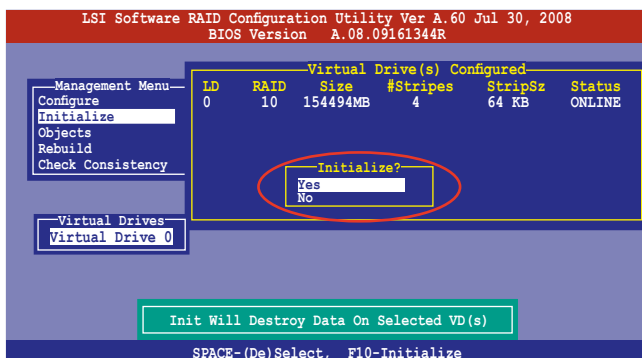
1. From the **Management Menu**, select **Initialize**, and then press <Enter>.



2. The screen displays the available RAID set(s) and prompts you to select the virtual drive to initialize. Use the arrow keys to select the virtual drive from the **Virtual Drive** selection, and then press <Space>.

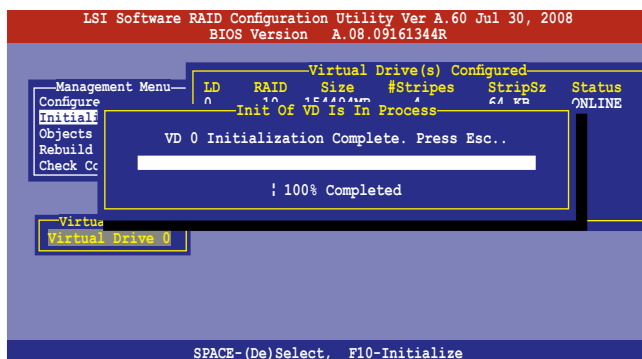


- Press <F10> to start initialization. When prompted, select **Yes** from the **Initialize?** dialog box, and then press <Enter>.



Initializing a virtual drive erases all data on the drive.

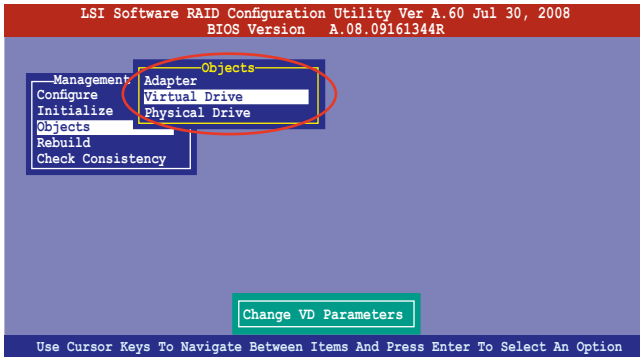
- A progress bar appears on screen. If desired, press <Esc> to abort initialization. When initialization is completed, press <Esc>.



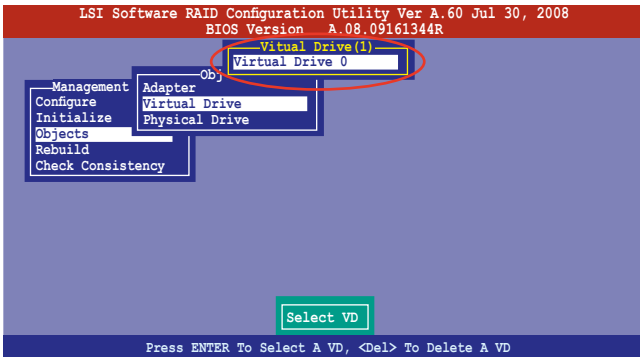
Using the Objects command

To initialize the virtual drives using the **Objects** command

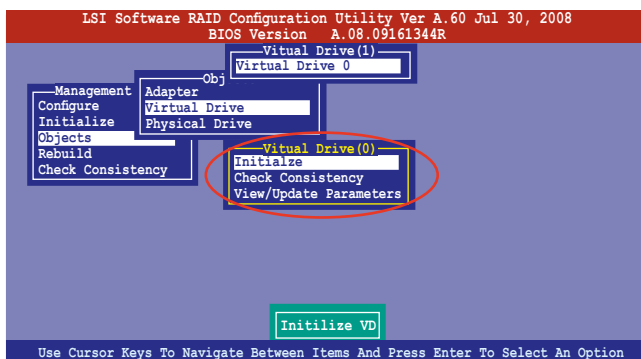
1. From the **Management Menu**, select **Objects > Virtual Drive**, and then press <Enter>.



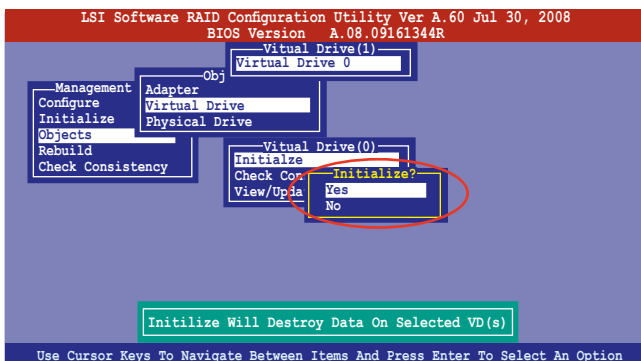
2. Select the virtual drive to initialize from the **Virtual Drives** sub-menu, and then press <Enter>.



3. Select **Initialize** from the pop-up menu, and then press <Enter> to start initialization.



4. When prompted, press the <Space> to select **Yes** from the **Initialize?** dialog box, and then press <Enter>.



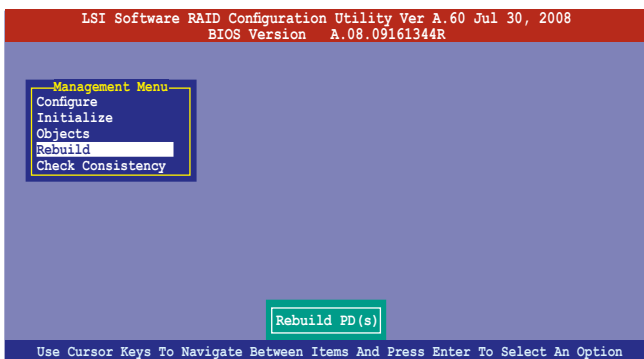
5. A progress bar appears on screen. If desired, press <Esc> to abort initialization. When initialization is completed, press <Esc>.

5.2.4 Rebuilding failed drives

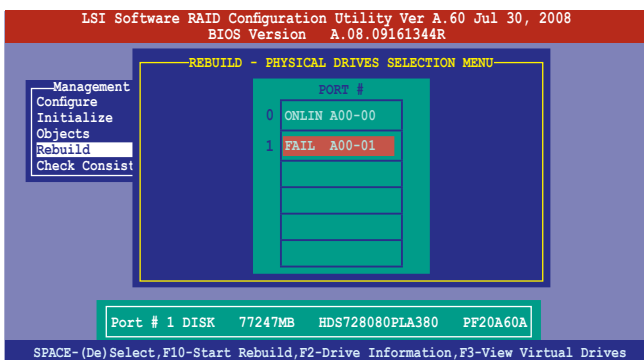
You can manually rebuild failed hard disk drives using the **Rebuild** command in the **Management Menu**.

To rebuild a failed hard disk drive

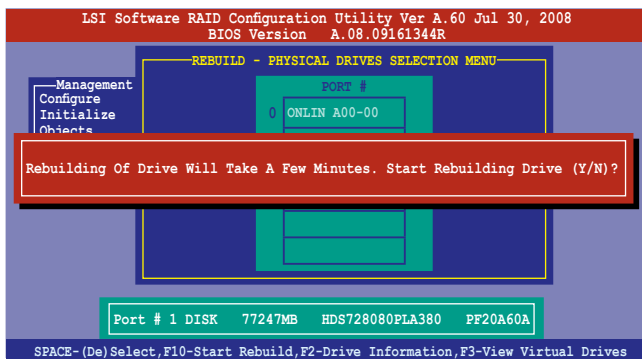
1. From the **Management Menu**, select **Rebuild**, and then press <Enter>.



2. The **PHYSICAL DRIVES SELECTION MENU** displays the available drives connected to the SATA ports. Select the drive you want to rebuild, and then press <Space>.



3. After selecting the drive to rebuild, press <F10>. When prompted, press <Y> to rebuild the drive.



4. When rebuild is complete, press any key to continue.

5.2.5 Checking the drives for data consistency

You can check and verify the accuracy of data redundancy in the selected virtual drive. The utility can automatically detect and/or detect and correct any differences in data redundancy depending on the selected option in the **Objects > Adapter** menu.

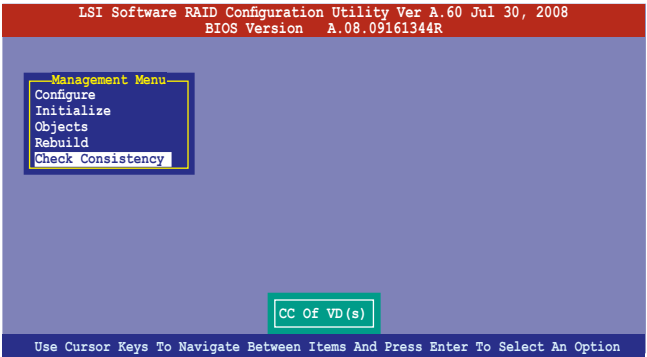


The **Check Consistency** command is available only for virtual drives included in a RAID 1 or RAID 10 set.

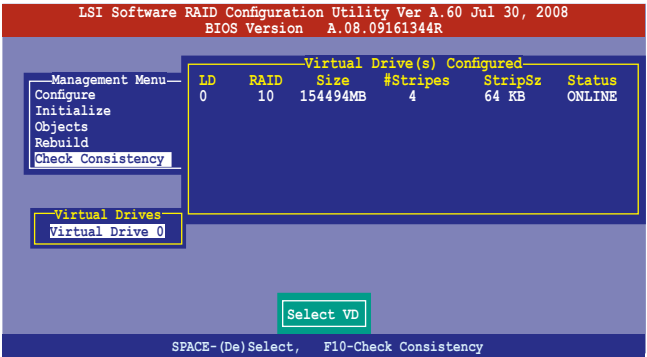
Using the Check Consistency Command

To check data consistency using the **Check Consistency** command

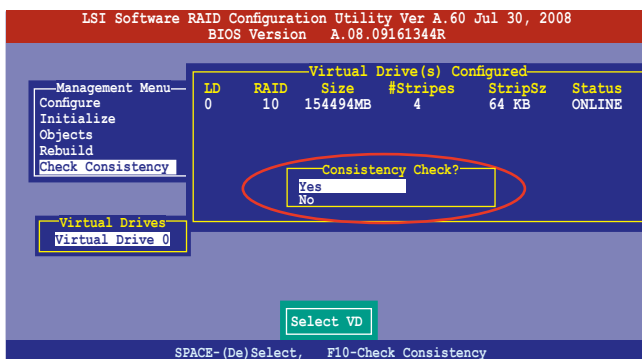
1. From the **Management Menu**, select **Check Consistency**, and then press <Enter>.



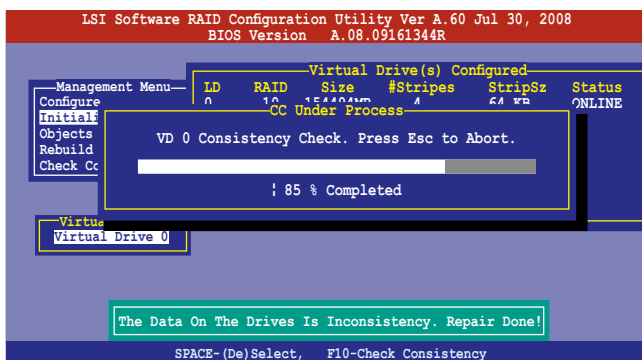
2. The screen displays the available RAID set(s) and prompts you to select the virtual drive to check. Press <Space> to select the virtual drive from the **Virtual Drive** sub-menu, and then press <F10>.



3. When prompted, use the arrow keys to select **Yes** from the **Consistency Check?** dialog box, and then press <Enter>.



A progress bar appears on screen.



4. While checking the disk consistency, press <Esc> to display the following options.
 - **Stop** - Stops the consistency check. The utility stores the percentage of disk checked, and when you restart checking, it continues from the last percentage completed rather than from zero percent.
 - **Continue** - Continues the consistency check.
 - **Abort** - Aborts the consistency check. When you restart checking, it continues from zero percent.
5. When checking is complete, press any key to continue.

Using the Objects command

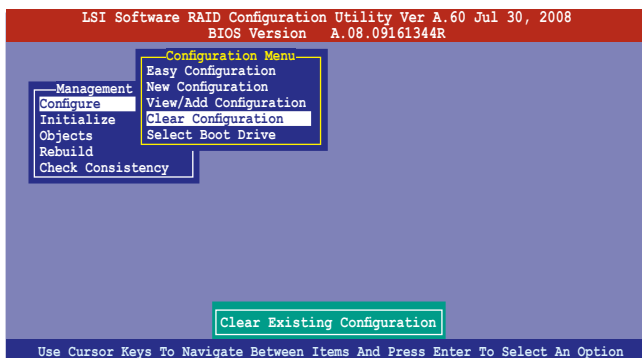
To check data consistency using the **Objects** command

1. From the **Management Menu**, select **Objects**, and then select **Virtual Drive** from the sub-menu.
2. Use the arrow keys to select the virtual drive you want to check, and then press <Enter>.
3. Select **Check Consistency** from the pop-up menu, and then press <Enter>.
4. When prompted, use the arrow keys to select **Yes** from the dialog box to check the drive.
5. When checking is complete, press any key to continue.

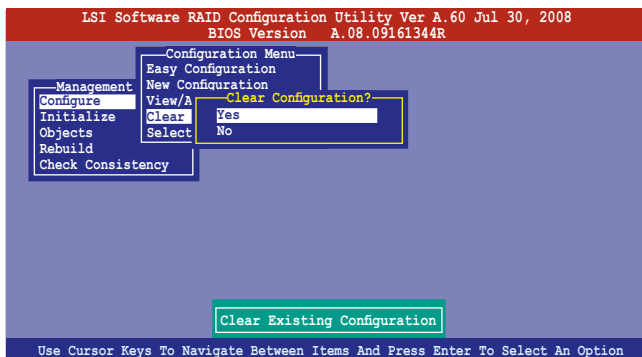
5.2.6 Deleting a RAID configuration

To delete a RAID configuration

1. From the **Management Menu**, select **Configure > Clear Configuration**, and then press <Enter>.



2. When prompted, use the arrow keys to select **Yes** from the **Clear Configuration?** dialog box, and then press <Enter>.



The utility clears all the current array(s).

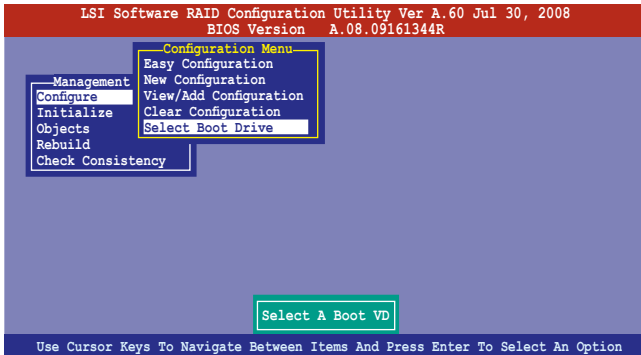
3. Press any key to continue.

5.2.7 Selecting the boot drive from a RAID set

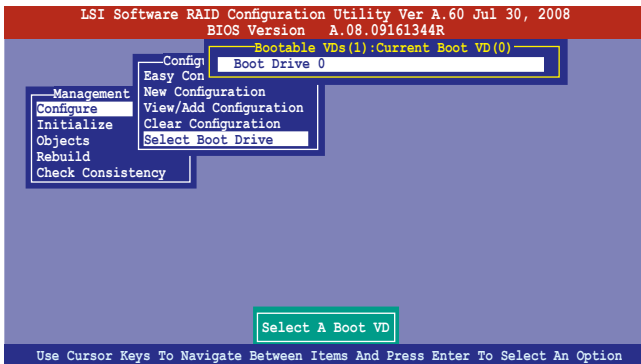
You must have created a new RAID configuration before you can select the boot drive from a RAID set. See section 5.2.1 **Creating a RAID set: Using New Configuration** for details.

To select the boot drive from a RAID set

1. From the **Management Menu**, select **Configure > Select Boot Drive**, and then press <Enter>.



2. When prompted, use the arrow keys to select the bootable virtual drive from the list, then press <Enter>.



3. The virtual drive is selected as boot drive. Press any key to continue.

5.2.8 Enabling WriteCache

You may manually enable the RAID controller's WriteCache option after creating a RAID set to improve the data transmission performance.



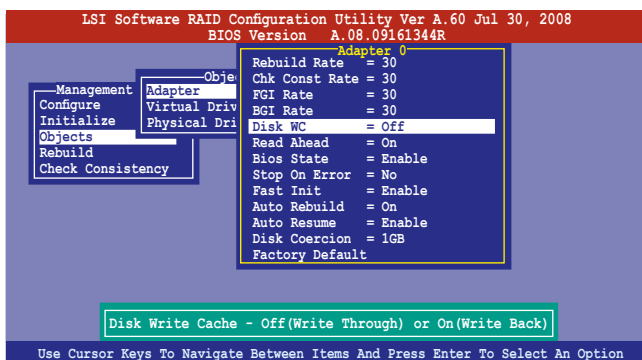
When you enable WriteCache, you may lose data when a power interruption occurs while transmitting or exchanging data among the drives.



The WriteCache function is recommended for RAID 1 and RAID 10 sets.

To enable WriteCache

1. From the **Management Menu**, select **Objects > Adapter**, and then press <Enter> to display the adapter properties.
2. Select **Disk WC**, and then press <Enter> to turn on the option.



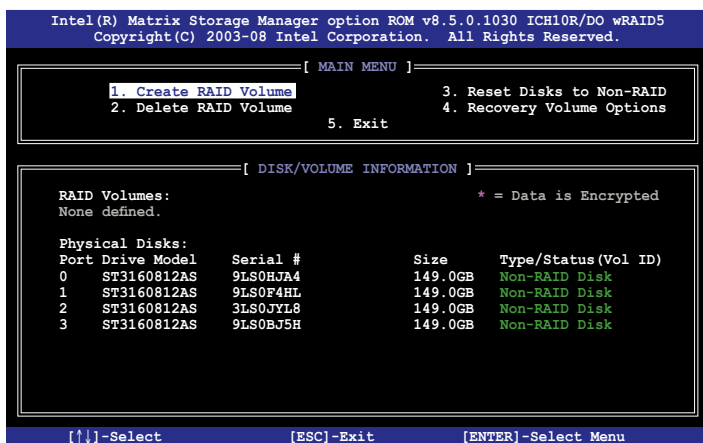
3. When finished, press any key to continue.

5.3 Intel® Matrix Storage Manager Option ROM Utility

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

To enter the Intel® Matrix Storage Manager option ROM utility:

1. Install all the Serial ATA hard disk drives.
2. Turn on the system.
3. During POST, press <Ctrl+I> 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.



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

5.3.1 Creating a RAID set

To create a RAID set

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

```
Intel(R) Matrix Storage Manager option ROM v8.5.0.1030 ICH10R/DO wRAID5
Copyright(C) 2003-08 Intel Corporation. All Rights Reserved.

-----[ CREATE VOLUME MENU ]-----
Name: Volume0
RAID Level: RAID0 (Stripe)
Disks: Select Disks
Strip Size: 128KB
Capacity: 0.0 GB
Sync: N/A
Create Volume

-----[ HELP ]-----

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

[↑↓]Change [TAB]-Next [ESC]-Previous Menu [ENTER]-Select
```

2. Enter a name for the RAID set and press <Enter>.
3. When the **RAID Level** item is selected, press the up/down arrow key to select a RAID level to create, and then press <Enter>.
4. When the **Disks** item is selected, press <Enter> to select the hard disk drives you want to include in the RAID set. The **SELECT DISKS** screen appears.

```
-----[ SELECT DISKS ]-----
Port Drive Model Serial # Size Status
0 ST3160812AS 9LS0HJA4 149.0GB Non-RAID Disk
1 ST3160812AS 9LS0F4HL 149.0GB Non-RAID Disk
2 ST3160812AS 3LS0JYL8 149.0GB Non-RAID Disk
3 ST3160812AS 9LS0BJ5H 149.0GB Non-RAID Disk

Select 2 to 6 disks to use in creating the volume.

[↑↓]-Prev/Next [SPACE]-SelectDisk [ENTER]-Done
```

5. Use the up/down arrow key to select a drive, and then press <Space> to select. A small triangle marks the selected drive. Press <Enter> after completing your selection.

6. Use the up/down arrow key to select the stripe size for the RAID array (for RAID 0, 10 and 5 only), and 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. When the **Capacity** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.
8. When the **Create Volume** item is selected, press <Enter>. The following warning message appears.

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

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

5.3.2 Creating a Recovery set

To create a recovery set

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

```

Intel(R) Matrix Storage Manager option ROM v8.5.0.1030 ICH10R/DO wRAID5
Copyright(C) 2003-08 Intel Corporation. All Rights Reserved.

[ CREATE VOLUME MENU ]
Name: Volume0
RAID Level: RAID0(Stripe)
Disks: Select Disks
Strip Size: 128KB
Capacity: 0.0 GB
Sync: N/A
Create Volume

[ HELP ]

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

[↑↓]Change [TAB]-Next [ESC]-Previous Menu [ENTER]-Select

```

2. Enter a name for the recovery set and press <Enter>.
3. When the **RAID Level** item is selected, press the up/down arrow key to select **Recovery**, and then press <Enter>.
4. When the **Disks** item is selected, press <Enter> to select the hard disk drives you want to include in the recovery set. The **SELECT DISKS** screen appears.

| [SELECT DISKS] | | | | | |
|---|-------------|----------|---------|---------------|--|
| Port | Drive Model | Serial # | Size | Status | |
| 0 | ST3160812AS | 9LS0HJA4 | 149.0GB | Non-RAID Disk | |
| 1 | ST3160812AS | 9LS0F4HL | 149.0GB | Non-RAID Disk | |
| 2 | ST3160812AS | 3LS0JYL8 | 149.0GB | Non-RAID Disk | |
| 3 | ST3160812AS | 9LS0BJ5H | 149.0GB | Non-RAID Disk | |
| Select 1 Master and 1 Recovery disk to create volume. | | | | | |
| [↑↓]-Prev/Next [TAB]-(M)aster [SPACE]-(R)ecovery [ENTER]-Done | | | | | |

5. Use the up/down arrow key to select a drive, press <TAB> to select a Master disk, and then press <SPACE> to select a Recovery disk. A small triangle marks the selected drive. Press <Enter> after completing your selection.
6. When the **Sync** item is selected, use the up/down arrow key to select a sync option that you want and press <Enter>.
7. When the **Create Volume** item is selected, press <Enter>. The following warning message appears.

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

8. Press <Y> to create the recovery set and return to the main menu, or <N> to go back to the **CREATE VOLUME** menu.



If a recovery set is created, you cannot add more RAID sets even when you have more non-RAID disks installed in your system.

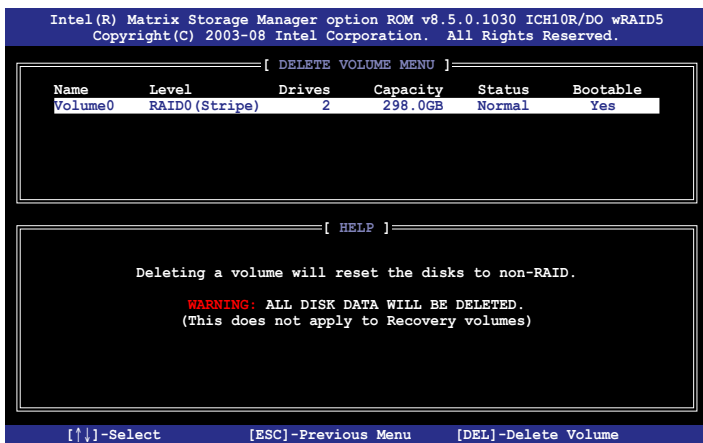
5.3.3 Deleting a RAID set



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>. The following screen appears.



2. Use the up/down arrow key to select the RAID set you want to delete, and then press . The following warning message appears.



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

5.3.4 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 hard disk drive

1. From the utility main menu, select **3. Reset Disks to Non-RAID** and press <Enter>. The following screen appears.

```
[ RESET RAID DATA ]

Resetting RAID disk will remove its RAID structures
and revert it to a non-RAID disk.

WARNING: Resetting a disk causes all data on the disk to be lost.
(This does not apply to Recovery volumes)

Port Drive Model      Serial #      Size      Status
0  ST3160812AS        9LS0HJA4     149.0GB   Member Disk
1  ST3160812AS        9LS0F4HL     149.0GB   Member Disk

Select the disks that should be reset.

[↑↓]-Previous/Next  [SPACE]-Selects [ENTER]-Selection Complete
```

2. Use the up/down arrow key to select the RAID set drive(s) you want to reset, and then press <Space> to select.
3. Press <Enter> to reset the RAID set drive(s). A confirmation message appears.
4. Press <Y> to reset the drive(s) or press <N> to return to the utility main menu.

5.3.5 Recovery Volume Options

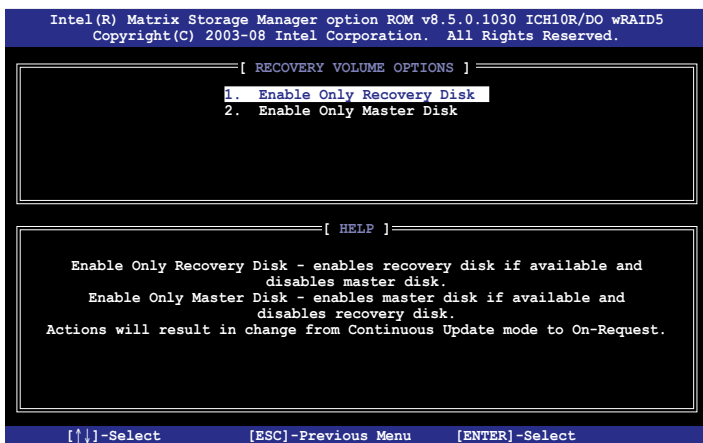
If you have created a recovery set, you can configure more recovery set options following the descriptions in the section.



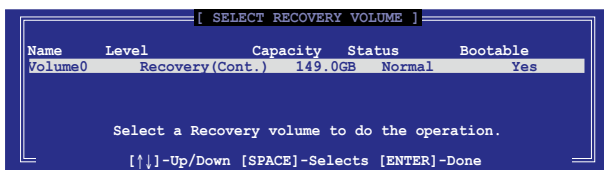
See section **5.3.2 Creating a Recovery set** to create a recovery set before continue.

To configure a recovery set

1. From the utility main menu, select **4. Recovery Volume Options** and press <Enter>. The following screen appears.



2. Use the up/down arrow key to select the option you want, and then press <ENTER>. The **SELECT RECOVERY VOLUME** screen appears.

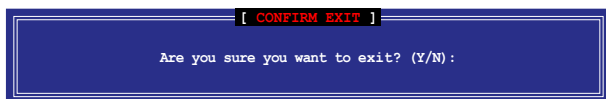


3. Use the up/down arrow key to select a drive, and then press <Space> to select. A small triangle marks the selected drive. Press <Enter> after completing your selection and return to the utility main menu.

5.3.6 Exiting the Intel® Matrix Storage Manager

To exit the utility

1. From the utility main menu, select **5. Exit**, and then press <Enter>. The following warning message appears.



2. Press <Y> to exit or press <N> to return to the utility main menu.

5.3.7 Rebuilding the RAID



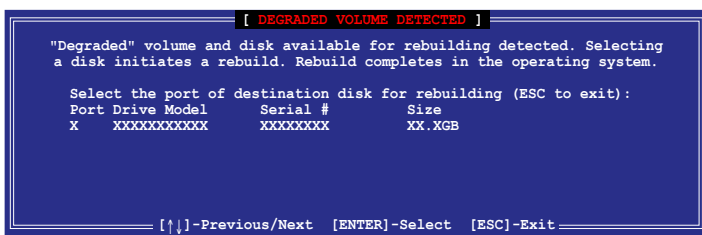
This option is only for the RAID 1 set.

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.

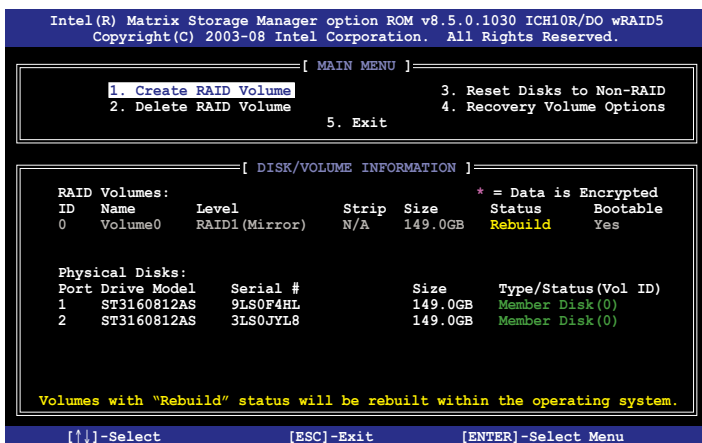
To rebuild the RAID with other non-RAID disk:

1. At the prompt, press <Ctrl> + <I> to enter the Intel Matrix Storage Manager option ROM utility.
2. If there is a non-RAID SATA Hard Disk available, the utility will prompt to rebuild the RAID. Press <Enter>, and then use up/down arrow keys to select the destination disk 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. The status of the degraded RAID volume is changed to **“Rebuild”**.



- Exit Intel Matrix Storage Manager and reboot the system.
- Select **Start > Programs > Intel Matrix Storage > Intel Matrix Storage Console** or click the **Intel Matrix Storage Manager** tray icon to load the Intel Matrix Storage Manager utility.
- From the **View** menu, select **Advanced Mode** to display the details of the Intel Matrix 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 and then follow the steps in section **Rebuilding the RAID with other non-RAID disk** on page 5-32.

5.3.8 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® Matrix Storage Manager.

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 option **Boot Device Priority**.
3. Use up/down arrow keys to select the boot priority and press <Enter>. See section **4.6.1 Boot Device Priority** for details.
4. From the **Exit** menu, select **Exit & Save Changes**, then press <Enter>.
5. When the confirmation window appears, select **OK**, then press <Enter>.

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

6 Driver installation

Chapter summary

6

| | | |
|-----|---|------|
| 6.1 | RAID driver installation | 6-3 |
| 6.2 | Intel chipset device software installation | 6-19 |
| 6.3 | LAN driver installation | 6-23 |
| 6.4 | Display driver installation | 6-27 |
| 6.5 | Mellanox ConnectX DDR PCI Gen2 Channel Adapter driver installation | 6-30 |
| 6.6 | Management application and utilities installation | 6-37 |

6.1 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 instructions on how to install the RAID controller drivers during OS installation.

6.1.1 Creating a RAID driver disk



You may have to use another system to create the RAID driver disk from the system/motherboard support DVD or from the Internet.

A floppy disk with the RAID driver is required when installing Windows® or Red Hat® Enterprise operating system on a hard disk drive that is included in a RAID set. You can create a RAID driver disk in DOS (using the Makedisk application in the support DVD).

To create a RAID driver disk in DOS environment:

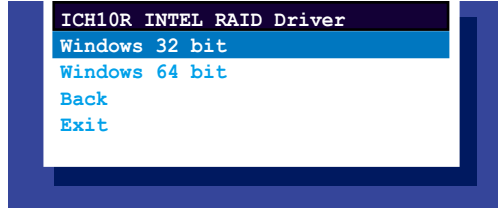
1. Place the motherboard support DVD in the optical drive.
2. Restart the computer, then enter the BIOS Setup.
3. Select the optical drive as the first boot priority to boot from the support DVD. Save your changes, then exit the BIOS Setup.
4. Restart the computer.

The Makedisk menu appears.



5. Use the arrow keys to select the type of RAID driver disk you want to create and press <Enter> to enter the sub-menu.

ICH10R Intel RAID Driver

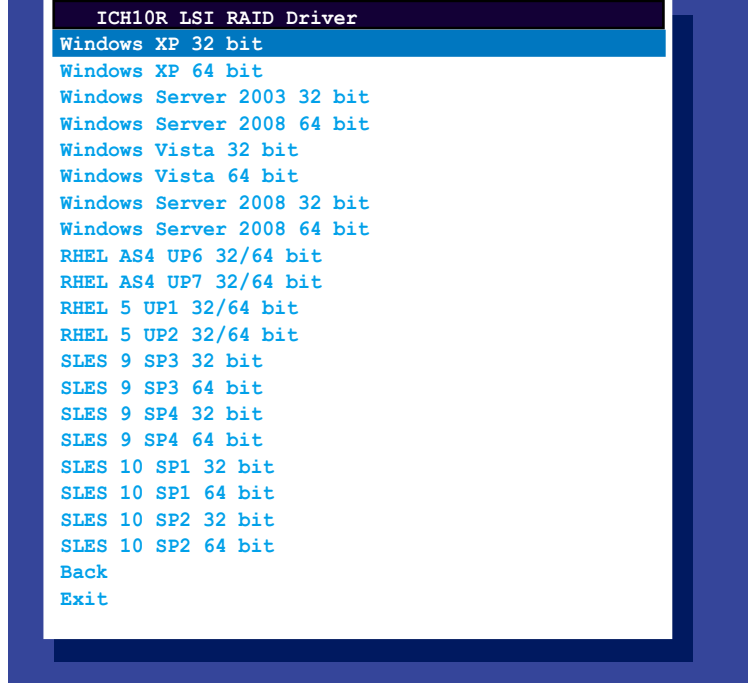


ICH10R INTEL RAID Driver

- Windows 32 bit
- Windows 64 bit
- Back
- Exit

The screenshot shows a blue-themed menu box with a dark blue header and a light blue background. The text is white. The 'Windows 32 bit' option is highlighted with a darker blue background.

ICH10R LSI RAID Driver

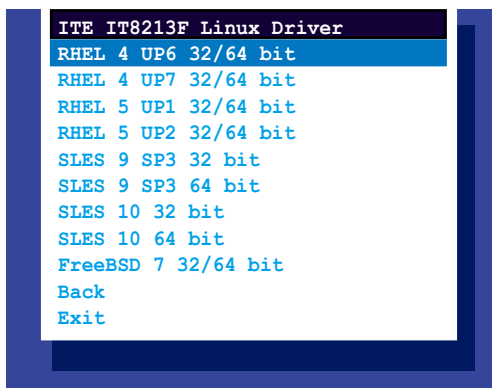


ICH10R LSI RAID Driver

- Windows XP 32 bit
- Windows XP 64 bit
- Windows Server 2003 32 bit
- Windows Server 2008 64 bit
- Windows Vista 32 bit
- Windows Vista 64 bit
- Windows Server 2008 32 bit
- Windows Server 2008 64 bit
- RHEL AS4 UP6 32/64 bit
- RHEL AS4 UP7 32/64 bit
- RHEL 5 UP1 32/64 bit
- RHEL 5 UP2 32/64 bit
- SLES 9 SP3 32 bit
- SLES 9 SP3 64 bit
- SLES 9 SP4 32 bit
- SLES 9 SP4 64 bit
- SLES 10 SP1 32 bit
- SLES 10 SP1 64 bit
- SLES 10 SP2 32 bit
- SLES 10 SP2 64 bit
- Back
- Exit

The screenshot shows a blue-themed menu box with a dark blue header and a light blue background. The text is white. The 'Windows XP 32 bit' option is highlighted with a darker blue background.

ITE IT8213F Linux Driver



6. Locate the RAID driver and place a blank, high-density floppy disk to the floppy disk drive.
7. Press <Enter>.
8. Follow screen instructions to create the driver disk.

6.1.2 Windows® OS

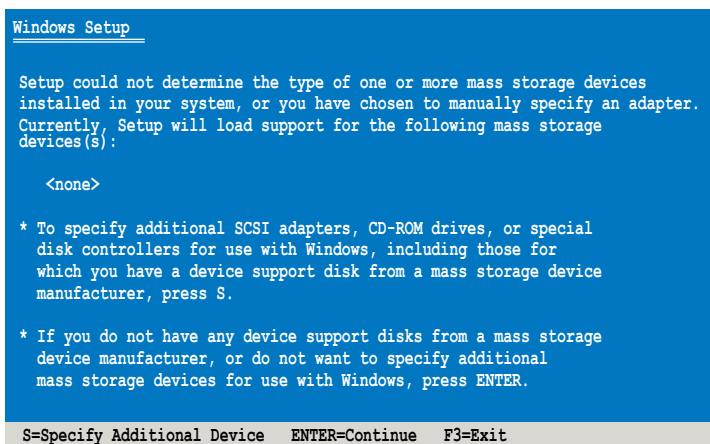
During Windows® OS installation

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

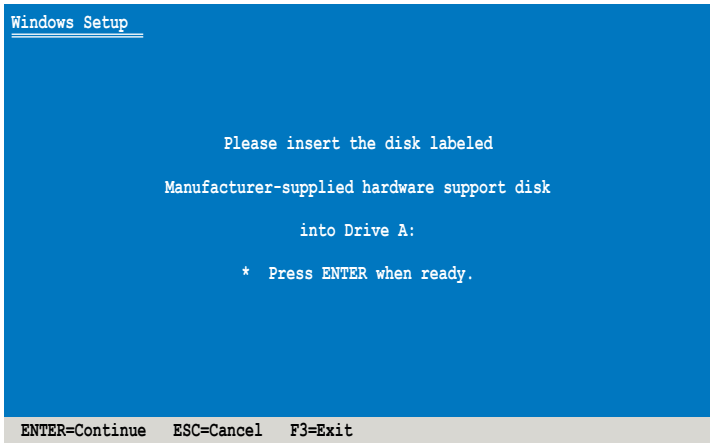
1. Boot the computer using the Windows® OS installation CD. The **Windows® Setup** starts.
2. Press <F6> when the message “Press F6 if you need to install a third party SCSI or RAID driver...” appears at the bottom of the screen.



3. The next screen appears. Press <S> to specify an additional device.



4. Insert the RAID driver disk you created earlier to the floppy disk drive, then press <Enter>.

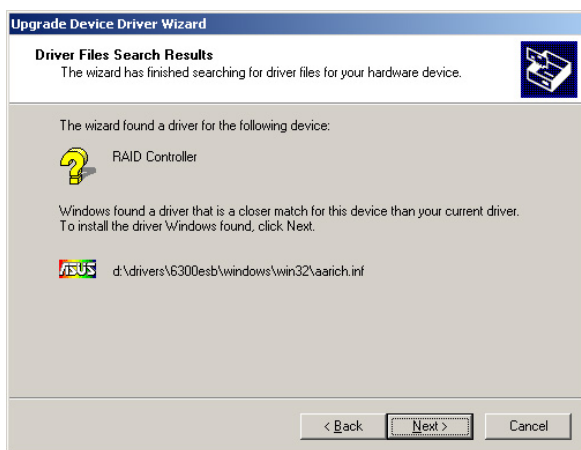


5. Select the RAID controller driver you need from the list, then press <Enter>.
6. The Windows® Setup loads the RAID controller drivers from the RAID driver disk. When next screen appears, press <Enter> to continue installation.
7. Setup then proceeds with the OS installation. Follow screen instructions to continue.

To an existing Windows® OS

To install the RAID controller driver on an existing Windows® OS:

1. Restart the computer, then log in with **Administrator** privileges.
2. Windows® automatically detects the RAID controller and displays a **New Hardware Found** window. Click **Cancel**.
3. Right-click the **My Computer** icon on the Windows® desktop, then select **Properties** from the menu.
4. Click the **Hardware** tab, then click the **Device Manager** button to display the list of devices installed in the system.
5. Right-click the **RAID controller** item, then select **Properties**.
6. Click the **Driver** tab, then click the **Update Driver** button.
7. The **Upgrade Device Driver Wizard** window appears. Click **Next**.
8. Insert the RAID driver disk you created earlier to the floppy disk drive.
9. Select the option **Search for a suitable driver for my device (recommended)**, then click **Next**.



10. The wizard searches the RAID controller drivers. When found, click **Next** to install the drivers.
11. Click **Finish** after the driver installation is done.

6.1.3 Red Hat® Enterprise Linux OS

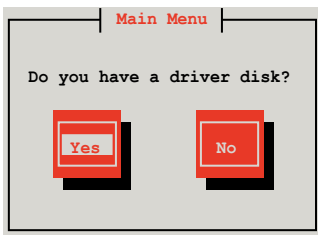
Red Hat® Enterprise Linux OS 4.7/4.8

To install the RAID controller driver when installing Red Hat® Enterprise OS:

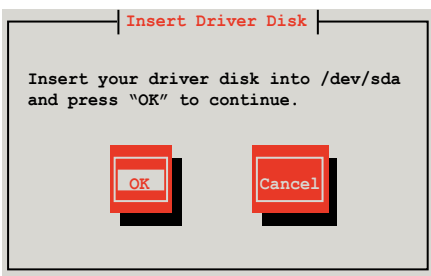
1. Boot the system from the Red Hat® OS installation CD.
2. At the **boot:**, type **linux dd nostorage**.
3. Press <Enter>.

```
- To install or upgrade in graphical mode, press the <ENTER> key.  
- To install or upgrade in text mode, type: linux text <ENTER>.  
- Use the function keys listed below for more information.  
[F1-Main] [F2-Options] [F3-General] [F4-Kernel] [F5-Rescue]  
boot: linux dd nostorage
```

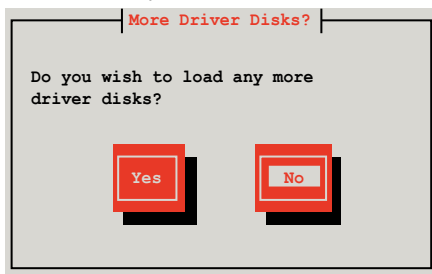
4. Select **Yes** using the <Tab> key when asked if you have the driver disk, then press <Enter>.



5. Press <Enter> to continue.



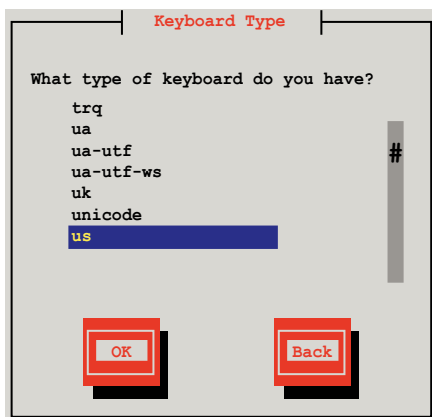
6. Select **No** and press <Enter> to continue.



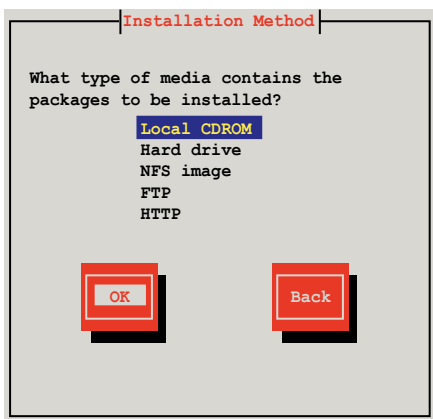
7. Select your desired language and press <Enter> to continue.



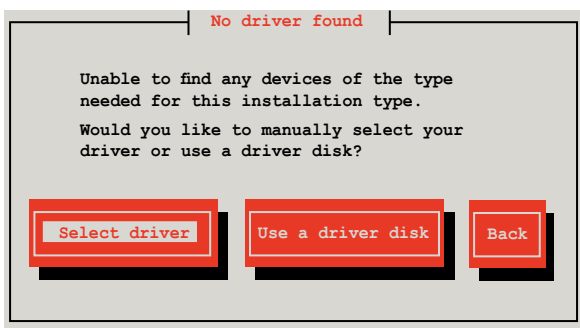
8. Select your keyboard type and press <Enter> to continue.



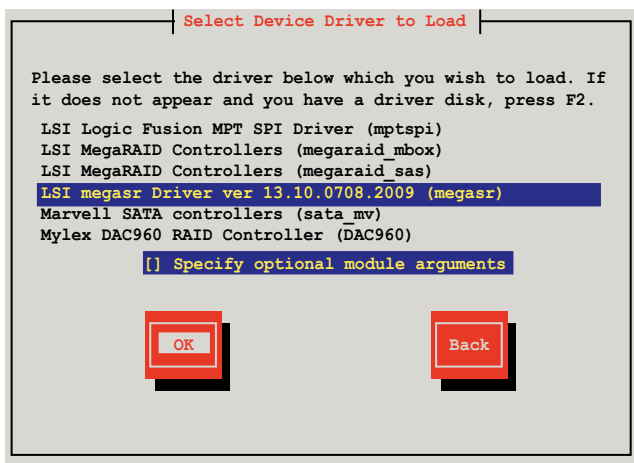
9. Select the media and press <tab> to select **OK**. Press <Enter> to continue.



10. Select the media and press <tab> to select **OK**. Press <Enter> to continue.

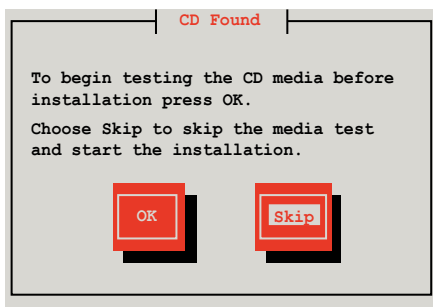


11. Scroll down to locate the driver and press <Enter> to continue.

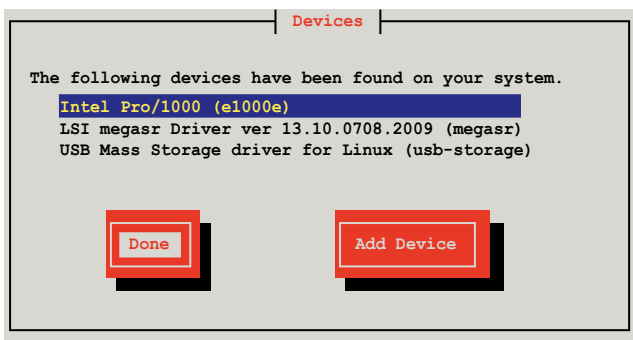


The driver version may vary with time and model. Select LSI Mega Software RAID driver (**LSI megaraid Driver**) all the time.

12. Select **Skip** and press <Enter> to continue.



13. Select **Done** and press <Enter> to continue.



The displayed devices may vary with models and systems.

14. Follow the onscreen instructions to finish installing the RedHat operating system.

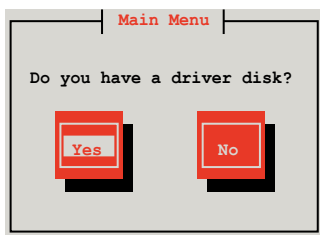
Red Hat® Enterprise Linux OS 5.0

To install the RAID controller driver when installing Red Hat® Enterprise OS:

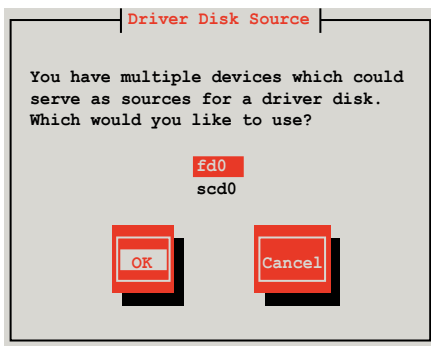
1. Boot the system from the Red Hat® OS installation CD.
2. At the `boot:`, type `linux dd noprobe=ata[n]`. The number of `ata` varies with the hard disk drive number you have when building a RAID set. For example, if you want to build a RAID set with 6 hard disk drives, type command line: `linux dd noprobe=ata1 noprobe=ata2 noprobe=ata3 noprobe=ata4 noprobe=ata5 noprobe=ata6`.
3. Press `<Enter>`.

```
- To install or upgrade in graphical mode, press the <ENTER> key.
- To install or upgrade in text mode, type: linux text <ENTER>.
- Use the function keys listed below for more information.
[F1-Main] [F2-Options] [F3-General] [F4-Kernel] [F5-Rescue]
boot: linux dd noprobe=ata[n]
```

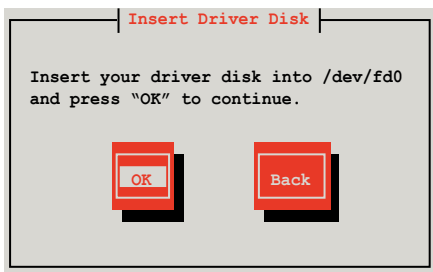
4. Select **Yes** using the `<Tab>` key when asked if you have the driver disk, then press `<Enter>`.



5. Select **fd0** using the `<Tab>` key when asked to select the driver disk source. Press `<Tab>` to move the cursor to **OK**, then press `<Enter>`.

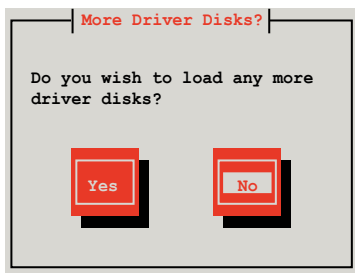


6. Insert the Red Hat® Enterprise RAID driver disk to the floppy disk drive, select **OK**, then press <Enter>.



The drivers for the RAID card are installed to the system.

7. When asked if you will load additional RAID controller drivers, select **No**, then press <Enter>.



8. Follow the onscreen instructions to finish the OS installation.
9. If you install RHEL AS5, when the installation is completed, DO NOT click **Reboot**. Press <Ctrl> + <Alt> + <F2> to switch to the command-line interface from graphic user interface.
10. Type the following commands when using a Legacy floppy.

```
mkdir /mnt/driver
mount /dev/fd0 /mnt/driver
cd /mnt/driver
sh replace_ahci.sh
reboot
```

Type the following commands when using a USB floppy.

```
cat /proc/partitions
```



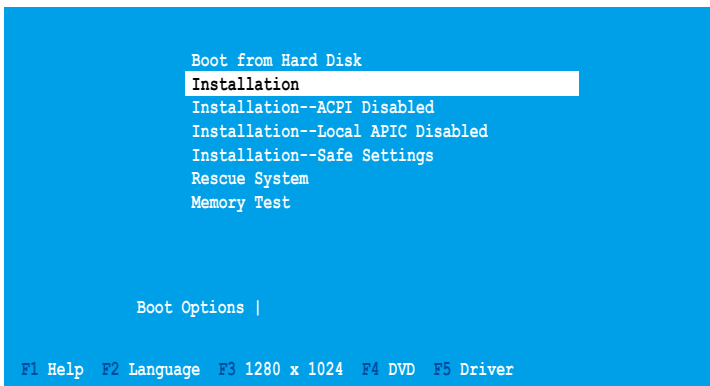
Write down the **Major** and **Minor** number before **sdb** for later use.

```
mknod /dev/sdb b [major number] [minor number]
mkdir /mnt/driver
mount /dev/sdb /mnt/driver
cd /mnt/driver
sh replace_ahci.sh
reboot
```

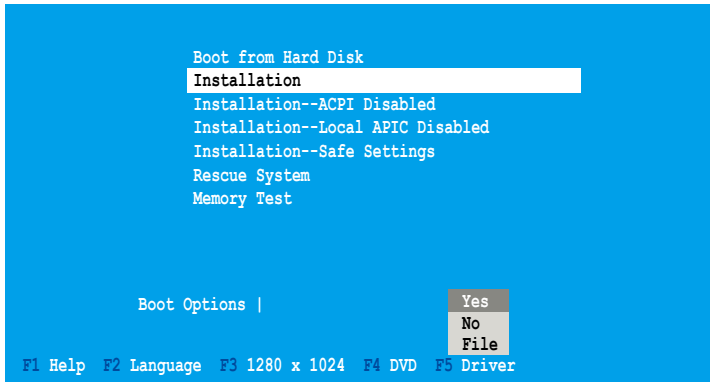
6.1.4 SUSE Linux Enterprise Server OS

To install the RAID controller driver when installing SUSE Linux Enterprise Server OS:

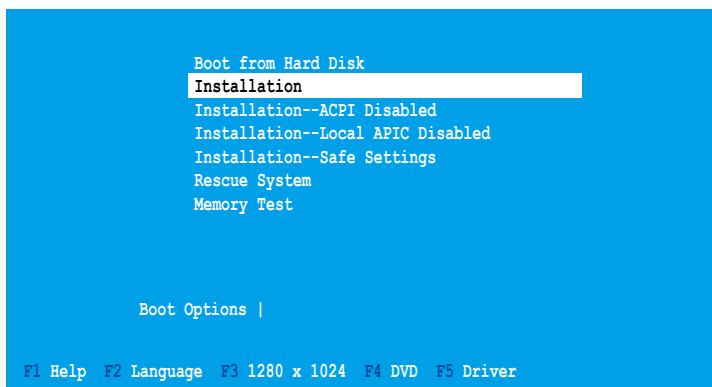
1. Boot the system from the SUSE OS installation CD.
2. Use the arrow keys to select **Installation** from the **Boot Options** menu.



3. Press <F5>, then select **Yes** from the menu. Press <Enter>.

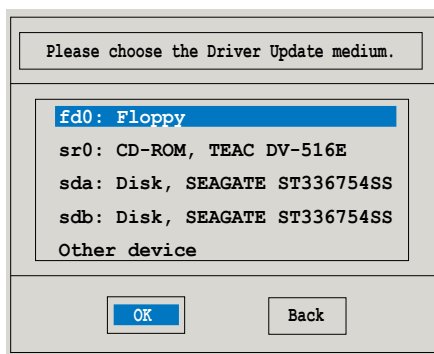


4. Insert the RAID driver disk to the floppy disk drive. Make sure that **Installation** from the **Boot Options** menu is selected, then press <Enter>.



If you install SLES 10, type `brokenmodules=ahci` after **Boot Options** and press **Enter** to continue.

5. When below screen appears, select the floppy disk drive (fd0) as the driver update medium. Select **OK**, then press <Enter>.



The drivers for the RAID controller are installed to the system.

6.2 Intel chipset device software installation

This section provides instructions on how to install the Plug and Play components for the Intel® chipset on the system.

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

1. Restart the computer, then log on with **Administrator** privileges.
2. Insert the motherboard/system support DVD to the optical drive. The support DVD automatically displays the **Drivers** menu if Autorun is enabled in your computer.
3. Click the item **Intel Chipset Device Software** from the menu.



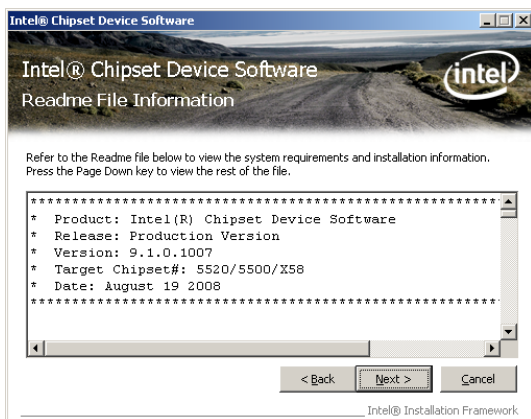
4. The **Intel(R) Chipset Device Software** window appears. Click **Next** to start the installation.



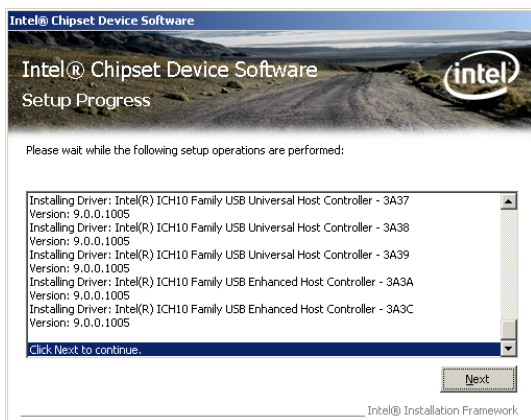
5. Select **Yes** to accept the terms of the **License Agreement** and continue the process.



6. Read the **Readme File Information** and click **Next** to activate the installation.



7. After completing the installation, click **Next** to continue.



8. Click **Yes, I want to restart this computer now** and click **Finish** to restart the computer.



6.3 LAN driver installation

This section provides the instructions on how to install Intel® Gigabit LAN controller drivers.

To install the Intel® Gigabit LAN controller driver on a Windows® OS:

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

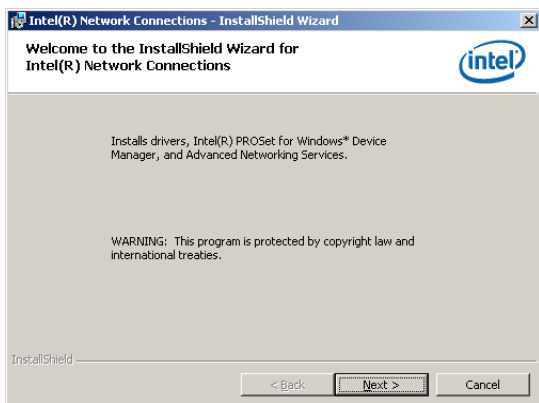


If **Autorun** is NOT enabled in your computer, browse the contents of the support DVD to locate the file **AUTORUN.EXE** and double-click the **AUTORUN.EXE** and follow step 4 to run the installation.

3. Click **Intel® PRO/1000 Gigabit Adapters Driver**.



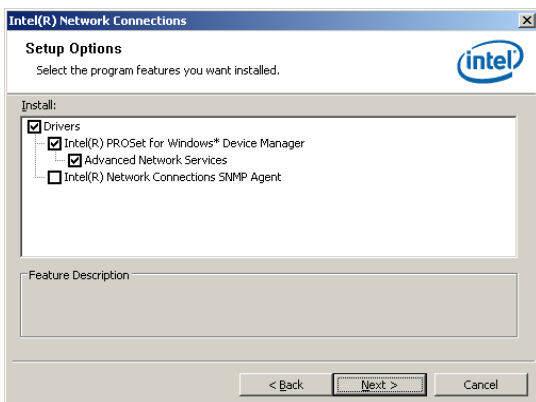
4. When the **Intel® PRO Network Connections – InstallShield Wizard** window appears, click **Next** to start the installation.



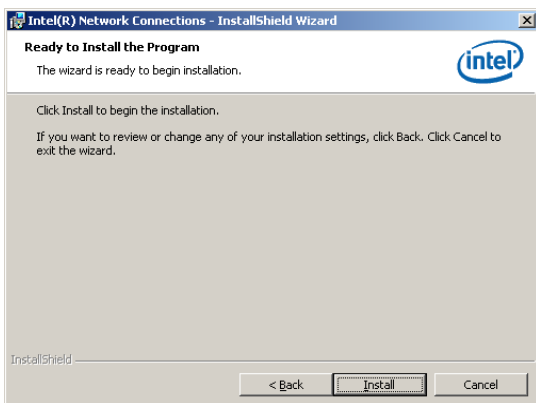
5. Click **I accept the terms in the license agreement** and then click **Next** to continue.



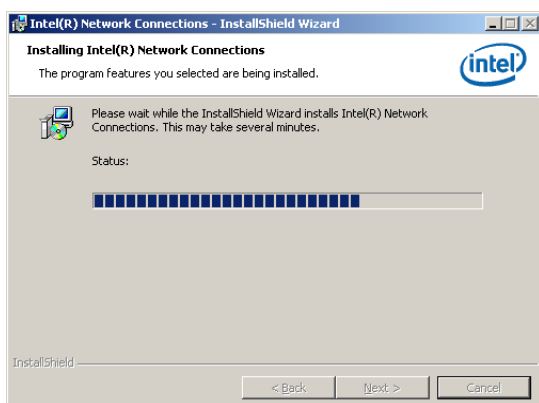
6. Select the programs you want to install and click **Next** to continue.



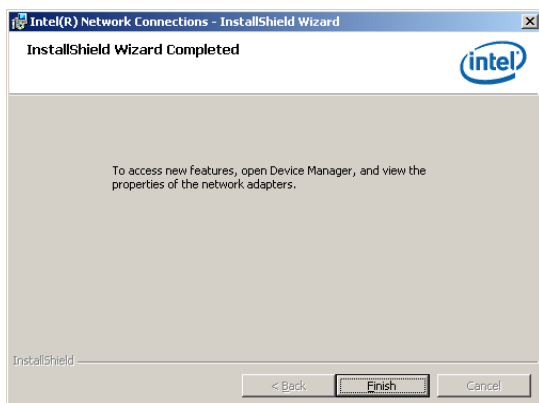
7. Click **Install** to start the installation.



8. The programs you select are being installed.



9. Click **Finish** to finish the installation.



6.4 Display driver installation

This section provides instructions on how to install the ASPEED display driver.

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

To install the ASPEED display driver

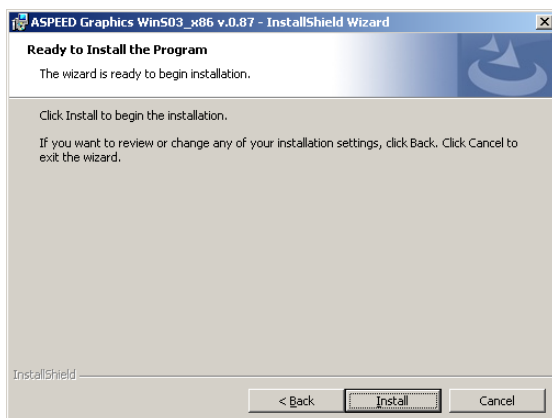
1. Restart the computer, then log on with Administrator privileges.
2. Insert the motherboard/system support DVD to the optical drive. The support DVD automatically displays the Drivers menu if Autorun is enabled in your computer.
4. Click **ASPEED AST2050 Display Driver**.



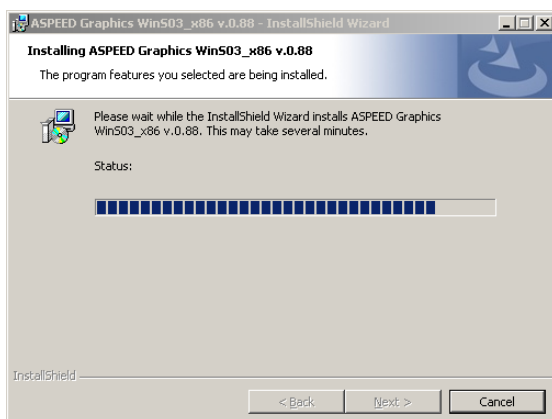
4. When the **ASPEED InstallShield Wizard** window appears, click **Next** to continue.



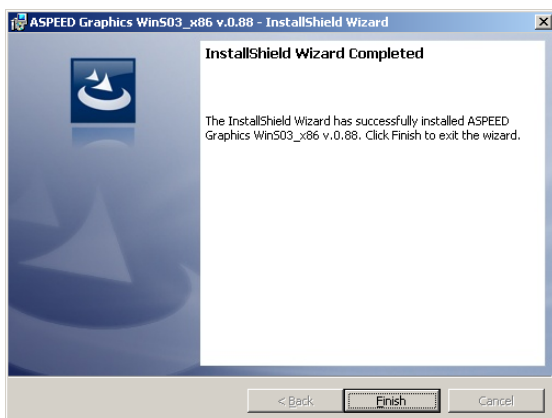
5. Click **Install** to start the installation.



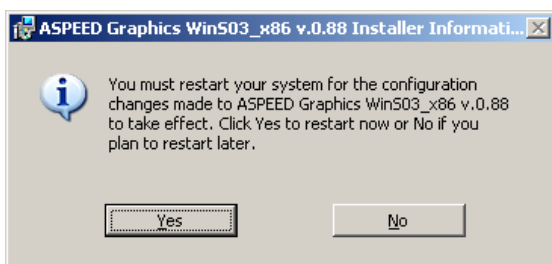
6. The system installs the driver automatically.



7. When the installation completes, click **Finish** to exit the wizard.



8. Click **Yes** to restart the computer.



6.5 Mellanox ConnectX DDR PCI Gen2 Channel Adapter driver installation

This section provides instructions on how to install the Mellanox driver.

6.5.1 Windows operating system

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

To install the Mellanox driver

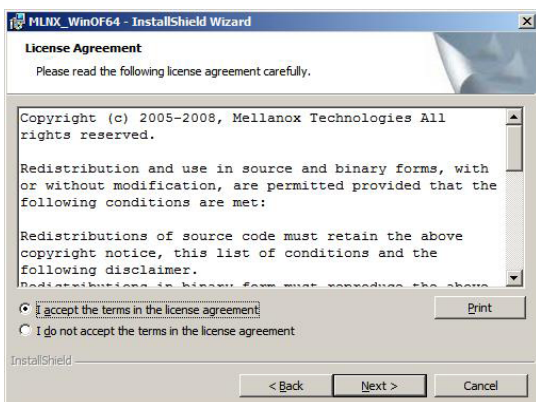
1. Restart the computer, then log on with Administrator privileges.
2. Insert the motherboard/system support DVD to the optical drive. The support DVD automatically displays the Drivers menu if Autorun is enabled in your computer.
3. Click **Mellanox ConnectX DDR PCI Gen2 Channel Adapter Driver**.



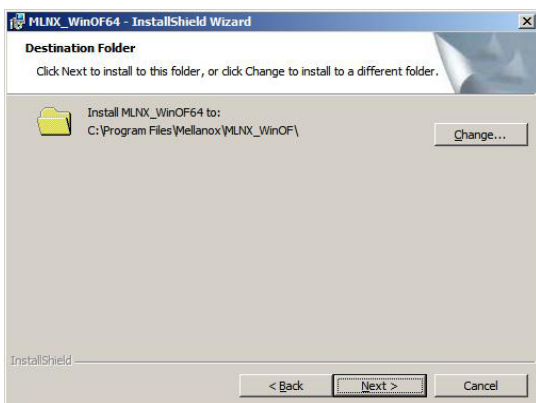
4. Click **Next** to start installing the driver.



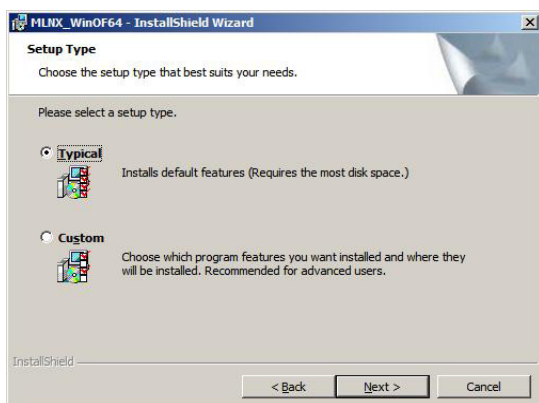
5. Click **I accept the terms in the license agreement** and click **Next** to continue.



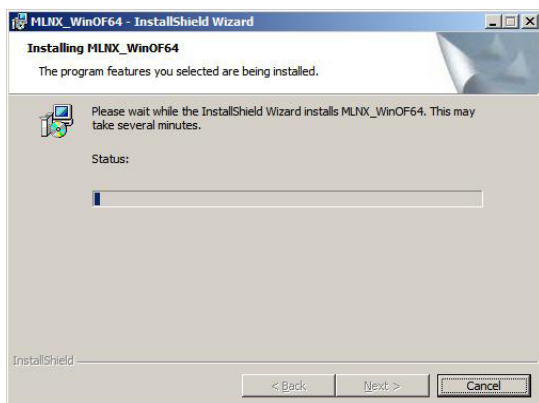
5. Click **Change** to select your desired destination folder and click **Next** to continue.



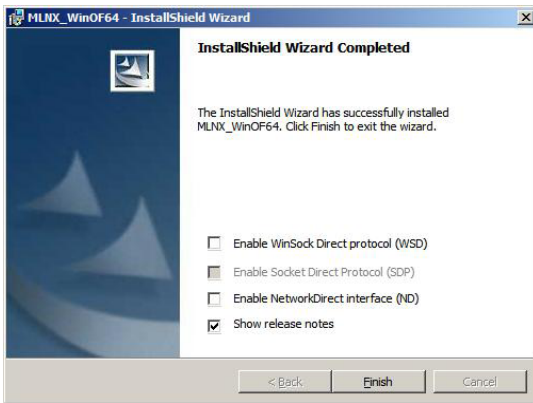
6. Select a setup type and click **Next** to continue.



7. The driver features you selected are being installed.



8. Click your preferred options and click **Finish** to exit the wizard.



6.5.2 Red Hat® Enterprise Linux OS

You need to manually mount the Mellanox driver on a Red Hat® Enterprise Linux OS.



For users using SUSE Linux Enterprise Server OS, follow the general instructions in this section to mount the Mellanox driver on your system.

To mount the Mellanox driver

1. Login to the system as root.
2. Create a folder on the desktop and copy the latest Mellanox driver to the folder.



You can name the folder as you like.

```
root@localhost:/  
File Edit View Terminal Tabs Help  
[root@localhost ~]# cd /  
[root@localhost /]# mkdir xxx  
[root@localhost /]#
```

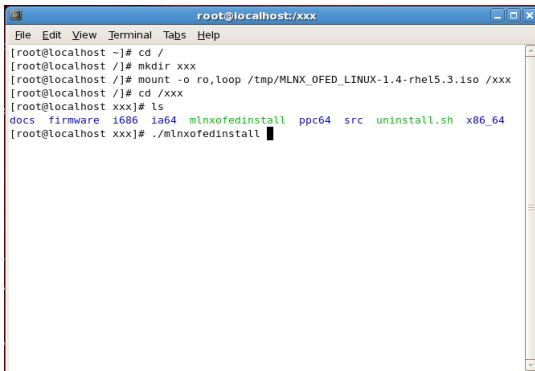
3. Type the command line and mount the driver to the system.



The driver version and the OS label may vary. Ensure that the command line matches your driver version and operating system.

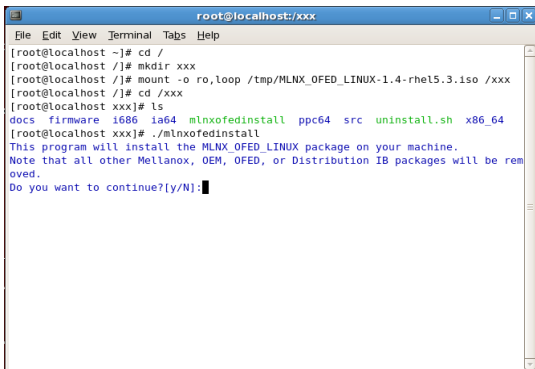
```
root@localhost:/  
File Edit View Terminal Tabs Help  
[root@localhost ~]# cd /  
[root@localhost /]# mkdir xxx  
[root@localhost /]# mount -o ro,loop /tmp/MLNX_OFED_LINUX-1.4-rhel5.3.iso /xxx
```

4. Type the command line and install the driver.



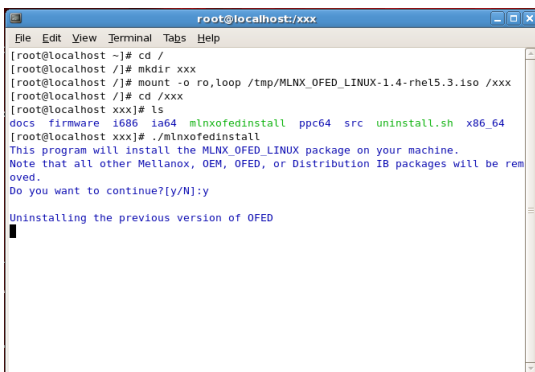
```
root@localhost/xxx
File Edit View Terminal Tabs Help
[root@localhost ~]# cd /
[root@localhost /]# mkdir xxx
[root@localhost /]# mount -o ro,loop /tmp/MLNX_OFED_LINUX-1.4-rhel5.3.iso /xxx
[root@localhost /]# cd /xxx
[root@localhost xxx]# ls
docs  firmware  1686  ia64  mlnxofedinstall  ppc64  src  uninstall.sh  x86_64
[root@localhost xxx]# ./mlnxofedinstall
```

5. All other Mellanox, OEM, OFED, or distribution IB packages will be removed. Press <Y> to continue.



```
root@localhost/xxx
File Edit View Terminal Tabs Help
[root@localhost ~]# cd /
[root@localhost /]# mkdir xxx
[root@localhost /]# mount -o ro,loop /tmp/MLNX_OFED_LINUX-1.4-rhel5.3.iso /xxx
[root@localhost /]# cd /xxx
[root@localhost xxx]# ls
docs  firmware  1686  ia64  mlnxofedinstall  ppc64  src  uninstall.sh  x86_64
[root@localhost xxx]# ./mlnxofedinstall
This program will install the MLNX_OFED_LINUX package on your machine.
Note that all other Mellanox, OEM, OFED, or Distribution IB packages will be removed.
Do you want to continue?[y/N]:
```

6. The system starts uninstalling the previous version of OFED.



```
root@localhost/xxx
File Edit View Terminal Tabs Help
[root@localhost ~]# cd /
[root@localhost /]# mkdir xxx
[root@localhost /]# mount -o ro,loop /tmp/MLNX_OFED_LINUX-1.4-rhel5.3.iso /xxx
[root@localhost /]# cd /xxx
[root@localhost xxx]# ls
docs  firmware  1686  ia64  mlnxofedinstall  ppc64  src  uninstall.sh  x86_64
[root@localhost xxx]# ./mlnxofedinstall
This program will install the MLNX_OFED_LINUX package on your machine.
Note that all other Mellanox, OEM, OFED, or Distribution IB packages will be removed.
Do you want to continue?[y/N]:y
Uninstalling the previous version of OFED
```

7. When the installation finishes, reboot your system to complete the installation.

```
root@localhost:xxx
File Edit View Terminal Tabs Help
65:libibmad-static ##### [ 88%]
66:libibmad-static ##### [ 89%]
67:librdmacm-devel ##### [ 91%]
68:librdmacm-devel ##### [ 92%]
69:libsdp-devel ##### [ 93%]
70:libsdp-devel ##### [ 95%]
71:opensm-devel ##### [ 96%]
72:opensm-devel ##### [ 97%]
73:opensm-static ##### [ 99%]
74:opensm-static ##### [100%]
Device (15b3:6732):
  0a:00:0 InfiniBand: Mellanox Technologies MT26418 [ConnectX IB DDR, PCIe
  2.0 5GT/s] (rev a0)
    Link Width: 8x
    Link Speed: 5Gb/s

Installation finished successfully.

The firmware version 2.6.0 is up to date.
Note: To force firmware update use '--force-fw-update' flag.
warning: /etc/infiniband/openib.conf saved as /etc/infiniband/openib.conf.rpmsave
[root@localhost xxx]#
```



If your system has the latest firmware, no firmware update will occur. To force firmware update, type **--force-fw-update**.

6.6 Management applications and utilities installation

The support DVD that came with the motherboard package contains the drivers, management applications, and utilities that you can install to avail all motherboard features.



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

6.6.1 Running the support DVD

Place the support DVD to the optical drive. The 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 DVD.

6.6.2 Drivers menu

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

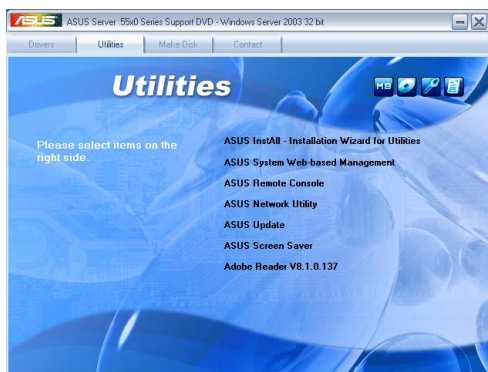


The screen display and driver options vary under different operating system versions.



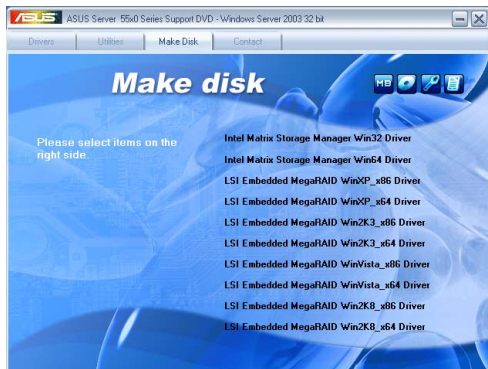
6.6.3 Utilities menu

The Utilities menu displays the software applications and utilities that the motherboard supports. Click an item to install.



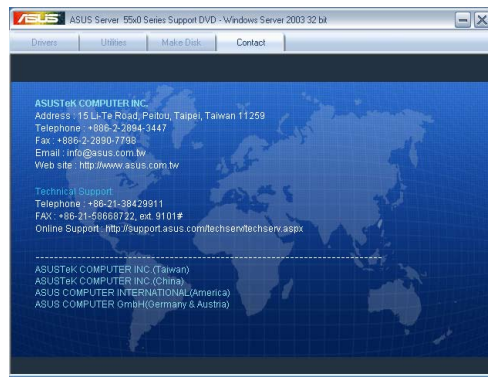
6.6.4 Make disk menu

The Make disk menu contains items to create the Intel Matrix Storage Manager and LSI Embedded MegaRAID driver disk.



6.6.5 Contact information

Click the Contact tab to display the ASUS contact information. You can also find this information on the inside front cover of this user guide.



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

Reference information

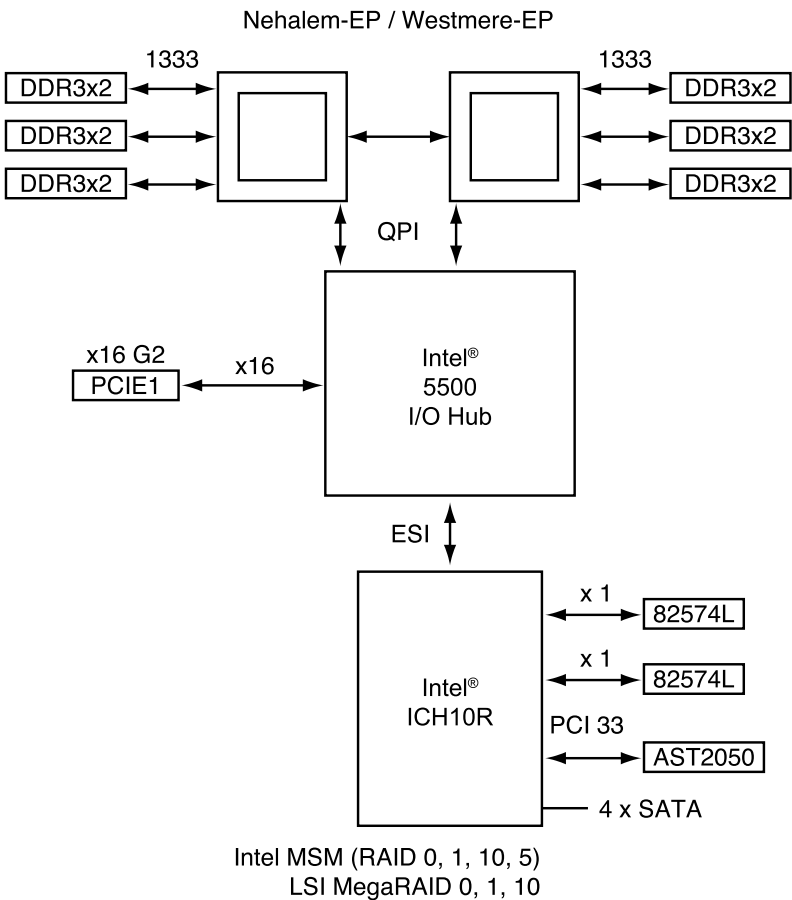


Appendix summary



| | | |
|-----|----------------------------------|-----|
| A.1 | Z8NH-D12 block diagram..... | A-3 |
| A.2 | Z8PH-D12/IFB block diagram | A-4 |

A.1 Z8NH-D12 block diagram



A.2 Z8PH-D12/IFB block diagram

