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This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in locations other than residential locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Furthermore, any modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

⚠️ Caution ⚠️ To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Note that the input AC power cable may be unshielded.
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Getting Started

This chapter describes the key features of the RMC-8356 and lists the kit contents and optional equipment you can order from National Instruments.

Unpacking

Carefully inspect the shipping container and the RMC-8356 for damage. Check for visible damage to the metal work. Check to make sure all hardware and switches are undamaged. If damage appears to have been caused during shipment, file a claim with the carrier. Retain the packing material for possible inspection and/or reshipment.

What You Need to Get Started

The RMC-8356 kit contains the following items:

- RMC-8356 rack mount controller
- RMC-8356 User Manual
- Windows recovery USB
- Rack mount kit
- AC power cable (refer to Table 1-1 for a list of AC power cables)
- DisplayPort to VGA adapter

Note: Onboard VGA is disabled by default. Use the included DisplayPort to VGA adapter to use a VGA monitor.
Chapter 1  Getting Started

RMC-8356 Overview

The RMC-8356 is a 1U PC-based controller for remote control of PXI chassis. The controller provides leading-edge processing power with Intel Xeon E3-1275-V5 processors, high disk bandwidth with RAID support, high I/O bandwidth with a PCI Express 3.0 x16, dedicated Intel Graphics w/ DP, and up to 64 GB of UDIMM Non-ECC memory.

Key Features

The RMC-8356 offers the performance of a high-end PC in a compact 1U rack-mountable form factor for controlling a PXI or PXI Express system using a National Instruments remote controller.

Mainboard Features

CPU

•  Intel Xeon E3-1275-V5 3.6 GHZ, 80 W

Chipset

•  Intel C236 chipset

Memory

•  16 GB UDIMM Non-ECC DDR4 memory standard (1 ×16 GB)
•  Maximum memory supported: 64 GB Unregistered Non-ECC DDR4-2133Mhz in 4 DIMM sockets.

<table>
<thead>
<tr>
<th>Power Cable</th>
<th>Reference Standards</th>
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<tr>
<td>Standard 120 V (USA)</td>
<td>ANSI C73.11/NEMA 5-15-P/IEC83</td>
</tr>
<tr>
<td>Switzerland 220 V</td>
<td>SEV</td>
</tr>
<tr>
<td>Australia 240 V</td>
<td>AS C112</td>
</tr>
<tr>
<td>Universal Euro 230 V</td>
<td>CEE (7), II, IV, VII IEC83</td>
</tr>
<tr>
<td>North America 240 V</td>
<td>ANSI C73.20/NEMA 5-15-P/IEC83</td>
</tr>
<tr>
<td>United Kingdom 230 V</td>
<td>BS 1363/IEC83</td>
</tr>
<tr>
<td>Japan 100 V</td>
<td>ANSI C73.11/NEMA 5-15-P/IEC83</td>
</tr>
</tbody>
</table>

The unit comes with the standard 120 V (USA) cable. If you have the incorrect AC power cable, contact National Instruments.
Slots
• 1 x PCI Express 3.0 x16 slot

Video
• Aspeed AST2400 BMC (max resolution 1280 × 1024), (disabled by default)
• Intel HD P530 Graphics, 2 × Display Port, 1 × DVI

HDD
• 1 x 500 GB SATA3 hard drive JBOD

Onboard LAN
• 1 x Intel PHY i219LM Gigabit Ethernet controller
• 1 x Intel I210-AT

Onboard I/O
• 1 x Front Serial port
• 1 x VGA port (disabled by default)
• 2 x Display Port
• 1 x DVI
• 2 x USB 2.0 ports (rear)
• 2 x USB 3.0 ports (rear)
• 2 x USB 3.0 ports (front)
• 2 x RJ-45 ports

Power Supply
• 350 W AC power supply w/ PFC

Fan
• Internal 4 x 4cm Fans

Power Management Features
• ACPI/ACPM power management
• Main switch override mechanism
• Wake-On-LAN (WOL) header
• Wake up on keyboard/mouse from Soft-Off
• Power-on mode from AC power recovery
Chapter 1  Getting Started

Front Panel LEDs

- Power indicator
- Power shuttle indicators
- LAN status indicators
- HDD indicator
- System temp (overheat) and fan (fail) warning indicator

System Management

- Monitoring for CPU and chassis environment
- CPU thermal trip support
- +5 V standby alert LED
- Fan speed control

RMC-8356 Description

Figure 1-1 shows the key features of the RMC-8356 front panel. For detailed information about the RMC-8356 rear panel, refer to Chapter 3, I/O Information.

Figure 1-1. Front View of the RMC-8356

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<td>USB Ports</td>
<td>COM Port</td>
<td>Control Panel</td>
<td>Rack Ear Brackets</td>
</tr>
</tbody>
</table>

The front of the chassis includes the following features:

- **SATA HDD**—Hot-swap 3.5" SATA hard disk drive.
- **USB Ports**—Two front-access USB 3.0 ports.
- **COM Port**—Front-access COM (Serial) port.
- **Control Panel**—Front control panel with LEDs and buttons.
- **Rack Ear Brackets**—Attaches server chassis to the rack.
The rear of the chassis includes the following features:

- **Power Supply**—350 W Platinum Level Power Supply.
- **I/O Back Panel**—Rear I/O ports.
- **Expansion Card Slot**—Slot for one expansion card (requires pre-installed riser card).
- **Rack Ear Brackets**—Attaches server chassis to the rack.

The control panel includes the following LEDs:

- **Overheat/Fan Fail LED**—Flash indicates a fan failure. Solid indicates overheat condition.
- **NIC2 LED**—Flash when there is activity on LAN port 2.
- **NIC1 LED**—Flash when there is activity on LAN port 1.
- **HDD LED**—Flash when there is hard drive activity.
- **Power LED**—Solid when system is operating.
- **Reset Button**—Reboots the system.
- **Power Button**—Removes the main power but maintains standby power. To perform many maintenance tasks, you must also unplug system before servicing.
Chapter 1

Getting Started

Upgrade/Optional Equipment

Memory Upgrades
National Instruments has tested and verified that the DDR-4 UDIMMs and HDDs we offer work with the RMC-8356. We recommend you purchase your DDR-4 UDIMM and HDD modules from National Instruments. Other off-the-shelf DDR-4 UDIMM and HDD modules are not guaranteed to work properly.

National Instruments Software
National Instruments hardware and software work together to help you make the most of your PXI Express system. The LabVIEW, Measurement Studio, and LabWindows™/CVI™ application development environments combine with leading hardware drivers such as NI-DAQmx to provide exceptional control of NI hardware. Instrument drivers are available at ni.com/idnet to simplify communication with instruments over a variety of buses.

LabVIEW is a powerful and easy-to-use graphical programming environment you can use to acquire data from thousands of different instruments including USB, IEEE 488.2, VXI, serial, PLCs, and plug-in boards. LabVIEW helps you convert acquired data into meaningful results using powerful data analysis routines. Add-on tools provide additional specialized functionality. For more information, visit ni.com/labview and ni.com/toolkits.

If you prefer to use Microsoft’s Visual Basic, Visual C++, and Visual Studio .NET for the core of your application, Measurement Studio adds tools for measurement and automation to each language. For more information, visit ni.com/mstudio.

LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI includes a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments. For more information, visit ni.com/lwcvi.

NI-DAQmx provides an extensive library of functions you can call from your application development environment or interactive environment, such as NI Signal Express. These functions provide an intuitive API for National Instruments multifunction DAQ products. Features include analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O, counter/timer operations, SCXI signal conditioning, RTSI or PXI synchronization, self-calibration, messaging, and acquiring data to extended memory. For more information, visit ni.com/daq.

National Instruments modular instruments use specialized drivers suited to each product’s specialization. Express VIs provide customized, interactive programming of instruments in a single interface, and soft front panels provide an interface for testing the functionality of each instrument with no programming required. NI switches, DMMs, high-speed DIO, high-speed
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You can expand the timing and triggering functionality of your PXI system with PXI timing and synchronization products. These products provide precision clock sources, custom routing of triggers for multichassis synchronization, clock sharing, and more, and are programmed with NI-Sync. For more information, visit ni.com/pxi.

NI-VISA is the National Instruments implementation of the VISA specification. VISA is a uniform API for communicating and controlling USB, Serial, GPIB, PXI, VXI, and various other types of instruments. This API aids in the creation of portable applications and instrument drivers. For information about writing your own PXI instrument driver with NI-VISA, refer to the NI-VISA Help and the readme.txt file in the NI-VISA directory. For more information, visit ni.com/visa.
Chapter 2

Installation and BIOS Setup

This chapter describes how to install, configure, and use the RMC-8356. Read this chapter before connecting the RMC-8356 to a power source.

Safety Information

⚠️ **Caution**  Before undertaking any troubleshooting, maintenance, or exploratory procedure, carefully read the following caution notices.

⚠️ **Caution**  To prevent damage, you must employ industry-standard ESD prevention measures during installation, maintenance, and operation.

⚠️ **Caution**  Overloading the circuits may damage supply wiring. Do not exceed the ratings on the equipment nameplate when connecting equipment to the supply circuit.

⚠️ **Caution**  There is a danger of explosion if the onboard battery is installed upside down (which reverses its polarities). This battery must be replaced only with the same or an equivalent type recommended by the manufacturer (CR2032).

This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

- **Chassis Grounding**—The RMC-8356 requires a connection from the premise wire safety ground to the RMC-8356 chassis ground. The earth safety ground must be connected during use of this equipment to minimize shock hazards. Refer to the Connecting Safety Ground section for instructions on connecting safety ground.

- **Mechanical Loading**—To avoid a hazardous load condition, be sure the mechanical load is even when rack mounting the equipment.

- **Live Circuits**—Operating personnel and service personnel must not remove protective covers when operating or servicing the RMC-8356. Adjustments and service to internal components must be undertaken by qualified service technicians. During service of this product, the main connector to the premise wiring must be disconnected. Dangerous voltages may be present under certain conditions; use extreme caution.

- **Explosive Atmosphere**—Do not operate the chassis in conditions where flammable gases are present. Under such conditions, this equipment is unsafe and may ignite the gases or gas fumes.
• **Parts Replacement**—Service this equipment only with parts that are exact replacements, both electrically and mechanically. Contact National Instruments for replacement part information. Installation of parts with those that are not direct replacements may cause harm to personnel operating the chassis. Furthermore, damage or fire may occur if replacement parts are unsuitable.

• **Modification**—*Do not* modify any part of the RMC-8356 from its original condition. Unsuitable modifications may result in safety hazards.

### Chassis Cooling Considerations

The RMC-8356 is designed to operate on a bench or in an instrument rack. Determine how you want to use the RMC-8356 and follow the appropriate installation instructions.

⚠️ **Caution** If installed in a closed or multiunit rack assembly, the rack environment operating ambient temperature may be greater than room ambient temperature. Therefore, install the equipment in an environment compatible with the maximum ambient operating temperature (Tma) specified in Appendix A, *Specifications*.

### Providing Adequate Clearance

Apertures in the front and rear of the chassis facilitate power supply and motherboard cooling. Air enters through the front of the chassis and exits through the fans on the rear of the chassis. Place the RMC-8356 on a bench top or in an instrument rack so that the fans (air outlets) and the air inlet apertures in the front and rear of the chassis have adequate ventilation. Keep other equipment a minimum of 76.2 mm (3 in.) away from the air outlets on the rear of the chassis.

### Installation

Follow these steps to connect devices to the RMC-8356:

1. Connect a keyboard and mouse to the appropriate connectors on the RMC-8356 rear panel.

2. Connect the DisplayPort or DVI monitor video cable to the corresponding DisplayPort or DVI connector on the rear panel.

3. Connect the USB and serial devices as necessary to the RMC-8356 front and rear panel ports.

⚠️ **Caution** To minimize shock hazard, make sure the electrical power outlet you use to power the RMC-8356 has an appropriate earth safety ground. Refer to the *Connecting Safety Ground* section for more information.

4. Connect the AC power cable to the AC inlet on the rear panel and to an AC power outlet. For more information, refer to the *Connecting to Power Source* section.

5. Power on the RMC-8356.

6. Verify that the RMC-8356 boots. If it does not boot, refer to the *What if the RMC-8356 does not boot?* section of Chapter 5, *Troubleshooting*. 

---

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Connecting Safety Ground

The RMC-8356 is designed with a three-position NEMA 5-15 style plug for the U.S. that connects the ground line to the chassis ground. To minimize shock hazard, make sure the electrical power outlet you use to power the chassis has an appropriate earth safety ground.

Connecting to Power Source

Attach input power through the rear AC inlet using the appropriate AC power cable supplied.

Caution Overloading the circuits may damage supply wiring. Do not exceed the ratings on the equipment nameplate when connecting equipment to the supply circuit.

Caution To completely remove power, you must disconnect the AC power cable.

The power switch allows you to power on the chassis or place it in standby mode. Push the power switch to the On position (if not already on). Observe that all fans become operational and the power indicator is lit.

BIOS Setup

This section describes the AMIBIOS™ Setup utility for the RMC-8356 motherboard. The BIOS is stored on a chip and can be easily upgraded using a flash program.

Note Due to periodic changes to the BIOS, some settings may have been added or deleted and might not yet be recorded in this manual. Refer to ni.com/downloads for any changes to BIOS that may not be reflected in this manual.

Starting the Setup Utility

To enter the BIOS Setup Utility, hit the <Delete> key while the system is booting-up. (In most cases, the <Delete> key is used to invoke the BIOS setup screen. There are a few cases when other keys are used, such as <F1>, <F2>, etc.) Each main BIOS menu option is described in this manual.

The Main BIOS screen has two main frames. The left frame displays all the options that can be configured. Grayed-out options cannot be configured. The right frame displays the key legend. Above the key legend is an area reserved for a text message. When an option is selected in the left frame, it is highlighted in white. Often a text message will accompany it. (Note that BIOS has default text messages built in. We retain the option to include, omit, or change any of these text messages.)

Highlighting a submenu and pressing the <Enter> key will open the list of settings within that submenu.
The BIOS setup utility uses a key-based navigation system called hot keys. Most of these hot keys (<F1>, <F10>, <Enter>, <ESC>, <Arrow> keys, etc.) can be used at any time during the setup navigation process.

**Main Setup**

When you first enter the AMI BIOS setup utility, you will enter the Main setup screen. You can always return to the Main setup screen by selecting the Main tab on the top of the screen. The Main BIOS setup screen is shown below. The following Main menu items will be displayed:

**System Date/System Time**

Use this option to change the system date and time. Highlight *System Date or System Time* using the arrow keys. Enter new values using the keyboard. Press the <Tab> key or the arrow keys to move between fields. The date must be entered in Day MM/DD/YYYY format. The time is entered in HH:MM:SS format.

\[\textbf{Note} \quad \text{The time is in the 24-hour format. For example, 5:30 PM. appears as 17:30:00. The date's default value is 01/01/2015 after RTC reset.}\]

**BIOS Version**

This item displays the version of the BIOS ROM used in the system.

**Build Date**

This item displays the date when the version of the BIOS ROM used in the system was built.

**Memory Information**

**Total Memory**

This item displays the total size of memory available in the system.

**Memory Speed**

This item displays the memory speed.

**Advanced Setup Configurations**

Use the arrow keys to select Boot Setup and press <Enter> to access the submenu items.

\[\textbf{Caution} \quad \text{Take caution when changing the Advanced settings. An incorrect value, a very high DRAM frequency, or an incorrect DRAM timing setting may make the system unstable. When this occurs, revert to the default to the manufacture default settings.}\]
**Boot Feature**

**Quiet Boot**
Use this feature to select the screen display between the POST messages and the OEM logo upon bootup. Select Disabled to display the POST messages. Select Enabled to display the OEM logo instead of the normal POST messages. The options are **Enabled** and **Disabled**.

**AddOn ROM Display Mode**
Use this feature to set the display mode for the Option ROM. Select Keep Current to display the current AddOn ROM setting. Select Force BIOS to use the Option ROM display set by the system BIOS. The options are **Force BIOS** and **Keep Current**.

**Bootup NumLock State**
Use this feature to set the Power-on state for the <Numlock> key. The options are **Off** and **On**.

**Wait For "F1" If Error**
Use this feature to force the system to wait until the “F1” key is pressed if an error occurs. The options are **Disabled** and **Enabled**.

**INT19 (Interrupt 19) Trap Response**
Interrupt 19 is the software interrupt that handles the boot disk function. When this item is set to Immediate, the ROM BIOS of the host adapters will capture Interrupt 19 at bootup immediately and allow the drives that are attached to these host adapters to function as bootable disks. If this item is set to Postponed, the ROM BIOS of the host adapters will not capture Interrupt 19 immediately and allow the drives attached to these adapters to function as bootable devices at bootup. The options are **Immediate** and **Postponed**.

**Re-try Boot**
If this item is enabled, the BIOS will automatically reboot the system from a specified boot device after its initial boot failure. The options are **Disabled**, **Legacy Boot**, and **EFI Boot**.

**Power Configuration**

**Watch Dog Function**
If enabled, the Watch Dog Timer will allow the system to reset or generate NMI based on jumper settings when it is expired for more than 5 minutes. The options are **Enabled** and **Disabled**.

**Power Button Function**
This feature controls how the system shuts down when the power button is pressed. Select **4 Seconds Override** for the user to power off the system after pressing and holding the power button for 4 seconds or longer. Select **Instant Off** to instantly power off the system as soon as the user presses the power button. The options are **4 Seconds Override** and **Instant Off**.
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Restore on AC Power Loss
Use this feature to set the power state after a power outage. Select Stay-Off for the system power to remain off after a power loss. Select Power-On for the system power to be turned on after a power loss. Select Last State to allow the system to resume its last power state before a power loss. The options are **Power-On**, **Stay-Off** and **Last State**.

CPU Configuration
The following CPU information will display:

- CPU Signature
- Microcode Patch
- Max CPU Speed
- Min CPU Speed
- CPU Speed
- Processor Cores
- Hyper Threading Technology
- Intel VT-x Technology
- Intel SMX Technology
- 64-bit
- EIST Technology
- CPU C3 State
- CPU C6 State
- CPU C7 State
- L1 Data Cache
- L1 Code Cache
- L2 Cache
- L3 Cache
- L4 Cache

Hyper-threading (Available when supported by the CPU)
Select Enabled to support Intel Hyper-threading Technology to enhance CPU performance. The options are **Enabled** and **Disabled**.

Active Processor Cores
This feature determines how many CPU cores will be activated for each CPU. When all is selected, all cores in the CPU will be activated. (Refer to Intel's website for more information.) The options are **All** and **1**, **2**, and **3**.
Intel® Virtualization Technology
Select Enable to use Intel Virtualization Technology so that I/O device assignments will be reported directly to the VMM (Virtual Memory Management) through the DMAR ACPI Tables. This feature offers fully-protected I/O resource-sharing across the Intel platforms, providing the user with greater reliability, security and availability in networking and data-sharing. The settings are **Enabled** and **Disabled**.

Hardware Prefetcher (Available when supported by the CPU)
If set to Enabled, the hardware prefetcher will prefetch streams of data and instructions from the main memory to the L2 cache to improve CPU performance. The options are **Disabled** and **Enabled**.

Adjacent Cache Line Prefetch (Available when supported by the CPU)
The CPU prefetches the cache line for 64 bytes if this feature is set to Disabled. The CPU prefetches both cache lines for 128 bytes as comprised if this feature is set to **Enabled**.

CPU AES
Select Enabled to enable Intel CPU Advanced Encryption Standard (AES) Instructions for CPU to enhance data integrity. The options are **Enabled** and **Disabled**.

Boot Performance Mode
This feature allows the user to select the performance state that the BIOS will set before the operating system handoff. The options are **Power Saving**, **Max Non-Turbo Performance** and **Turbo Performance**.

HardWare P-States (HWP)
Use this feature to enable or disable hardware P-States support. The options are **Disabled** and **Enabled**.

Intel® SpeedStep™
Intel SpeedStep Technology allows the system to automatically adjust processor voltage and core frequency to reduce power consumption and heat dissipation. The options are **Disabled** and **Enabled**.

Turbo Mode
Select Enabled for processor cores to run faster than the frequency specified by the manufacturer. The options are **Disabled** and **Enabled**.

Package Power Limit MSR Lock
Select Enabled to lock the package power limit for the model specific registers. The options are **Disabled** and **Enabled**.
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Power Limit 1 Override
Select Enabled to support average power limit (PL1) override. The default setting is **Disabled**.

Power Limit 2 Override
Select Enabled to support rapid power limit (PL2) override. The default setting is **Enabled**.

Power Limit 2
Use this item to configure the value for Power Limit 2. The value is in milliwatts and the step size is 125 mW. Use the number keys on your keyboard to enter the value. Enter 0 to use the manufacture default setting. If the value is 0, the BIOS will set PL2 as 1.25 * TDP.

Core Ratio Limit Override
This increases (multiplies) 1 clock speed in the CPU core in relation to the bus speed when one CPU core is active. Press + or - on your keyboard to change the value. Enter 0 to use the manufacture default setting.

Core Ratio Limit Override
This increases (multiplies) 2 clock speeds in the CPU core in relation to the bus speed when two CPU cores are active. Press + or - on your keyboard to change the value. Enter 0 to use the manufacture default setting.

Core Ratio Limit Override
This increases (multiplies) 3 clock speeds in the CPU core in relation to the bus speed when three CPU cores are active. Press + or - on your keyboard to change the value. Enter 0 to use the manufacture default setting.

Core Ratio Limit Override
This increases (multiplies) 4 clock speeds in the CPU core in relation to the bus speed when three CPU cores are active. Press + or - on your keyboard to change the value. Enter 0 to use the manufacture default setting.

CPU C-States
Use this feature to enable the C-State of the CPU. The options are **Disabled** and **Enabled**.

Enhanced C-States
Use this feature to enable the enhanced C-State of the CPU. The options are **Disabled** and **Enabled**.

C-State Auto Demotion
Use this feature to prevent unnecessary excursions into the C-states to improve latency. The options are **Disabled**, **C1**, **C3**, and **C1 and C3**.
C-State Un-Demotion
This feature allows the user to enable or disable the un-demotion of C-State. The options are **Disabled**, **C1**, **C3**, and **C1 and C3**

Package C-State Demotion
Use this feature to enable or disable the Package C-State demotion. The options are **Disabled** and **Enabled**.

Package C-State Un-Demotion
Use this feature to enable or disable the Package C-State un-demotion. The options are **Disabled** and **Enabled**.

C-State Pre-Wake
This feature allows the user to enable or disable the C-State Pre-Wake. The options are **Disabled** and **Enabled**.

Package C-State Limit
Use this feature to set the Package C-State limit. The options are **C0/C1**, **C2**, **C3**, **C6**, **C7**, **C7s**, **C8**, and **AUTO**.

CPU Thermal Configuration

CPU DTS
Select **Enabled** for the ACPI thermal management to use the DTS SMM mechanism to obtain CPU temperature values. Select **Disabled** for EC to report the CPU temperature values. The options are **Disabled** and **Enabled**.

ACPI 3.0 T-States
Select **Enabled** to support CPU throttling by the operating system to reduce power consumption. The options are **Enabled** and **Disabled**.

Chipset Configuration

**Caution** Setting the wrong values in the following features may cause the system to malfunction.

System Agent (SA) Configuration
The following System Agent information will display:

- System Agent Bridge Name
- SA PCIe Code Version
- VT-d
VT-d
Select Enabled to enable Intel Virtualization Technology support for Direct I/O VT-d by reporting the I/O device assignments to VMM through the DMAR ACPI Tables. This feature offers fully-protected I/O resource-sharing across the Intel platforms, providing the user with greater reliability, security and availability in networking and data-sharing. The options are Enabled and Disabled.

Gaussian Mixture Model
This feature is to enable or disable the System Agent Gaussian Mixture Model device. The options are Enabled and Disabled.

Graphics Configuration

Primary Display
Use this feature to select the graphics device to be used as the primary display. The options are Auto, IGFX, PEG, and PCIE.

Primary PEG
This feature allows the user to select the primary PCI Express Graphics (PEG) slot. The default setting is CPU SLOT6 PCI-E 3.0 X16.

Primary PCIE (PCI-Express Graphics)
This feature allows the user to specify which graphics card to be used as the primary graphics card. The options are Auto, PCH SLOT4 PCI-E 3.0 X4 (IN X8), Onboard, and PCH SLOT7 PCI-E 3.0 X4 (INX8).

Internal Graphics
Select Auto to keep an internal graphics device installed on an expansion slot supported by the CPU to be automatically enabled. The options are Auto, Disabled, and Enabled.

DMI/OPI Configuration
The following DMI information will display:
• DMI

DMI VC1 Control
Use this feature to enable or disable DMI Virtual Channel 1. The options are Enabled and Disabled.

DMI VCm Control
Use this feature to enable or disable the DMI Virtual Channel map. The options are Enabled and Disabled.
DMI Link ASPM Control
Use this feature to set the ASPM (Active State Power Management) state on the SA (System Agent) side of the DMI Link. The options are **Disabled** and **L1**.

DMI Extended Sync Control
Use this feature to enable or disable the DMI extended synchronization. The options are **Disabled** and **Enabled**.

DMI De-Emphasis Control
Use this feature to configure the De-emphasis control on DMI. The options are **-6dB** and **-3.5dB**.

PEG Port Configuration

**SLOT6 Max Link Speed**
This feature allows the user to select PCI-E support for the device installed on SLOT6. The options are **Auto**, **Gen 1**, **Gen 2**, and **Gen 3**.

**SLOT6 Max Payload Size**
Use this feature to select the PEG0 maximum payload size. The options are **Auto**, **128 TLP**, and **256 TLP**.

**SLOT6 Power Limit Value**
Use this feature to set the upper limit on the power supplied by the PCIE slot. Press + or - on your keyboard to change this value. The default setting is **75**.

**SLOT6 Power Limit Scale**
Use this feature to select the scale used for the slot power limit value. The options are **1.0x**, **0.1x**, **0.01x**, and **0.001x**.

**Program PCIe ASPM After OPROM**
PCIe ASPM, the Active State Power Management for PCI-Express slots, is a power management protocol used to manage power consumption of serial-link devices installed on PCI-Exp slots during a prolonged off-peak time. If this item is set to **Enabled**, PCIe-E ASPM will be programmed after OPROM. If this item is set to **Disabled**, the PCI-E ASPM will be programmed before OPROM. The options are **Disabled** and **Enabled**.

**Memory Configuration**
The following memory information will display:
- **Memory RC Version**
- **Memory Frequency**
- **Total Memory**
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- VDD
- DIMMA1
- DIMMA2
- DIMMB1
- DIMMB2
- Memory Timings (tCL-tRCD-tRP-tRAS)

Maximum Memory Frequency
Use this feature to set the maximum memory frequency for onboard memory modules. The options are Auto, 1067, 1200, 1333, 1400, 1600, 1800, 1867, 2000, 2133, 2200, 2400, 2600, 2667, 2800, 2933, 3000, and 3200.

Max TOLUD
This feature sets the maximum TOLUD value, which specifies the Top of Low Usable DRAM memory space to be used by internal graphics devices, GTT Stolen Memory, and TSEG, respectively, if these devices are enabled. The options are Dynamic, 1 GB, 1.25 GB, 1.5 GB, 1.75 GB, 2 GB, 2.25 GB, 2.5 GB, 2.75 GB, 3 GB, 3.25 GB, and 3.5 GB.

Energy Performance Gain
Use this feature to enable or disable the energy performance gain. The options are Disabled and Enabled.

Memory Scrambler
Select Enabled to enable memory scrambler support. The options are Disabled and Enabled.

Fast Boot
Use this feature to enable or disable fast path through the memory reference code. The options are Enabled and Disabled.

REFRESH_2X_MODE
Use this feature to select the refresh mode. The options are Disabled, 1-Enabled for WARM or HOT, and 2-Enabled HOT only.

GT - Power Management Control
The following GT - Power Management Control information will display:

- GT Info

RC6 (Render Standby)
Select Enabled to enable render standby support. The options are Disabled and Enabled.
PCH-IO Configuration

The following PCH-IO information will display:

- Intel PCH RC Version
- Intel PCH SKU Name
- Intel PCH Rev ID

PCI Express Configuration

DMI Link ASPM Control
Use this feature to set the ASPM (Active State Power Management) state on the SA (System Agent) side of the DMI Link. The options are Disabled and Enabled.

Peer Memory Write Enable
Use this feature to enable or disable peer memory write. The options are Disabled or Enabled.

PCH SLOT4 PCI-E 3.0 X4 (IN X8)

SLOT4 ASPM Support
Use this item to set the Active State Power Management (ASPM) level for a PCI-E device. Select Auto for the system BIOS to automatically set the ASPM level based on the system configuration. Select Disabled to disable ASPM support. The options are Disabled, L0s, L1, L0s & L1, and Auto.

SLOT4 L1 Substates
Use this feature to configure the PCI Express L1 Substates. The options are Disabled, L1.1, L1.2, and L1.1 & L1.2

SLOT4 PCIe Speed
Use this feature to select the PCI Express port speed. The options are Auto, Gen1, Gen2, and Gen3.

SLOT4 Detect Non-Compliance Device
Select Enabled for the AMI BIOS to automatically detect a PCI-E device that is not compliant with the PCI-E standards. The options are Disabled and Enabled.

PCH SLOT7 PCI-E 3.0 X4 (IN X8)

SLOT7 ASPM Support
Use this item to set the Active State Power Management (ASPM) level for a PCI-E device. Select Auto for the system BIOS to automatically set the ASPM level based on the system configuration. Select Disabled to disable ASPM support. The options are Disabled, L0s, L1, L0s & L1, and Auto.
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SLOT7 L1 Substates
Use this feature to set the PCI Express L1 Substates. The options are Disabled, L1.1, L1.2, and L1.1 & L1.2.

SLOT7 PCIe Speed
Use this feature to select the PCI Express port speed. The options are Auto, Gen1, Gen2, and Gen3.

SLOT7 Detect Non-Compliance Device
Select Enabled for the AMI BIOS to automatically detect a PCI-E device that is not compliant with the PCI-E standards. The options are Disabled and Enabled.

Port 61h bit-4 Emulation
Select Enabled to enable the emulation of Port 61h bit-4 toggling in SMM (System Management Mode). The options are Disabled and Enabled.

PCIe PLL SSC
Enable this feature to reduce EMI interference by down spreading clock 0.5%. Disable this feature to centralize the clock without spreading. The options are Disabled and Enabled.

SATA Configuration
When this submenu is selected, the AMI BIOS automatically detects the presence of the SATA devices that are supported by the Intel PCH chip and displays the following items:

SATA Controller(s)
This item enables or disables the onboard SATA controller supported by the Intel PCH chip. The options are Enabled and Disabled.

SATA Mode Selection
Use this item to select the mode for the installed SATA drives. The options are AHCI and RAID.

SATA Frozen
Use this item to enable the HDD Security Frozen Mode. The options are Enabled and Disabled.

Note  If the item above SATA Mode Selection is set to RAID, the following items will display:

SATA RAID Option ROM/UEFI Driver
Select UEFI to load the EFI driver for system boot. Select Legacy to load a legacy driver for system boot. The options are Legacy ROM and UEFI Driver.
SATA Port 0 ~ Port 3
This item displays the information detected on the installed SATA drive on the particular SATA port.
• Model number of drive and capacity
• Software Preserve Support

Port 0 ~ Port 3 Spin Up Device
On an edge detect from 0 to 1, set this item to allow the PCH to initialize the device. The options are Enabled and Disabled.

Port 0 ~ Port 3 SATA Device Type
Use this item to specify if the SATA port specified by the user should be connected to a Solid State drive or a Hard Disk Drive. The options are Hard Disk Drive and Solid State Drive.

PCle/PCI/PnP Configuration
The following information will display:
• PCI Bus Driver Version
• PCI Devices Common Settings:

PCI PERR/SERR Support
Select Enabled to allow a PCI device to generate a PERR/SERR number for a PCI Bus Signal Error Event. The options are Enabled and Disabled.

Above 4G Decoding (Available if the system supports 64-bit PCI decoding)
Select Enabled to decode a PCI device that supports 64-bit in the space above 4G Address. The options are Enabled and Disabled.

PCH SLOT4 PCI-E 3.0 X4 (IN X8)
Use this feature to select which firmware type to be loaded for the add-on card in this slot.
The options are Disabled, Legacy, and EFI.

CPU SLOT6 PCI-E 3.0 X16
Use this feature to select which firmware type to be loaded for the add-on card in this slot.
The options are Disabled, Legacy, and EFI.

PCH SLOT 7 PCI-E 3.0 X4 (IN X8)
Use this feature to select which firmware type to be loaded for the add-on card in this slot.
The options are Disabled, Legacy, and EFI.
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Onboard LAN Option ROM Type
Select Enabled to enable Option ROM support to boot the computer using a network device specified by the user. The options are Legacy and EFI.

Onboard LAN1 Option ROM
Use this option to select the type of device installed in LAN Port1 used for system boot. The default setting for LAN1 Option ROM is PXE.

Onboard LAN2 Option ROM
Use this option to select the type of device installed in LAN Port2 used for system boot. The default setting for LAN2 Option ROM is Disabled.

Onboard LAN3 Option ROM
Use this option to select the type of device installed in LAN Port3 used for system boot. The default setting for LAN3 Option ROM is Disabled (X11SSZ-TLN4F only).

Onboard LAN4 Option ROM
Use this option to select the type of device installed in LAN Port4 used for system boot. The default setting for LAN4 Option ROM is Disabled (X11SSZ-TLN4F only).

Onboard Video Option ROM
Use this feature to select which firmware type to be loaded for the onboard video controller.

The options are Disabled, Legacy, and EFI.

Network Stack
Select Enabled to enable PXE (Preboot Execution Environment) or UEFI (Unified Extensible Firmware Interface) for network stack support.

The options are Enabled and Disabled.

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

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

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

Media detect count
Use this option to specify the number of times media will be checked. Press + or - on your keyboard to change the value. The default setting is 1.
Super IO Configuration
The following Super IO information will display:
• AMI SIO Driver Version

Super IO Chip Logical Device(s) Configuration

Serial Port 1
Serial Port 1 Configuration
This submenu allows the user to configure settings of Serial Port 1.

Serial Port 1
Select Enabled to enable the selected onboard serial port. The options are Enabled and Disabled.

Logical Device Settings
This item displays the status of a serial part specified by the user.

Serial Port 1 Change Settings
This feature specifies the base I/O port address and the Interrupt Request address of a serial port specified by the user. Select Auto to allow the BIOS to automatically assign the base I/O and IRQ address.

The options for Serial Port 1 are Use Automatic Settings, (IO=3F8h; IRQ=4; DMA), (IO=3F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), (IO=2F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), (IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), and (IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA).

Serial Port 2
Serial Port 2 Configuration
This submenu allows the user to configure settings of Serial Port 2.

Serial Port 2
Select Enabled to enable the selected onboard serial port. The options are Enabled and Disabled.

Logical Device Settings
This item displays the status of a serial part specified by the user.

Serial Port 2 Change Settings
This feature specifies the base I/O port address and the Interrupt Request address of a serial port specified by the user. Select Auto to allow the BIOS to automatically assign the base I/O and IRQ address.
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The options for Serial Port 2 are **Use Automatic Settings**, (IO=2F8h; IRQ=3; DMA), (IO=3F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), (IO=2F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), (IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA), and (IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12; DMA).

**Serial Port 2 Attribute (Available for Serial Port 2 only)**
Select SOL to use COM Port 2 as a Serial_Over_LAN (SOL) port for console redirection. The options are **COM** and **SOL**.

**PCH-FW Configuration**
The following firmware information will display:
- ME FW Version
- ME Firmware Mode
- ME Firmware Type
- ME Firmware SKU

**ME FW Image Re-Flash**
Use this feature to update the Management Engine firmware. The options are **Enabled** and **Disabled**.

**AMT Configuration**
**Intel AMT**
Select Enabled to use Intel AMT (Active Management Technology) to enhance system performance. The options are **Enabled** and **Disabled**.

**BIOS Hotkey Pressed**
Select Enabled to use the BIOS Hotkey feature. The options are **Enabled** and **Disabled**.

**Watch Dog**
Select Enabled to allow AMT to reset or power down the system if the operating system or BIOS hangs or crashes. The options are **Disabled**, and **Enabled**.

**OS Timer / BIOS Timer**
These options appear if Watch Dog Timer (above) is enabled. This is a timed delay in seconds, before a system power down or reset after a BIOS or operating system failure is detected. Directly enter the value in seconds.
Serial Port Console Redirection

COM1 Console Redirection Console Redirection
Select Enabled to enable console redirection support for a serial port specified by the user.

The options are Enabled and Disabled.

*If the item above set to Enabled, the following items will become available for user's configuration:

COM1 Console Redirection Settings
This feature allows the user to specify how the host computer will exchange data with the client computer, which is the remote computer used by the user.

COM1 Terminal Type
This feature allows the user to select the target terminal emulation type for Console Redirection. Select VT100 to use the ASCII Character set. Select VT100+ to add color and function key support. Select ANSI to use the Extended ASCII Character Set. Select VT-UTF8 to use UTF8 encoding to map Unicode characters into one or more bytes. The options are VT100, VT100+, VT-UTF8, and ANSI.

COM1 Bits Per second
Use this feature to set the transmission speed for a serial port used in Console Redirection. Make sure that the same speed is used in the host computer and the client computer. A lower transmission speed may be required for long and busy lines. The options are 9600, 19200, 38400, 57600 and 115200 (bits per second).

COM1 Data Bits
Use this feature to set the data transmission size for Console Redirection. The options are 7 Bits and 8 Bits.

COM1 Parity
A parity bit can be sent along with regular data bits to detect data transmission errors. Select Even if the parity bit is set to 0, and the number of 1's in data bits is even. Select Odd if the parity bit is set to 0, and the number of 1's in data bits is odd. Select None if you do not want to send a parity bit with your data bits in transmission. Select Mark to add a mark as a parity bit to be sent along with the data bits. Select Space to add a Space as a parity bit to be sent with your data bits. The options are None, Even, Odd, Mark and Space.

COM1 Stop Bits
A stop bit indicates the end of a serial data packet. Select 1 Stop Bit for standard serial data communication. Select 2 Stop Bits if slower devices are used. The options are 1 and 2.
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COM1 Flow Control
Use this feature to set the flow control for Console Redirection to prevent data loss caused by buffer overflow. Send a Stop signal to stop sending data when the receiving buffer is full. Send a Start signal to start sending data when the receiving buffer is empty. The options are None and Hardware RTS/CTS.

COM1 VT-UTF8 Combo Key Support
Select Enabled to enable VT-UTF8 Combination Key support for ANSI/VT100 terminals. The options are Disabled and Enabled.

COM1 Recorder Mode
Select Enabled to capture the data displayed on a terminal and send it as text messages to a remote server. The options are Disabled and Enabled.

COM1 Resolution 100x31
Select Enabled for extended-terminal resolution support. The options are Disabled and Enabled.

COM1 Legacy OS Redirection Resolution
Use this feature to select the number of rows and columns used in Console Redirection for legacy OS support. The options are 80x24 and 80x25.

COM1 Putty KeyPad
This feature selects the settings for Function Keys and KeyPad used for Putty, which is a terminal emulator designed for the Windows OS. The options are VT100, LINUX, XTERMR6, SC0, ESCN, and VT400.

COM1 Redirection After BIOS Post
Use this feature to enable or disable legacy console redirection after BIOS POST. When set to Bootloader, legacy console redirection is disabled before booting the OS. When set to Always Enable, legacy console redirection remains enabled when booting the OS. The options are Always Enable and Bootloader.

SOL/COM2 Console Redirection
Select Enabled to use the SOL port for Console Redirection. The options are Enabled and Disabled.
*If the item above set to Enable d, the following items will become available for user's configuration:

**SOL(COM2 Console Redirection Settings**

Use this feature to specify how the host computer will exchange data with the client computer, which is the remote computer used by the user.

**COM2 Terminal Type**

Use this feature to select the target terminal emulation type for Console Redirection. Select VT100 to use the ASCII Character set. Select VT100+ to add color and function key support. Select ANSI to use the Extended ASCII Character Set. Select VT-UTF8 to use UTF8 encoding to map Unicode characters into one or more bytes. The options are ANSI, VT100, VT100+, and VT-UTF8.

**COM2 Bits Per second**

Use this feature to set the transmission speed for a serial port used in Console Redirection. Make sure that the same speed is used in the host computer and the client computer. A lower transmission speed may be required for long and busy lines. The options are 9600, 19200, 38400, 57600 and 115200 (bits per second).

**COM2 Data Bits**

Use this feature to set the data transmission size for Console Redirection. The options are 7 Bits and 8 Bits.

**COM2 Parity**

A parity bit can be sent along with regular data bits to detect data transmission errors. Select Even if the parity bit is set to 0, and the number of 1's in data bits is even. Select Odd if the parity bit is set to 0, and the number of 1's in data bits is odd. Select None if you do not want to send a parity bit with your data bits in transmission. Select Mark to add a mark as a parity bit to be sent along with the data bits. Select Space to add a Space as a parity bit to be sent with your data bits. The options are None, Even, Odd, Mark and Space.

**COM2 Stop Bits**

A stop bit indicates the end of a serial data packet. Select 1 Stop Bit for standard serial data communication. Select 2 Stop Bits if slower devices are used. The options are 1 and 2.

**COM2 Flow Control**

Use this feature to set the flow control for Console Redirection to prevent data loss caused by buffer overflow. Send a Stop signal to stop sending data when the receiving buffer is full. Send a Start signal to start sending data when the receiving buffer is empty. The options are None and Hardware RTS/CTS.
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COM2 VT-UTF8 Combo Key Support
Select Enabled to enable VT-UTF8 Combination Key support for ANSI/VT100 terminals. The options are Disabled and Enabled.

COM2 Recorder Mode
Select Enabled to capture the data displayed on a terminal and send it as text messages to a remote server. The options are Disabled and Enabled.

COM2 Resolution 100x31
Select Enabled for extended-terminal resolution support. The options are Disabled and Enabled.

COM2 Legacy OS Redirection Resolution
Use this feature to select the number of rows and columns used in Console Redirection for legacy OS support. The options are 80x24 and 80x25.

COM2 Putty KeyPad
This feature selects Function Keys and KeyPad settings for Putty, which is a terminal emulator designed for the Windows OS. The options are VT100, LINUX, XTERMR6, SCO, ESCN, and VT400.

COM2 Redirection After BIOS Post
Use this feature to enable or disable legacy Console Redirection after BIOS POST. When set to Bootloader, legacy Console Redirection is disabled before booting the OS. When set to Always Enable, legacy Console Redirection remains enabled when booting the OS. The options are Always Enable and Bootloader.

EMS (Emergency Management Services) Console Redirection
Select Enabled to use a COM port selected by the user for EMS Console Redirection. The options are Enabled and Disabled.

*If the item above set to Enabled, the following items will become available for user's configuration:

EMS Console Redirection Settings
This feature allows the user to specify how the host computer will exchange data with the client computer, which is the remote computer used by the user.

Out-of-Band Management Port
The feature selects a serial port in a client server to be used by the Microsoft Windows Emergency Management Services (EMS) to communicate with a remote host server. The options are COM1 and SOL/COM2.
Terminal Type
Use this feature to select the target terminal emulation type for Console Redirection. Select VT100 to use the ASCII character set. Select VT100+ to add color and function key support. Select ANSI to use the extended ASCII character set. Select VT-UTF8 to use UTF8 encoding to map Unicode characters into one or more bytes. The options are VT100, VT100+, VT-UTF8, and ANSI.

Bits Per Second
This item sets the transmission speed for a serial port used in Console Redirection. Make sure that the same speed is used in the host computer and the client computer. A lower transmission speed may be required for long and busy lines. The options are 9600, 19200, 57600, and 115200 (bits per second).

Flow Control
Use this item to set the flow control for Console Redirection to prevent data loss caused by buffer overflow. Send a Stop signal to stop sending data when the receiving buffer is full. Send a Start signal to start sending data when the receiving buffer is empty. The options are None, Hardware RTS/CTS, and Software Xon/Xoff.

ACPI Settings
ACPI Sleep State
This feature selects the ACPI Sleep State that the system will enter into when the suspend button is activated. The options are Suspend Disabled and S3 (Suspend to RAM).

High Precision Event Timer
Select Enabled to activate the High Performance Event Timer (HPET) that produces periodic interrupts at a much higher frequency than a Real-time Clock (RTC) does in synchronizing multimedia streams, providing smooth playback and reducing the dependency on other timestamp calculation devices, such as an x86 RDTSC Instruction embedded in the CPU. The High Performance Event Timer is used to replace the 8254 Programmable Interval Timer. The options are Disabled and Enabled.

WHEA Support
Select Enabled to support the Windows Hardware Error Architecture (WHEA) platform and provide a common infrastructure for the system to handle hardware errors within the Windows OS environment to reduce system crashes and to enhance system recovery and health monitoring. The options are Enabled and Disabled.
Chapter 2 Installation and BIOS Setup

Trusted Computing Configuration

Security Device Support
If this feature and the TPM jumper on the motherboard are both set to Enabled, onboard security devices will be enabled for TPM (Trusted Platform Module) support to enhance data integrity and network security. Reboot the system for a change on this setting to take effect. The options are **Disabled** and **Enabled**.

TPM State
This feature changes the TPM State. The options are **Disabled** and **Enabled**.

**Note** The system will restart to change the TPM State.

Pending TPM operation
Use this item to schedule a TPM-related operation to be performed by a security device for system data integrity. Your system will reboot to carry out a pending TPM operation. The options are **None** and **TPM Clear**.

Device Select
Use this feature to select the TPM version. TPM 1.2 will restrict support to TPM 1.2 devices. TPM 2.0 will restrict support for TPM 2.0 devices. Select Auto to enable support for both versions. The default setting is **Auto**.

The following are informational status messages that indicate the current TPM State:
- TPM Enabled
- Status TPM Active Status
- TPM Owner Status

TXT Support
Intel TXT (Trusted Execution Technology) helps protect against software-based attacks and ensures protection, confidentiality and integrity of data stored or created on the system. Use this feature to enable or disable TXT Support. The options are **Disabled** and **Enabled**.

iSCSI Configuration

iSCSI Initiator Name
This feature allows the user to enter the unique name of the iSCSI Initiator in IQN format. Once the name of the iSCSI Initiator is entered into the system, configure the proper settings for the following items:
- Add an Attempt
- Delete Attempts
- Change Attempt order
Intel I210 Gigabit Network Connection - 00:25:90:5D:39:AF

NIC Configuration

Link Speed
Use this feature to specify the port speed used for the selected boot protocol. The options are Auto Negotiated, 10 Mbps Half, 10 Mbps Full, 100 Mbps Half, and 100 Mbps Full.

Wake On LAN
Select Enabled for Wake On LAN support, which will allow the system to wake up when an onboard LAN device receives an incoming signal. The options are Disabled and Enabled.

Blink LEDs
Use this feature to identify the physical network port by blinking the associated LED. Use the keyboard to select a value.

UEFI Driver
This item displays the UEFI driver version.

Adapter PBA
This item displays the Processor Bus Adapter (PBA) model number. The PBA number is a nine digit number (i.e., 010B00-000) located near the serial number.

Device Name
This item displays the adapter device name.

Chip Type
This item displays the network adapter chipset name.

PCI Device ID
This item displays the device ID number.

PCI Address
This item displays the PCI address for this computer. PCI addresses are 3 two-digit hexadecimal numbers.

Link Status
This item displays the connection status.

MAC Address
This item displays the MAC address for this computer. Mac addresses are 6 two-digit hexadecimal numbers.
Chapter 2 Installation and BIOS Setup

Intel Ethernet Connection (H) I219-LM
00:25:90:5D:39:AE

NIC Configuration

Link Speed
Use this feature to specify the port speed used for the selected boot protocol. The options are Auto Negotiated, 10 Mbps Half, 10 Mbps Full, 100 Mbps Half, and 100 Mbps Full.

Wake On LAN
Select Enabled for Wake On LAN support, which will allow the system to wake up when an onboard LAN device receives an incoming signal. The options are Disabled and Enabled.

Blink LEDs
Use this feature to identify the physical network port by blinking the associated LED. Use the keyboard to select a value.

UEFI Driver
This item displays the UEFI driver version.

Adapter PBA
This item displays the Processor Bus Adapter (PBA) model number. The PBA number is a nine digit number (i.e., 010B00-000) located near the serial number.

Device Name
This item displays the adapter device name.

Chip Type
This item displays the network adapter chipset name.

PCI Device ID
This item displays the device ID number.

PCI Address
This item displays the PCI address for this computer. PCI addresses are 3 two-digit hexadecimal numbers.

Link Status
This item displays the connection status.

MAC Address
This item displays the MAC address for this computer. Mac addresses are 6 two-digit hexadecimal numbers.
Virtual MAC Address
This item displays the Virtual MAC address for this computer. Mac addresses are 6 two-digit hexadecimal numbers.

Event Logs
Use this feature to configure Event Log settings.

Change SMBIOS Event Log Settings

Enabling/Disabling Options SMBIOS Event Log
Change this item to enable or disable all features of the SMBIOS Event Logging during system boot. The options are Enabled and Disabled.

Erasing Settings

Erase Event Log
If No is selected, data stored in the event log will not be erased. Select Yes, Next Reset, data in the event log will be erased upon next system reboot. Select Yes, Every Reset, data in the event log will be erased upon every system reboot. The options are No, Yes, Next reset, and Yes, Every reset.

When Log is Full
Select Erase Immediately for all messages to be automatically erased from the event log when the event log memory is full. The options are Do Nothing and Erase Immediately.

SMBIOS Event Long Standard Settings

Log System Boot Event
This option toggles the System Boot Event logging to enabled or disabled. The options are Disabled and Enabled.

MECI
The Multiple Event Count Increment (MECI) counter counts the number of occurrences that a duplicate event must happen before the MECI counter is incremented. This is a numeric value. The default value is 1.

METW
The Multiple Event Time Window (METW) defines number of minutes must pass between duplicate log events before MECI is incremented. This is in minutes, from 0 to 99. The default value is 60.

Note
After making changes on a setting, be sure to reboot the system for the changes to take effect.
Chapter 2  Installation and BIOS Setup

View SMBIOS Event Log
This section displays the contents of the SMBIOS Event Log.

IPMI
Use this feature to configure Intelligent Platform Management Interface (IPMI) settings.

BMC Firmware Revision
This item indicates the IPMI firmware revision used in your system.

IPMI Status (Baseboard Management Controller)
This item indicates the status of the IPMI firmware installed in your system.

System Event Log

Enabling/Disabling Options SEL Components
Select Enabled for all system event logging at bootup. The options are Enabled and Disabled.

Erasing Settings

Erase SEL
Select Yes, On next reset to erase all system event logs upon next system reboot. Select Yes, On every reset to erase all system event logs upon each system reboot. Select No to keep all system event logs after each system reboot. The options are No, Yes, On next reset, and Yes, On every reset.

When SEL is Full
This feature allows the user to decide what the BIOS should do when the system event log is full. Select Erase Immediately to erase all events in the log when the system event log is full. The options are Do Nothing and Erase Immediately.

Note  After making changes on a setting, be sure to reboot the system for the changes to take effect.

BMC Network Configuration

BMC Network Configuration
*The BMC network information is only valid when the IPMI Function is enabled.*

IPMI LAN Selection
This item displays the IPMI LAN setting. The default setting is Failover.
IPMI Network Link Status
This item displays the IPMI Network Link status. The default setting is Shared LAN.

Update IPMI LAN Configuration
Select Yes for the BIOS to implement all IP/MAC address changes at the next system boot.
The options are No and Yes

Configuration Address Source
This feature allows the user to select the source of the IP address for this computer. If Static is selected, you will need to know the IP address of this computer and enter it to the system manually in the field. If DHCP is selected, the BIOS will search for a DHCP (Dynamic Host Configuration Protocol) server in the network that is attached to and request the next available IP address for this computer. The options are DHCP and Static. The following items are assigned IP addresses automatically if DHCP is selected.

Current Configuration Address Source
This item displays the current configuration address for this computer.

Station IP Address
This item displays the Station IP address for this computer. This should be in decimal and in dotted quad form (i.e., 192.168.10.253).

Subnet Mask
This item displays the sub-network that this computer belongs to. The value of each three-digit number separated by dots should not exceed 255.

Station MAC Address
This item displays the Station MAC address for this computer. Mac addresses are 6 two-digit hexadecimal numbers.

Gateway IP Address
This item displays the Gateway IP address for this computer. This should be in decimal and in dotted quad form (i.e., 172.31.0.1).

IPMI Function Support
Use this feature to enable IPMI support. The options are Enabled and Disabled. When Disabled, the system powers on quickly by removing BIOS support for extended IPMI features. The Disable option is for applications that require faster power on time without using Update Manager (SUM) or extended IPMI features. The BMC network configuration in the BIOS setup is also invalid when IPMI Function Support is disabled. The general BMC function and motherboard health monitor such as fan control are still functioning when this option is disabled.
Chapter 2 Installation and BIOS Setup

Security

This menu allows the user to configure the following security settings for the system.

Password Check
Select Setup for the system to check for a password at Setup. Select Always for the system to check for a password at bootup or upon entering the BIOS Setup utility. The options are Setup and Always.

Administrator Password
Press Enter to create a new, or change an existing Administrator password.

Secure Boot Menu
This section displays the contents of the following secure boot features:

- System Mode
- Secure Boot
- Vendor Keys

Secure Boot
Use this item to enable secure boot. The options are Disabled and Enabled.

Secure Boot Mode
Use this item to select the secure boot mode. The options are Standard and Custom.

CSM Support
Select Enabled to support the EFI Compatibility Support Module (CSM), which provides compatibility support for traditional legacy BIOS for system boot. The options are Enabled and Disabled.

Key Management
This submenu allows the user to configure the following Key Management settings.

Provision Factory Default Keys
Select Enabled to install the default Secure-Boot keys set by the manufacturer. The options are Disabled and Enabled.

Enroll All Factory Default Keys
Select Yes to install all default secure keys set by the manufacturer. The options are Yes and No.

Save All Secure Boot Variables
This feature allows the user to decide if all secure boot variables should be saved.
Platform Key (PK)
This feature allows the user to configure the settings of the platform keys.

Set New Key
Select Yes to load the new platform keys (PK) from the manufacturer's defaults. Select No to load the platform keys from a file. The options are Yes and No.

Key Exchange Key Set New Key
Select Yes to load the KEK from the manufacturer's defaults. Select No to load the KEK from a file. The options are Yes and No.

Append Key
Select Yes to add the KEK from the manufacturer's defaults list to the existing KEK. Select No to load the KEK from a file. The options are Yes and No.

Authorized Signatures Set New Key
Select Yes to load the database from the manufacturer's defaults. Select No to load the DB from a file. The options are Yes and No.

Append Key
Select Yes to add the database from the manufacturer's defaults to the existing DB. Select No to load the DB from a file. The options are Yes and No.

Forbidden Signatures Set New Key
Select Yes to load the DBX from the manufacturer's defaults. Select No to load the DBX from a file. The options are Yes and No.

Append Key
Select Yes to add the DBX from the manufacturer's defaults to the existing DBX. Select No to load the DBX from a file. The options are Yes and No.

Authorized TimeStamps Set New Key
Select Yes to load the DBT from the manufacturer's defaults. Select No to load the DBT from a file. The options are Yes and No.

Append Key
Select Yes to add the DBT from the manufacturer's defaults list to the existing DBT. Select No to load the DBT from a file. The options are Yes and No.
Chapter 2  Installation and BIOS Setup

Boot

Use this feature to configure Boot Settings:

Boot Mode Select
Use this item to select the type of device that the system is going to boot from. The options are
Legacy, UEFI, and Dual. The default setting is Dual.

Fixed Boot Order Priorities
This option prioritizes the order of bootable devices that the system to boot from. Press
<Enter> on each entry from top to bottom to select devices.

If the item above set to Legacy, UEFI/Dual the following items will be displayed:
• Legacy/UEFI/Dual/Boot Option #1
• Legacy/UEFI/Dual/Boot Option #2
• Legacy/UEFI/Dual/Boot Option #3
• Legacy/UEFI/Dual/Boot Option #4
• Legacy/UEFI/Dual/Boot Option #5
• Legacy/UEFI/Dual/Boot Option #6
• Legacy/UEFI/Dual/Boot Option #7
• Legacy/UEFI/Dual/Boot Option #8
• Legacy/UEFI/Dual/Boot Option #9
• Legacy/UEFI/Dual/Boot Option #10
• Legacy/UEFI/Dual/Boot Option #11
• Legacy/UEFI/Dual/Boot Option #12
• Legacy/UEFI/Dual/Boot Option #13
• Legacy/UEFI/Dual/Boot Option #14
• Legacy/UEFI/Dual/Boot Option #15

Delete Boot Option
Use this feature to remove a pre-defined boot device from which the system will boot during
startup.

The settings are [any pre-defined boot device].

NETWORK Drive BBS Priorities
This feature allows the user to specify which Network devices are boot devices.
• Legacy Boot Order #1
**UEFI NETWORK Drive BBS Priorities**
This feature allows the user to specify which UEFI network drive devices are boot devices.
- UEFI Boot Order #1
- UEFI Boot Order #2

**UEFI Application Boot Priorities**
This feature allows the user to specify which UEFI devices are boot devices.
- UEFI Boot Order #1

**Save & Exit**
Select the Exit tab from the BIOS setup utility screen to enter the Exit BIOS Setup screen.

**Discard Changes and Exit**
Select this option to quit the BIOS Setup without making any permanent changes to the system configuration, and reboot the computer. Select Discard Changes and Exit from the Exit menu and press <Enter>.

**Save Changes and Reset**
When you have completed the system configuration changes, select this option to leave the BIOS setup utility and reboot the computer, so the new system configuration parameters can take effect. Select Save Changes and Exit from the Exit menu and press <Enter>.

**Save Changes**
After completing the system configuration changes, select this option to save the changes you have made. This will not reset (reboot) the system.

**Discard Changes**
Select this option and press <Enter> to discard all the changes and return to the AMI BIOS utility Program.

**Default Options**

**Restore Optimized Defaults**
To set this feature, select Restore Optimized Defaults from the Save & Exit menu and press <Enter>. These are factory settings designed for maximum system stability, but not for maximum performance.

**Save As User Defaults**
To set this feature, select Save as User Defaults from the Exit menu and press <Enter>. This enables the user to save any changes to the BIOS setup for future use.
Chapter 2  Installation and BIOS Setup

Restore User Defaults
To set this feature, select Restore User Defaults from the Exit menu and press <Enter>. Use this feature to retrieve user-defined settings that were saved previously.

Boot Override
Listed on this section are other boot options for the system (i.e., Built-in EFI shell). Select an option and press <Enter>. Your system will boot to the selected boot option.

BIOS Error Beep Codes

Errors may occur during the Power-On Self-Test (POST) routines, which are performed each time the system is powered on.

Nonfatal errors are those which, in most cases, allow the system to continue the boot-up process. The error messages normally appear on the screen.

Fatal errors do not allow the system to continue the boot-up procedure. If a fatal error occurs, consult with your system manufacturer about possible repairs.

<table>
<thead>
<tr>
<th>Beep Code</th>
<th>Error Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>One beep</td>
<td>Refresh</td>
<td>Circuits have been reset. (Ready to power up.)</td>
</tr>
<tr>
<td>Five short beeps and one long beep</td>
<td>Memory error</td>
<td>No memory is detected in the system</td>
</tr>
<tr>
<td>One beep per device</td>
<td>Refresh</td>
<td>One beep for each USB device detected</td>
</tr>
<tr>
<td>One continuous beep</td>
<td>System overheat</td>
<td>System is overheating</td>
</tr>
</tbody>
</table>

OS Reinstallation and Recovery

Caution  Recovering the OS using the hard drive-based recovery or the OS recovery USB erases the contents of your hard disk. Before recovering the OS, back up any files you want to keep.

The RMC-8356 includes a preinstalled OS from the factory. The RMC-8356 also includes two methods of restoring/reinstalling the OS to your system.

- Hard drive-based recovery stores a factory backup on a separate portion of your hard drive, allowing you to restore your server without additional media.
The hard drive recovery hot key is <F4>. To access the hard drive-based recovery tool, press and hold <F4> when video first appears during the boot process.

Note Hard drive recovery is not available if the OS is installed on a RAID array.

- The RMC-8356 may also ship with an OS recovery USB you can use to reinstall your operating system onto your hard drive.

If you need to reinstall your operating system, you can use the included OS recovery USB. Boot the RMC-8356 using the OS recovery USB to recover the OS.

Note You also may need to update or reinstall software after using the OS reinstallation USB to recover your OS. The OS reinstallation USB may contain drivers that are older or newer than the factory-installed version of the OS and may not contain the latest RAID drivers. To ensure you have the latest drivers, go to www.intel.com and install the Intel Rapid Storage Technology (Intel RST) RAID software package.

Note After you reinstall or recover your OS, you may find shortcuts on the desktop that require you to install specific drivers or software (for example, video drivers). Due to driver and software packaging, it was not possible to preinstall this software during the OS installation.

Cleaning

Caution Always disconnect the AC power cable before cleaning or servicing the chassis.

Exterior Cleaning

Caution Avoid getting moisture inside the chassis during exterior cleaning, especially through the top vents.

Do not wash the front- or rear-panel connectors or switches. Cover these components while cleaning the chassis.

Do not use harsh chemical cleaning agents; they may damage the chassis. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Clean the exterior surfaces of the chassis with a dry lint-free cloth or a soft-bristle brush. Do not use abrasive compounds on any part of the chassis.
Chapter 2  Installation and BIOS Setup

Rack Mounting

Caution  When mounting the equipment in the rack, do not create a hazardous condition due to uneven mechanical loading.

Installing the Rails

There are a variety of rack units on the market, which may require a slightly different assembly procedure.

The following is a basic guideline for installing the system into a rack with the rack mounting hardware provided. You should also refer to the installation instructions that came with the specific rack you are using.

Identifying the Rails

The rack rails and the related hardware should have been included with the system. Refer to Figure 2-1 to identify the rail sections.

Note  The two rails are left/right specific.

Installing the Chassis Rails

Begin the rack mounting procedure by installing the inner rails to the server chassis.

1. Position the front and rear chassis rail sections along the side of the server making sure the screw holes line up. Note that these two rails are left/right specific.

2. Screw the front chassis rail (the long piece) securely to the side of the chassis. There should be two screws for each side. Repeat this procedure for the other rail on the opposite side of the chassis.

3. Attach the two rear chassis rails to the chassis in the same manner, again keeping in mind that the rails are left/right specific. (You will also need to attach the rail brackets when installing into a Telco rack.)

Caution  Slide rail mounted equipment is not to be used as a shelf or a work space.

Caution  Do not pick up the server with the front handles. They are designed to pull the system from a rack only.
Installing the Rack Rails

Determine where you want to place the server in the rack. Note that servers should always be installed to the bottom of a rack first for stability reasons.

1. Position the chassis rail guides at the desired location in the rack, keeping the sliding rail guide facing the inside of the rack.
2. Screw the assembly securely to the rack using the brackets provided.
3. Attach the other assembly to the other side of the rack, making sure that both are at the exact same height and with the rail guides facing inward.

Note Both front chassis rails and the rack rails have a locking tab, which serves two functions. First, it locks the server into place when installed and pushed fully into the rack (its normal operating position). In addition, these tabs lock the server in place when fully extended from the rack. This prevents the server from coming completely out of the rack when pulled out for servicing.

Installing the Server into a Rack

You should now have rails attached to both the chassis and the rack. The next step is to install the server into the rack.

1. Line up the rear of the chassis rails with the front of the rack rails.
2. Slide the chassis rails into the rack rails, keeping the pressure even on both sides (you may have to press the locking tabs when inserting).
3. When the server has been pushed completely into the rack, you should hear the locking tabs click.

**Figure 2-2. Installing the Server into a Rack**

---

**Note**  Figures are for illustrative purposes only. Always install servers to the bottom of a rack first.

**Caution** Stability hazard. The rack stabilizing mechanism must be in place, or the rack must be bolted to the floor before you slide the unit out for servicing. Failure to stabilize the rack can cause the rack to tip over.

### Installing the Server into a Telco Rack

To install the SuperServer 5019S-M2 into a Telco (open) type rack, use two L-shaped brackets on either side of the chassis (four total).

1. First, determine how far the server will extend out from the front of the rack. The chassis should be positioned so that the weight is balanced between front and back.

2. Attach the two front brackets to each side of the chassis, then the two rear brackets positioned with just enough space to accommodate the width of the rack.
3. Finish by sliding the chassis into the rack and tightening the brackets to the rack.

**Figure 2-3.** Installing the Server into a Telco Rack

*Note* Figure is for illustrative purposes only. Always install servers to the bottom of a rack first.
I/O Information

This chapter describes the RMC-8356 I/O connectors.

Rear Panel Connectors

Serial
Two COM connectors (COM1 & COM2) are provided on the motherboard. Both are located near the PCI-E slot 4.

SATA
The motherboard includes a total of four SATA connectors, supported by the Intel C236 PCH chip. These SATA connectors support RAID 0 and 1.

Rear I/O
Refer to the following figure for locations and descriptions of the various I/O connectors on the rear of the motherboard.

![Rear I/O Connectors](image)

| 1 | IPMI LAN |
| 2 | USB1 (2.0) |
| 3 | USB0 (2.0) |
| 4 | USB3 (3.0) |
| 5 | USB2 (3.0) |
| 6 | LAN2 |
| 7 | LAN1 |
| 8 | VGA (Disabled by default) |
| 9 | DVI |
| 10 | DisplayPort2 |
| 11 | DisplayPort1 |

LAN
There are two LAN connectors (LAN1/LAN2) on the I/O back panel. There is also a dedicated IPMI LAN connector on the I/O back panel. These connectors accept RJ45 type cables. Refer to the LED Indicators section of Appendix B, Hardware Configuration, for more information.
Chapter 3  I/O Information

Universal Serial Bus (USB)

There are two USB 2.0 connectors (USB0/1) and two USB 3.0 connectors (USB2/3) located on the I/O back panel. The motherboard also has three front access USB 2.0 headers (USB4/5, USB6/7, and USB8/9) and one front access USB 3.0 header (USB10/11). The USB12 header is USB Type A. The onboard headers can be used to provide front side USB access with a cable (not included).

Table 3-1. Front Panel USB (3.0/2.0) Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
</tr>
<tr>
<td>2</td>
<td>IntA_P2_SSRX-</td>
</tr>
<tr>
<td>3</td>
<td>IntA_P2_SSRX+</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>IntA_P1_SSTX+</td>
</tr>
<tr>
<td>6</td>
<td>IntA_P1_SSTX+</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>IntA_P1_D-</td>
</tr>
<tr>
<td>9</td>
<td>IntA_P1_D+</td>
</tr>
<tr>
<td>10</td>
<td>ID</td>
</tr>
<tr>
<td>11</td>
<td>IntA_P2_SSDX+</td>
</tr>
<tr>
<td>12</td>
<td>IntA_P2_SSDX-</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
</tr>
<tr>
<td>14</td>
<td>IntA_P2_SSTX+</td>
</tr>
<tr>
<td>15</td>
<td>IntA_P2_SSTX-</td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
</tr>
<tr>
<td>17</td>
<td>IntA_P2_SSRX+</td>
</tr>
<tr>
<td>18</td>
<td>IntA_P2_SSRX-</td>
</tr>
<tr>
<td>19</td>
<td>VBus</td>
</tr>
</tbody>
</table>
A VGA connector and a DVI connector are located next to the LAN connector on the I/O back panel. Use these connections for VGA and DVI displays. The VGA connector is on top and the DVI is on the bottom.

### Table 3-2. Front Panel USB 2.0 Header Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5 V</td>
</tr>
<tr>
<td>2</td>
<td>+5 V</td>
</tr>
<tr>
<td>3</td>
<td>USB_PN2</td>
</tr>
<tr>
<td>4</td>
<td>USB_PN3</td>
</tr>
<tr>
<td>5</td>
<td>USB_PP2</td>
</tr>
<tr>
<td>6</td>
<td>USB_PP3</td>
</tr>
<tr>
<td>7</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>Key</td>
</tr>
<tr>
<td>10</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### Table 3-3. Type A USB 10 (3.0) Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
</tr>
<tr>
<td>2</td>
<td>USB_N</td>
</tr>
<tr>
<td>3</td>
<td>USB_P</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>SSRX-</td>
</tr>
<tr>
<td>6</td>
<td>SSRX+</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>SSTX-</td>
</tr>
<tr>
<td>9</td>
<td>SSTX+</td>
</tr>
</tbody>
</table>
Chapter 3  I/O Information

DP (DisplayPort)
There are two DisplayPort connectors located on the rear I/O back panel. DisplayPort, developed by the VESA consortium, delivers digital display at a fast refresh rate. It can connect to virtually any display using a DisplayPort adapter for devices such as VGA, DVI, or HDMI.

MXI-Express Connectors

Refer to your MXI-Express hardware user manual for connector information.

Note  To access the NI MXI-Express BIOS Compatibility Software, search for MXI-Express BIOS Compatibility Software at ni.com/drivers.
Common Configuration Questions

This chapter answers common configuration questions you may have when using the RMC-8356.

General Questions

What do the LEDs on the RMC-8356 front panel mean?
The power indicator lights when the main power is turned on. The LAN status LEDs flash to when there is activity on LAN1 and LAN2. The hard drive LED lights when there is hard drive activity on the RMC-8356. For more information, refer to Figure 1-1, Front View of the RMC-8356.

How do I check the configuration of the memory, hard drive, time/date, and so on?
You can view these parameters in the BIOS setup. To enter the BIOS setup, reboot the RMC-8356 and press <Delete> during the memory tests. Refer to the BIOS Setup section of Chapter 2, Installation and BIOS Setup, for more information.

Can I use the internal SATA drive and an external hard drive at the same time?
Yes.

What RAID modes are supported?
The RMC-8356 supports only RAID 0 and 1.

Does the RMC-8356 support a PCI card?
No, the RMC-8356 can support only PCI Express cards while using a riser card (provided).

What is the shortcut key to get to the boot menu while the BIOS is going through POST?
The shortcut key is <F11>.
Chapter 4  Common Configuration Questions

Boot Options

**What devices can I boot from?**

The RMC-8356 can boot from the following devices:

- The internal SATA hard drive
- A network PXE server on the same subnet
- An external USB mass storage device such as a USB hard drive or CD-ROM

**Note** You should enable Legacy USB support to boot from USB devices. Refer to the BIOS Setup section of Chapter 2, *Installation and BIOS Setup*, for more information.

- An external USB floppy drive

**Note** There are some limitations when booting from a USB device. The RMC-8356 BIOS configures the USB devices so that they will work in a DOS environment.

**How do I configure the controller to boot from these devices?**

Press <Delete>, enter the BIOS, and select **Boot**. Set the order by device type and set the order for the devices listed within the device type. Refer to BIOS Setup in Chapter 2, *Installation and BIOS Setup*, for more information.

Chassis Configuration

**How do I set up the RMC-8356 to work with my PXI chassis?**

Configuration of the PXI system is handled through Measurement & Automation Explorer (MAX), included with the software pre-installed on your RMC-8356. MAX creates the **pxi-sys.ini** file, which defines the layout and parameters of your PXI system.

The configuration steps for single or multiple-chassis systems are the same. In MAX, select Help»Help Topics»PXI to configure your chassis.

The PXI specification allows many combinations of PXI chassis and system modules. To assist system integrators, the manufacturers of PXI chassis and system modules must document the capabilities of their products. The minimum documentation requirements are contained in **.ini** files, which consist of ASCII text. System integrators, configuration utilities, and device drivers can use these **.ini** files.

The capability documentation for the chassis is contained in a **chassis.ini** file provided by the chassis manufacturer. The information in this file is combined with information about the system controller to create a single system initialization file called **pxisys.ini** (PXI System Initialization). The RMC-8356 uses MAX to generate the **pxisys.ini** file from the **chassis.ini** file.
Device drivers and other utility software read the `pxisys.ini` file to obtain system information. For detailed information about initialization files, refer to the PXI specification at www.pxisa.org.

Upgrade Information

**How do I upgrade system memory?**
Refer to the *Upgrading Memory* section in Appendix B, *Hardware Configuration*.

**How do I upgrade my hard drive or solid state disk?**
Refer to the *Upgrading and Replacing Hard Disk Drives* section of Appendix B, *Hardware Configuration*.

**How do I flash a new BIOS?**
To see if the latest BIOS is available, go to ni.com/downloads.

**Where do I get the latest software drivers?**
The latest National Instruments software is available from ni.com/downloads.

**What upgrade options are available for the RMC-8356?**
Table 4-1 lists the available upgrade options.

<table>
<thead>
<tr>
<th>Orderable P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>785651-01</td>
<td>Spare 1 TB HDD</td>
</tr>
<tr>
<td>785652-01</td>
<td>Spare 16 GB DDR4 memory module</td>
</tr>
</tbody>
</table>
Troubleshooting

This chapter answers common troubleshooting questions you may have when using the RMC-8356.

What if the RMC-8356 does not boot?

Several problems can cause a controller not to boot. Here are some things to look for and possible solutions.

Things to Notice:

- Which LEDs come on? The power indicator LED should stay lit. The hard disk drive LEDs should blink during boot as the disk is accessed.
- What appears on the display? Does it hang at some particular point (BIOS, Operating System, and so on)? If nothing appears on the screen, try a different monitor. Does your monitor work with a different PC? If it hangs, note the last screen output that you saw for reference when consulting National Instruments technical support.
- What has changed about the system? Did you recently move the system? Was there electrical storm activity? Did you recently add a new module, memory chip, or piece of software?
- Has the system overheated? If the Overheat/FanFail LED is lit, this indicates overheating. Unplug the AC power cord from the controller and allow it to cool down before powering it on again.

Things to Try:

- Make sure the RMC-8356 is plugged in to a working power source.
- Remove any nonessential cables or devices.
- Make sure the CPU and memory modules are properly seated in their slots.
- Clear the CMOS. (Refer to the CMOS Clear section of Appendix B, Hardware Configuration.)
- Recover the hard drive on the RMC-8356. (Refer to the OS Reinstallation and Recovery section of Chapter 2, Installation and BIOS Setup.)

My RMC-8356 boots fine until I get to Windows, at which point I cannot read the screen. This may include garbled output, white screen, black screen, or an out of synch message from the monitor.

This problem usually results from having the video card output set past the limits of the monitor. You will need to boot Windows in Safe Mode. To do this, reboot the RMC-8356. As Windows begins to boot, hold down <F8>. You should now be able to reset the video driver to lower set-
tings. Try setting the resolution to 640 × 480 and the refresh rate to 60 Hz. Once you reboot, you can raise these values again, using the test option in Windows. These settings are accessible through the **Advanced** tab of the **Display** item in the **Control Panel**. Alternately, you can try a different monitor, preferably a newer and larger one.

**My system boots fine as long as a particular module is not in my chassis.**

The most common cause of this is a damaged module. Try the module in a different chassis or with a different controller. Also, remove any external cables or terminal blocks connected to the system. If the module does not work in these cases, it is likely damaged. Contact the module manufacturer for further troubleshooting.

Refer to the KnowledgeBase or product manuals section at [ni.com](http://ni.com) for more information specific to the chassis and module with which you are having difficulties.

**How do I set Windows to prompt me before shutting down when I press the power button?**

Select **Start»Control Panel»Power Options** to open the **Power Options Properties** window. Select **Choose what the power buttons do**. Under the Power and sleep button settings, use the drop down menu next to **When I press the power button** to select from **Do nothing**, **Sleep**, **Hibernate**, **Shut down**, or **Turn off the display**. Click **Save Changes**.
Specifications

This appendix lists the RMC-8356 electrical, mechanical, and environmental specifications.

Electrical

AC Input

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>100 VAC to 240 VAC</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>90 VAC to 264 VAC</td>
</tr>
<tr>
<td>Input frequency</td>
<td>50 Hz/60 Hz</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>47 Hz to 63 Hz</td>
</tr>
<tr>
<td>Input current rating</td>
<td>4.2 A max</td>
</tr>
<tr>
<td>Power disconnect</td>
<td>The AC power cable provides main power disconnect. Depressing the front panel power switch enables or inhibits the internal power supply.</td>
</tr>
</tbody>
</table>

Caution Using the RMC-8356 in a manner not described in this document may impair the protection the RMC-8356 provides.

Mainboard

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socket</td>
<td>LGA 1151</td>
</tr>
<tr>
<td>Chipset</td>
<td>Intel C236 chipset</td>
</tr>
<tr>
<td>Memory slots</td>
<td>4 x Dual Channel DDR4 UDIMM, unbuffered ECC/Non-ECC</td>
</tr>
<tr>
<td>PCI Express</td>
<td>1 x PCI Express 3.0 x16 slot</td>
</tr>
<tr>
<td>SATA</td>
<td>4 x 3.5 in. Hot-Swappable SATA3 Bays</td>
</tr>
<tr>
<td>USB ports</td>
<td>2 x USB 2.0 ports (Rear)</td>
</tr>
<tr>
<td></td>
<td>4 x USB 3.0 (2 Rear, 2 Front)</td>
</tr>
</tbody>
</table>
### Appendix A  Specifications

<table>
<thead>
<tr>
<th><strong>Video</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x Display Port</td>
<td></td>
</tr>
<tr>
<td>1 x DVI-I</td>
<td></td>
</tr>
<tr>
<td>1 x VGA (disabled by default)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Serial</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232 serial port</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LAN</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x Gigabit Ethernet RJ45,</td>
<td></td>
</tr>
<tr>
<td>1 x Dedicated IPMI RJ45</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Onboard LAN controller</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel i219LM + i210AT Dual-Port Gigabit Ethernet controller</td>
<td></td>
</tr>
</tbody>
</table>

### CPU

<table>
<thead>
<tr>
<th><strong>CPU</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Xeon E3-1275-V5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Clock speed</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 GHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Max turbo frequency</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4 GHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Intel Smart Cache</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8 MB</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Package</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LGA 1151</td>
<td></td>
</tr>
</tbody>
</table>

### Hard Disk Drive

<table>
<thead>
<tr>
<th><strong>Capacity</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 TB 3.5 in. with 3 additional 3.5 in. drive bays for expansion</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Interface</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial-ATA 3</td>
<td></td>
</tr>
</tbody>
</table>

### Memory

<table>
<thead>
<tr>
<th><strong>Standard memory</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 16 GB DDR4 SDRAM, UDIMM ECC 2133MHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Max configurable upgrade</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>64 GB (4 x 16 GB) DDR4 SDRAM, UDIMM ECC 2133MHz</td>
<td></td>
</tr>
</tbody>
</table>

### Mechanical

<table>
<thead>
<tr>
<th><strong>Overall dimensions (standard chassis)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height</strong></td>
<td>1U</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>437 mm (17.2 in.)</td>
</tr>
</tbody>
</table>
Environmental

**Caution** If installed in a closed or multiunit rack assembly, the rack environment operating ambient temperature may be greater than room ambient temperature. Therefore, install the equipment in an environment compatible with the maximum ambient temperature (Tma) the manufacturer specifies.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>10 to 35 °C</td>
</tr>
<tr>
<td></td>
<td>(Tested in accordance with IEC 60068-2-1.)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 60 °C</td>
</tr>
<tr>
<td></td>
<td>(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Operating 8 to 90% noncondensing</td>
</tr>
<tr>
<td></td>
<td>Nonoperational (storage) 5 to 95% noncondensing</td>
</tr>
<tr>
<td>Operating location</td>
<td>Indoor use only</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>2,000 m</td>
</tr>
<tr>
<td>Installation Category</td>
<td>II</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>2</td>
</tr>
</tbody>
</table>

Acoustic Emissions

Sound pressure level (at front bystander position)

<table>
<thead>
<tr>
<th>Level</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>53.1 dBA</td>
</tr>
<tr>
<td>Maximum</td>
<td>61.4 dBA</td>
</tr>
</tbody>
</table>

Safety

This product is designed to meet the requirements of the following standards of safety for information technology equipment:

- IEC 60950-1, EN 60950-1
- UL 60950-1, CSA 60950-1
Caution Overloading the circuits may damage supply wiring. Do not exceed the ratings on the equipment nameplate when connecting equipment to the supply circuit.

Note For UL and other safety certifications, refer to the product label or the Online Product Certification section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for digital devices and information technology equipment:

- EN 55032 (CISPR 32): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AZ/NZS CISPR 32: Class A Emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-003: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 32) Class A equipment is intended for use only in non-residential locations.

Note For EMC declarations and certifications, and additional information, refer to the Online Product Certification section.

CE Compliance

This product meets the essential requirements of applicable European Directives as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/13/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.
For additional environmental information, refer to the Minimize Our Environmental Impact web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

**Waste Electrical and Electronic Equipment (WEEE)**

**EU Customers** At the end of the product life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2012/19/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.

**Battery Replacement and Disposal**

**Battery Directive** This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit ni.com/environment/batterydirective.

**电子信息产品污染控制管理办法（中国 RoHS）**

**中国客户** National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。 (For information about China RoHS compliance, go to ni.com/environment/rohs_china.)
Hardware Configuration

This appendix describes how to configure and upgrade the RMC-8356 hardware.

⚠️ **Caution**  No user (operator) serviceable parts are inside the RMC-8356.

The hardware configuration and upgrade procedures described in this appendix must be performed only by a qualified service technician.

Disconnect the power cord before servicing.

**Motherboard Layout**

The following is a layout of the RMC-8356 motherboard with jumper, connector, and LED locations shown. Refer the following tables for descriptions. For detailed descriptions, pinout information and jumper settings, refer to the *Power Connections* section.

Figure B-1 shows the key features of the RMC-8356 mainboard.
Figure B-1. RMC-8356 Mainboard Layout
**Note** Figure B-1 shows three motherboard layouts. The motherboard has the features shown above except for the LAN3 and LAN4 ports and their associated jumpers.

**Note** Jumpers not identified are for test purposes only.

**Caution** There is a danger of explosion if the onboard battery is installed upside down (which reverses its polarities). This battery must be replaced only with the same or an equivalent type recommended by the manufacturer (CR2032).

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Description</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBT1</td>
<td>CMOS clear</td>
<td>Open (Normal)</td>
</tr>
<tr>
<td>JFC1/JFC2</td>
<td>SMB to PCI Express slots Enable/Disable</td>
<td>Pins 1-2 (Enabled)</td>
</tr>
<tr>
<td>JPB1</td>
<td>BMC Enable/Disable</td>
<td>Pins 1-2 (Enabled)</td>
</tr>
<tr>
<td>JPG1</td>
<td>VGA Enable/Disable (Disabled by default)</td>
<td>Pins 1-2 (Enabled)</td>
</tr>
<tr>
<td>JPL1/JPL2</td>
<td>LAN1/2 Enable/Disable</td>
<td>Pins 1-2 (Enabled)</td>
</tr>
<tr>
<td>JPME2</td>
<td>Manufacturing Mode</td>
<td>Pins 1-2 (Normal)</td>
</tr>
<tr>
<td>JVRM1</td>
<td>VRM SMB Clock (to BMC or PCH)</td>
<td>Pins 1-2 (BMC, Normal)</td>
</tr>
<tr>
<td>JVRM2</td>
<td>VRM SMB Data (to BMC or PCH)</td>
<td>Pins 1-2 (BMC, Normal)</td>
</tr>
<tr>
<td>JWD1</td>
<td>Watchdog</td>
<td>Pins 1-2 (Reset)</td>
</tr>
</tbody>
</table>

**Caution** To prevent damage to the power supply or motherboard, use a power supply with a 24-pin and one 8-pin power connectors. Be sure to connect these connectors to the 24-pin (JPW1) and one 8-pin (JPW2) power connectors on the motherboard. Failure to do so voids the manufacturer warranty on your power supply and motherboard.

**Note** When the LED4 LED is on, the onboard power connection is on. Be sure to unplug the power cables before removing or installing components.
### Table B-2. Connector Descriptions

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUDIO FP</td>
<td>Audio Front Panel Header</td>
</tr>
<tr>
<td>BT1</td>
<td>Onboard Battery</td>
</tr>
<tr>
<td>COM1/COM2</td>
<td>COM Headers</td>
</tr>
<tr>
<td>DP1/DP2</td>
<td>DisplayPorts</td>
</tr>
<tr>
<td>FAN1 ~ FAN4</td>
<td>System/CPU Fan Headers</td>
</tr>
<tr>
<td>FANA, FANB</td>
<td>I/O Fan Headers</td>
</tr>
<tr>
<td>IPMI_LAN</td>
<td>Dedicated IPMI LAN Port</td>
</tr>
<tr>
<td>I-SATA0 ~ I-SATA3</td>
<td>Intel® PCH SATA 3.0 Ports</td>
</tr>
<tr>
<td>I-SGPIO1</td>
<td>Serial Link General Purpose I/O Header</td>
</tr>
<tr>
<td>J15</td>
<td>4-pin Connector for HDD (to provide power from the motherboard to onboard devices)</td>
</tr>
<tr>
<td>J18</td>
<td>Extended CMOS Battery Connector</td>
</tr>
<tr>
<td>JD1</td>
<td>Speaker/Buzzer Header</td>
</tr>
<tr>
<td>JF1</td>
<td>Front Panel Control Header</td>
</tr>
<tr>
<td>JGPIO1</td>
<td>General Purpose I/O Header</td>
</tr>
<tr>
<td>JIPMB1</td>
<td>4-pin BMC External I2C Header</td>
</tr>
<tr>
<td>JL1</td>
<td>Chassis Intrusion Header</td>
</tr>
<tr>
<td>JP12C1</td>
<td>Power Supply SMBbus I2C Header</td>
</tr>
<tr>
<td>JPW1</td>
<td>24-pin ATX Power Connector</td>
</tr>
<tr>
<td>JPW2</td>
<td>2V DC power for CPU (or alternative power for special enclosure when the 24-pin ATX power is not in use)</td>
</tr>
<tr>
<td>JPWR1</td>
<td>4-pin 12 V Power Connector</td>
</tr>
<tr>
<td>JSD1</td>
<td>SATA DOM Power Connector</td>
</tr>
<tr>
<td>JSMB1</td>
<td>PCH SMBus Header</td>
</tr>
<tr>
<td>JSPDIF_OUT1</td>
<td>Sony/Phillips Digital Interface Audio Output Header</td>
</tr>
<tr>
<td>JTPM1</td>
<td>Trusted Platform Module/Port 80 Connector</td>
</tr>
</tbody>
</table>
Front Control Panel Connector (JF1)

JF1 contains header pins for various control panel connections. Refer to the following figure for pin locations and definitions of the control panel buttons and LED indicators.

All JF1 wires have been bundled into a single cable to simplify this connection. Make sure the red wire plugs into pin 1 as marked on the motherboard. The other end connects to the control panel PCB board.
Motherboard Connections

This section describes the connections on the motherboard and provides pinout definitions. Note that depending on how the system is configured, not all connections are required. The LEDs on the motherboard are also described here. A serverboard layout indicating component locations may be found in Appendix B.

Refer to the Safety Information section of Chapter 2, Hardware Configuration, before installing or removing components.

Power Connections

Two power connections on the motherboard must be connected to the power supply. The wiring is included with the power supply.

- 24-pin Primary ATX Power (JPW1)
- 8-pin Processor Power (JPW2)
- CMOS Battery Power (J18)

ATX Main Power Connector

The primary power connector (JPW1) meets the ATX SSI EPS 12 V specification. You must also connect the 8-pin (JPW2) processor power connector to your power supply.
To provide adequate power to the motherboard, connect the 24-pin and the 8-pin power connectors to the power supply. Failure to do so may void the manufacturer's warranty on your power supply and motherboard.

**Processor Power Connector**

The 8-pin JPW2 must also be connected to the power supply. This connector is used to power the processor(s).

### Table B-4. ATX Main Power 24-pin Connector Pin Definitions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>+3.3 V</td>
<td>1</td>
<td>+3.3 V</td>
</tr>
<tr>
<td>14</td>
<td>-12 V</td>
<td>2</td>
<td>+3.3 V</td>
</tr>
<tr>
<td>15</td>
<td>Ground</td>
<td>3</td>
<td>Ground</td>
</tr>
<tr>
<td>16</td>
<td>PS_ON</td>
<td>4</td>
<td>+5 V</td>
</tr>
<tr>
<td>17</td>
<td>Ground</td>
<td>5</td>
<td>Ground</td>
</tr>
<tr>
<td>18</td>
<td>Ground</td>
<td>6</td>
<td>+5 V</td>
</tr>
<tr>
<td>19</td>
<td>Ground</td>
<td>7</td>
<td>Ground</td>
</tr>
<tr>
<td>20</td>
<td>Res (NC)</td>
<td>8</td>
<td>PWR_OK</td>
</tr>
<tr>
<td>21</td>
<td>+5 V</td>
<td>9</td>
<td>5VSB</td>
</tr>
<tr>
<td>22</td>
<td>+5 V</td>
<td>10</td>
<td>+12 V</td>
</tr>
<tr>
<td>23</td>
<td>+5 V</td>
<td>11</td>
<td>+12 V</td>
</tr>
<tr>
<td>24</td>
<td>Ground</td>
<td>12</td>
<td>+3.3 V</td>
</tr>
</tbody>
</table>

Required Connection

**Note** To provide adequate power to the motherboard, connect the 24-pin and the 8-pin power connectors to the power supply. Failure to do so may void the manufacturer's warranty on your power supply and motherboard.

### Table B-5. +12 V 8-Pin Power Pin Definitions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Ground</td>
</tr>
<tr>
<td>5-8</td>
<td>+12 V</td>
</tr>
</tbody>
</table>

Required Connection
4-pin 12 V Power Connector
JPWR1 is a 4-pin 12 V power connector that provides alternative power.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Ground</td>
</tr>
<tr>
<td>3-4</td>
<td>+12 V</td>
</tr>
</tbody>
</table>

Extended CMOS Battery Connector
J18 is a secondary power connector that provides power to the CMOS battery.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBAT</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
</tbody>
</table>

4-pin HDD Power Connector
J15 is a 4-pin power connector that provides power to onboard HDD devices. Refer to the following table for pin definitions.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12 V</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>5 V</td>
</tr>
</tbody>
</table>

Headers and Connectors

Fan Headers
There are six fan headers on the motherboard. These are 4-pin fan headers; pins 1-3 are backward compatible with traditional 3-pin fans. The onboard fan speeds are controlled by Thermal Management via IPMI. When using Thermal Management setting, please use all 3-pin fans or all 4-pin fans.
Speaker/Buzzer
On the JD1 header, pins 1-4 are for the speaker and pins 3-4 are for the buzzer. If you wish to use an external speaker, connect its cable to pins 1-4.

Table B-10. Speaker Connection Pin Definitions

<table>
<thead>
<tr>
<th>Pin Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-4</td>
<td>Speaker</td>
</tr>
<tr>
<td>Pins 3-4</td>
<td>Buzzer</td>
</tr>
</tbody>
</table>

SGPIO Headers
The I-SGPIO1 (Serial General Purpose Input/Output) header is used to communicate with the enclosure management chip on the backplane.

Table B-11. SGPIO Header Pin Definitions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>2</td>
<td>NC</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>4</td>
<td>Data</td>
</tr>
<tr>
<td>5</td>
<td>Load</td>
<td>6</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>Clock</td>
<td>8</td>
<td>NC</td>
</tr>
</tbody>
</table>

NC = No Connection
Appendix B  Hardware Configuration

General Purpose I/O Header
The JGPIO1 (General Purpose Input/Output) header is a general purpose I/O expander on a pin header via the SMBus.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.3 V Stby</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>GP0</td>
<td>4</td>
<td>GP1</td>
</tr>
<tr>
<td>5</td>
<td>GP2</td>
<td>6</td>
<td>GP3</td>
</tr>
<tr>
<td>7</td>
<td>GP5</td>
<td>8</td>
<td>GP5</td>
</tr>
<tr>
<td>9</td>
<td>GP6</td>
<td>10</td>
<td>GP7</td>
</tr>
</tbody>
</table>

Table B-12. JGPIO1 Header Pin Definitions

TPM/Port 80 Header
A Trusted Platform Module (TPM)/Port 80 header is located at JTPM1 to provide TPM support and Port 80 connection. A TPM is a security device that supports encryption and authentication in hard drives. It enables the motherboard to deny access if the TPM associated with the hard drive is not installed in the system.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCLK</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>LFRAME#</td>
<td>4</td>
<td>&lt;(Key)&gt;</td>
</tr>
<tr>
<td>5</td>
<td>LRESET#</td>
<td>6</td>
<td>+5 V</td>
</tr>
<tr>
<td>7</td>
<td>LAD3</td>
<td>8</td>
<td>LAD2</td>
</tr>
<tr>
<td>9</td>
<td>+3.3 V</td>
<td>10</td>
<td>LAD1</td>
</tr>
<tr>
<td>11</td>
<td>LAD0</td>
<td>12</td>
<td>GND</td>
</tr>
<tr>
<td>13</td>
<td>SMB_CLK</td>
<td>14</td>
<td>SMB_DAT</td>
</tr>
<tr>
<td>15</td>
<td>+3 V Sby</td>
<td>16</td>
<td>SERIRQ</td>
</tr>
<tr>
<td>17</td>
<td>GND</td>
<td>18</td>
<td>CLKRUN#</td>
</tr>
<tr>
<td>19</td>
<td>LPCPD#</td>
<td>20</td>
<td>LDRQ#</td>
</tr>
</tbody>
</table>

Table B-13. Trusted Platform Module Header Pin Definitions
Front Accessible Audio Header
A 10-pin audio header is provided on the motherboard. Connect an audio cable to this header for audio playback.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Microphone_Left</td>
<td>6</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>Audio_Ground</td>
<td>7</td>
<td>Jack_Detect</td>
</tr>
<tr>
<td>3</td>
<td>Microphone_Right</td>
<td>8</td>
<td>Key</td>
</tr>
<tr>
<td>4</td>
<td>Audio_Detect</td>
<td>9</td>
<td>Line_2_Left</td>
</tr>
<tr>
<td>5</td>
<td>Line_2_Right</td>
<td>10</td>
<td>Ground</td>
</tr>
</tbody>
</table>

SPDIF_OUT
The SPDIF Out header is used for digital audio. You will also need the appropriate cable to use this feature.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPDIF Out</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Chassis Intrusion
A Chassis Intrusion header is located at JL1 on the motherboard. Attach the appropriate cable from the chassis to the header to inform you when the chassis has been opened.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intrusion Input</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
</tbody>
</table>
Internal Speaker/Buzzer
The Internal Speaker/Buzzer (SP1) is used to provide audible indications for various beep codes.

**Table B-17. Internal Buzzer Pin Definitions**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pos (+)</td>
</tr>
<tr>
<td>2</td>
<td>Neg (-)</td>
</tr>
</tbody>
</table>

Power SMB (I²C) Header
Power System Management Bus (I²C) header at JPIC1 monitors the power supply, fan and system temperatures.

**Table B-18. Power SMB Pin Definitions**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clock</td>
</tr>
<tr>
<td>2</td>
<td>Data</td>
</tr>
<tr>
<td>3</td>
<td>PMBUS_Alert</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>+3.3 V</td>
</tr>
</tbody>
</table>

4-pin BMC External I²C Header
A System Management Bus header for IPMI 2.0 is located at JIPMB1. Connect the appropriate cable here to use the IPMB I²C connection on your system.

**Table B-19. External I²C Header Pin Definitions**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>Clock</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
</tr>
</tbody>
</table>

System Management Bus Header
A System Management Bus header for additional slave devices or sensors is located at JSMB1.
The Disk-On-Module (DOM) power connector at JSD1 provides 5 V power to a solid-state DOM storage device connected to one of the SATA ports.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Clock</td>
</tr>
<tr>
<td>4</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**Disk-On-Module Power Connector**

The Disk-On-Module (DOM) power connector at JSD1 provides 5 V power to a solid-state DOM storage device connected to one of the SATA ports.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5 V</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**Unit Identifier Switch/UID LED Indicator**

A Unit Identifier (UID) switch and an LED Indicator are located on the motherboard. The UID switch is located at JUIDB1, which is next to the DP port on the I/O back panel. The UID LED (LED1) is located next to the UID switch. When you press the UID switch, the UID LED will be turned on. Press the UID switch again to turn off the LED indicator. The UID Indicator provides easy identification of a system unit that may be in need of service.

*Note* UID can also be triggered via IPMI on the motherboard.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Button In</td>
</tr>
<tr>
<td>4</td>
<td>Button In</td>
</tr>
</tbody>
</table>
Appendix B  Hardware Configuration

Table B-23. UID LED Pin Definitions

<table>
<thead>
<tr>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue: On</td>
<td>Unit Identified</td>
</tr>
</tbody>
</table>

Pin Definitions

Power Button
The Power Button connection is located on pins 1 and 2 of JF1. Momentarily contacting both pins will power on/off the system. This button can also be configured to function as a suspend button. To turn off the power when the system is in suspend mode, press the button for 4 seconds or longer.

Table B-24. Power Button Pin Definitions (JF1)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Signal</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Reset Button
The Reset Button connection is located on pins 3 and 4 of JF1. Attach it to a hardware reset switch on the computer case.

Table B-25. Reset Button Pin Definitions (JF1)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Reset</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Power Fail LED
The Power Fail LED connection is located on pins 5 and 6 of JF1.

Table B-26. Power Fail LED Pin Definitions (JF1)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.3 V</td>
</tr>
<tr>
<td>6</td>
<td>PWR Supply Fail</td>
</tr>
</tbody>
</table>
Overheat (OH)/Fan Fail
Connect an LED cable to pins 7 and 8 of JF1 to use the Overheat/Fan Fail LED connections.

<table>
<thead>
<tr>
<th>Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Normal</td>
</tr>
<tr>
<td>On</td>
<td>Overheat</td>
</tr>
<tr>
<td>Flashing</td>
<td>Fan Fail</td>
</tr>
</tbody>
</table>

NIC1/NIC2 (LAN1/LAN2)
The NIC (Network Interface Controller) LED connection for LAN port 1 is located on pins 11 and 12 of JF1, and the LED connection for LAN Port 2 is on Pins 9 and 10. Attach the NIC LED cables here to display network activity.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/11</td>
<td>3.3 V Stby</td>
</tr>
<tr>
<td>10/12</td>
<td>LAN LED Active</td>
</tr>
</tbody>
</table>

HDD LED
The HDD LED connection is located on pins 13 and 14 of JF1. Attach a cable here to indicate the status of all HDD-related activity.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>3.3 V Stby</td>
</tr>
<tr>
<td>14</td>
<td>HD Active</td>
</tr>
</tbody>
</table>

Power LED
The Power LED connection is located on pins 15 and 16 of JF1.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>3.3 V Standby</td>
</tr>
<tr>
<td>16</td>
<td>Power LED</td>
</tr>
</tbody>
</table>
Appendix B  Hardware Configuration

NMI Button
The non-maskable interrupt button header is located on pins 19 and 20 of JF1.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Control</td>
</tr>
<tr>
<td>20</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Jumpers
To modify the operation of the motherboard, jumpers are used to choose between optional settings. Jumpers create shorts between two pins to change the function associated with it. Pin 1 is identified with a square solder pad on the printed circuit board. See the motherboard layout page for jumper locations.

Note On a two-pin jumper, closed means the jumper is on both pins and open indicates the jumper is either on only one pin or has been completely removed.

CMOS Clear
JBT1 is used to clear the CMOS, which will also clear any passwords. Instead of pins, this jumper consists of contact pads to prevent accidentally clearing the contents of the CMOS.

Complete the following steps to clear the CMOS:
1. First power down the system and unplug the power cord(s).
2. Remove the cover of the chassis to access the motherboard.
3. Remove the onboard battery from the motherboard.
4. Short the CMOS pads with a metal object such as a small screwdriver for at least four seconds.
5. Remove the screwdriver (or shorting device).
6. Replace the cover, reconnect the power cord(s) and power on the system.

Note Clearing the CMOS will also clear all passwords.

Caution Do not use the PW_ON connector to clear the CMOS.

LAN1/2 Enable/Disable
Change the setting of jumper JPL1 and JPL2 to enable or disable the LAN1 and LAN2 Ethernet ports, respectively. The default setting is Enabled.
Watch Dog

JWD controls the Watch Dog function. Watch Dog is a monitor that can reboot the system when a software application hangs. Jumping pins 1-2 will cause Watch Dog to reset the system if an application hangs. Jumping pins 2-3 will generate a non-maskable interrupt signal for the application that hangs. Watch Dog must also be enabled in BIOS. The default setting is *Reset*.

*Note* When Watch Dog is enabled, the user needs to write their own application software to disable it.

---

**Table B-32.** LAN1/2 Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>Enabled</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

---

**Table B-33.** Watch Dog Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>Reset</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>NMI</td>
</tr>
<tr>
<td>Open</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

---

**Table B-34.** I2C for PCIe Slots Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>Enabled</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

---

**SMBus to PCI Slots**

Use jumpers J12C1 and J12C2 to connect the System Management Bus (I2C) to PCI-Express slots to improve PCI performance. These two jumpers should be set to the same setting. The default setting is *Enabled*.

---

**BMC Enabled**

JPB1 allows you to enable or disable the BMC (Baseboard Management Control) chip and the onboard IPMI connection. This jumper is used together with the IPMI settings in the BIOS. If the BMC is disabled, IPMI health monitoring and remote management functions are no longer supported. The default setting is *BMC Enable*.
Appendix B  Hardware Configuration

Table B-35. BMC Enabled Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>BMC Enabled</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

Manufacturer Mode Select
Close pins 2 and 3 of jumper JPME2 to bypass SPI flash security and force the system to operate in the manufacturer mode, which will allow the user to flash the system firmware from a host server for system setting modifications. The default setting is Normal.

Table B-36. Manufacturer Mode Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>Normal</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>Manufacturer Mode</td>
</tr>
</tbody>
</table>

I2C Bus for VRM
Jumpers JVRM1 and JVRM2 allow the BMC or the PCH to access the PCU and memory VRM controllers. The default setting is BMC.

Table B-37. VRM Jumper Settings

<table>
<thead>
<tr>
<th>Jumper Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pins 1-2</td>
<td>BMC (Default)</td>
</tr>
<tr>
<td>Pins 2-3</td>
<td>PCH</td>
</tr>
</tbody>
</table>

LED Indicators

LAN LEDs
Each of the Ethernet LAN ports has two LEDs. One LED indicates activity when flashing while the other Link LED may be green, amber, or off to indicate the speed of the connection.

Table B-38. LAN Link LED State

<table>
<thead>
<tr>
<th>LED Color</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No Connection/10 Mbps</td>
</tr>
<tr>
<td>Green</td>
<td>100 Mb/s</td>
</tr>
<tr>
<td>Green</td>
<td>1 Gb/s</td>
</tr>
</tbody>
</table>
Dedicated IPMI LAN LEDs
An IPMI LAN is also located on the rear I/O panel. The LED on the right indicates activity, while the LED on the left indicates the speed of the connection.

<table>
<thead>
<tr>
<th>Table B-39. IPMI LAN LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Color</td>
</tr>
<tr>
<td>Off</td>
</tr>
<tr>
<td>Green: Solid</td>
</tr>
<tr>
<td>Amber: Blinking</td>
</tr>
</tbody>
</table>

Unit ID LED (UID)
A rear Unit ID LED (LED1) is located next to the I/O back panel. This UID indicator provides easy identification of a system unit that may be in need of service. Refer to the table for the LED status.

<table>
<thead>
<tr>
<th>Table B-40. Unit ID LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Color</td>
</tr>
<tr>
<td>Blue: On</td>
</tr>
</tbody>
</table>

BMC Heartbeat LED
A BMC Heartbeat LED is located at LED3 on the motherboard. When LED3 is blinking, the BMC is functioning normally.

<table>
<thead>
<tr>
<th>Table B-41. BMC Heartbeat LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Color</td>
</tr>
<tr>
<td>Green: Blinking</td>
</tr>
</tbody>
</table>

Onboard Power LED
The Onboard Power LED is located at LED4. When this LED is on, it means power is present on the motherboard. Be sure to turn off the system and unplug the power cord before removing or installing components.

<table>
<thead>
<tr>
<th>Table B-42. Onboard Power LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Color</td>
</tr>
<tr>
<td>Off</td>
</tr>
<tr>
<td>Green</td>
</tr>
</tbody>
</table>
Appendix B  Hardware Configuration

Overheat/PWR Fail/Fan Fail LED
An Overheat/PWR/Fail/ Fan Fail LED is located at LED2.

<table>
<thead>
<tr>
<th>LED Color</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>Overheat</td>
</tr>
<tr>
<td>Blinking</td>
<td>PWR Fail or Fan Fail</td>
</tr>
</tbody>
</table>

Data Cables
The data cables in the system have been carefully routed to maintain airflow efficiency. If you disconnect any data cables, take care to re-route them as they were originally when reconnecting them.

⚠️ **Caution**  Ensure the cables do not come into contact with the fans.

Upgrading Memory
The mainboard supports 4 240-pin UDIMM ECC DDR4 SDRAM slots with maximum memory size of 64 GB. We recommend you purchase your DDR-4 UDIMM modules from National Instruments. Other off-the-shelf DDR-4 UDIMM modules are not guaranteed to work properly.

DIMM Module Population Sequence
When installing memory modules, the DIMM slots should be populated in the following order: DIMMB2, DIMMA2, DIMMB1, DIMMA1.

- Always use DDR4 DIMM modules of the same type, size and speed.
- Mixed DIMM speeds can be installed. However, all DIMMs will run at the speed of the slowest DIMM.
- The motherboard will support odd-numbered modules (1 or 3 modules installed). However, for best memory performance, install DIMM modules in pairs to activate memory interleaving.
Memory upgrades are available from National Instruments under the following orderable part numbers:

- 1 × 16 GB DDR4 SDRAM for RMC-8356 (1 × 16 GB DIMM)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>785652-01</td>
<td>16 GB SDRAM replacement/upgrade for RMC-8356</td>
</tr>
</tbody>
</table>

**Memory Installation**

- **Note** National Instruments recommends using 16 GB DDR4 SDRAM, UDIMM ECC 2133 MHz memory modules purchased from National Instruments. Other off-the-shelf DDR4 UDIMM modules are not guaranteed to work properly.

- **Caution** Exercise extreme care when installing or removing DIMM modules to prevent any possible damage. Also, note that the memory is interleaved to improve performance.

**Memory Support**

The RMC-8356 supports up to 64 GB registered UDIMM ECC DDR4 2133 MHz in 4 DIMMs. (Refer to ni.com for the recommended memory list.)

**System Memory Allocation and Availability**

Table B-44 lists possible system memory allocation and availability.
Installing DDR Modules

Follow these steps to install DDR modules:

1. Remove power from system.
2. Press the cover release buttons on the top of the RMC-8356.
3. Push the cover backward to remove it.
4. Align the notch in the center of the DDR DIMM module with the key on the DIMM slot. Insert the module vertically into the slot and push it in until the pins are fully inserted, as shown below.

![Diagram of DDR DIMM module insertion](image)

5. When the module is fully inserted, the plastic clip at each side of the slot automatically closes, as shown below.

![Diagram of DDR DIMM module insertion with closed clips](image)

6. Replace the RMC-8356 cover by sliding the cover forward. Make sure the safety lock fits firmly.

**Removing DDR Modules**

Follow these steps to remove DDR modules:
1. Remove power from system.
2. Open the plastic clips on both sides of the module.
3. Remove the module from the slot.
Upgrading and Replacing Hard Disk Drives

Hard Drives
Your server may or may not have come with hard drives installed. Up to four 3.5" hard drives are supported by the chassis.

The SATA drives are mounted in drive carriers to simplify their installation and removal from the chassis. (Both procedures may be done without removing power from the system.)

Removing a Hot-Swap Drive Carrier
1. Push the release button on the carrier.
2. Swing the handle fully out.
3. Grasp the handle and use it to pull the drive carrier out of its bay.

Mounting a Drive in a Drive Carrier
1. To add a new drive, install it into the carrier with the printed circuit board side facing down so that the mounting holes align with those in the carrier.
2. Secure the drive to the carrier with the screws provided, then push the carrier completely into the drive bay. You should hear a *click* when the drive is fully inserted. This indicates that the carrier has been fully seated and connected to the midplane, which automatically makes the power and logic connections to the hard drive.

Figure B-4. Removing a Drive Carrier
Removing a Drive from a Drive Carrier

1. Remove the screws that secure the hard drive to the carrier and separate the hard drive from the carrier.
2. Replace the carrier back into the drive bay.

![Figure B-5. Mounting a Drive in a Carrier](image)

Hard Drive Carrier Indicators

Each hard drive carrier has two LED indicators: an activity indicator and a status indicator. In RAID configurations, the status indicator lights to indicate the status of the drive. In non-RAID configurations, the status indicator remains off. See the table below for details.

<table>
<thead>
<tr>
<th>LED</th>
<th>State/Condition</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Blinking</td>
<td>Drive activity</td>
</tr>
<tr>
<td>Red</td>
<td>Solid on</td>
<td>Drive failure</td>
</tr>
</tbody>
</table>

**Note**  
Enterprise level hard disk drives are recommended for use in NI chassis and servers.
Appendix B  Hardware Configuration

Hard Drive Part Numbers
Use the part number in Table B-46 to order a spare/upgrade hard drive.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>785651-01</td>
<td>Spare 1 TB HDD for RMC-8356</td>
</tr>
</tbody>
</table>

PCI Expansion Card Installation
The system includes a pre-installed riser card that positions a standard size PCI-E x16 card at a 90 degree angle, allowing it to fit inside the chassis.

Installing PCI Expansion Cards
The CSE-RR1U-E16 riser card has already been pre-installed into the motherboard. Perform the following steps to install an add-on card:

1. Remove the chassis cover to access the inside of the system.
2. Remove the PCI slot shield on the chassis by releasing the locking tab.
3. Insert the expansion (add-on) card into the riser card.
4. Secure the card with the locking tab.

Motherboard Battery
The motherboard uses non-volatile memory to retain system information when system power is removed. This memory is powered by a lithium battery residing on the motherboard.

Replacing the Battery
Begin by removing power from the system.
1. Push aside the small clamp that covers the edge of the battery. When the battery is released, lift it out of the holder.
2. To insert a new battery, slide one edge under the lip of the holder with the positive (+) side facing up. Then push the other side down until the clamp snaps over it.

Note Please handle used batteries carefully. Do not damage the battery in any way; a damaged battery may release hazardous materials into the environment. Do not discard a used battery in the garbage or a public landfill. Please comply with the regulations set up by your local hazardous waste management agency to dispose of your used battery properly.
System Cooling

Four, 4 cm counter-rotating fans provide the cooling for the system. Each fan unit is actually made up of two fans joined back-to-back, which rotate in opposite directions. This counter-rotating action generates exceptional airflow and is effective in dampening vibration levels.

It is very important that the chassis top cover is installed for the cooling air to circulate properly through the chassis and cool the components.

Installing Fans

Fan speed is controlled by system temperature via IPMI. If a fan fails, the remaining fans will ramp up to full speed. The system will continue to operate, but at reduced performance. Replace any failed fan at your earliest convenience with the same type and model.

Complete the following steps to replace a system fan.

1. If necessary, open the chassis while the power is running to determine which fan requires replacement. Do not run the server for an extended period of time with the chassis open.
2. Power down the system and unplug the AC power cord from the rear of the power supply. Open the chassis cover.
3. Remove the failed fan's cable from the connector on the motherboard.
4. Gently pull upward to remove the failed fan from the housing.
5. Place the new fan into the vacant space in the housing. Make sure that the arrows on the side of the fan (indicating air direction) point in the same direction as the arrows on the other fans.
6. Connect the fan wires to the same fan header as the fan just removed.
7. Plug the power cord into the rear of the power supply, power up the system and check that the fan is working properly before replacing the chassis cover.
This appendix describes the Intel SATA RAID utility for Intel C236.

Intel RAID Configuration Utility

The Intel RAID Configuration utility is an embedded BIOS utility for creating, managing, and deleting arrays from the controller BIOS and initializing drives.

To run the Intel RAID Configuration utility, press <Del> during system bootup to enter the BIOS Setup Utility. The main menu appears. To select an option from this or any menu, browse with the arrow keys to highlight an option and press <Enter>. In some cases, selecting an option displays another menu. To return to the previous menu at any time, press <Esc>.

Intel HostRAID Configurations

The following types of Intel HostRAID configurations are supported:

- **RAID0 (Data Stripping)**—RAID0 writes data in parallel, interleaved (“striped”) sections between two hard drives. RAID0 doubles the data transfer rate (over a single hard drive) to enhance system performance. To use RAID0, two or more hard drive disks are required.

- **RAID1 (Data Mirroring)**—Use RAID1 to copy identical data from one disk drive to another. By doing so, a “mirror” of source data is created to enhance data security. To use RAID1, two or more hard drive disks are required, and the second drive must be the same size or larger than the first drive.

Configuring the AMI BIOS for SATA RAID Settings

**Note** Press <Del> during system bootup to enter the BIOS Setup Utility.

Follow these steps to configure the AMI BIOS for SATA RAID settings:

1. Use the arrow keys to select the Advanced menu from the menu bar and press <Enter> to enter the Advanced menu.
2. In the Advanced menu, scroll down to IDE/SATA Configuration and press <Enter> to enter the IDE/SATA Configuration submenu.
3. Once in the IDE/SATA Configuration submenu, scroll down to Configure SATA#1 as and press <Enter>. The Options window displays.
4. From the Options window, select RAID and press <Enter>. 

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5. Press <Esc> to return to the previous menu. Use the arrow keys to select Exit from the menu bar at the top and press <Enter> to enter the Exit submenu.

6. From the Exit submenu, select Save Changes and Exit and press <Enter> to save the changes and exit the BIOS. The system reboots.

7. After the system exits from the BIOS Setup Utility, the system automatically reboots. When the system is rebooting, press <Delete> to enter the BIOS. Select Advanced > Intel RSTe SATA Controller to manage RAID.

Creating a RAID0 Volume

Follow these steps to create a RAID0 volume:

1. Select Create RAID Volume from the main menu and press <Enter>.

2. Specify a name for the RAID0 set and press <Tab> or <Enter> to go to the next field. (To select the previous menu, press <Esc>.)

3. When RAID Level is highlighted, use the up and down arrow keys to select RAID0 (Stripe) and press <Enter>.

4. When Disks is highlighted, press <Enter> to select the HDD to configure for RAID.

5. Use the up and down arrow keys to highlight a drive and press the space bar to select it. A triangle appears to confirm the drive selection.

6. When Stripe Size is highlighted, use the up and down arrow keys to select the stripe size for your RAID0 and press <Enter>.

   Note: Stripe size is 4–128 KB for RAID0. For a server, use a lower stripe size; for a multimedia system, use a higher stripe size. The default stripe size is 128 KB.

7. Press <Enter> when the Create Volume item is highlighted. A warning message displays, indicating that all data on the selected disks will be lost.

8. At the Are you sure you want to create this volume (Y/N) prompt, press <Y> to create the RAID volume or <N> to return to the Create Volume menu.

Creating a RAID1 Volume

Follow these steps to create a RAID1 volume:

1. Select Create RAID Volume from the main menu and press <Enter>.

2. Specify a name for the RAID1 set and press <Tab> or <Enter> to go to the next field. (To select the previous menu, press <Esc>.)

3. When RAID Level is highlighted, use the up and down arrow keys to select RAID1 (Mirror) and press <Enter>.

4. When Disks is highlighted, press <Enter> to select the HDD to configure for RAID.

5. Use the up and down arrow keys to highlight a drive and press the space bar to select it. A triangle appears to confirm the drive selection.
6. When **Capacity** is highlighted, press <Enter> to specify the disk capacity to configure for RAID1.

7. Press <Enter> when **Create Volume** is highlighted. A warning message displays, indicating that all data on the selected disks will be lost.

8. At the **Are you sure you want to create this volume (Y/N)** prompt, press <Y> to create the RAID volume or <N> to return to the **Create Volume** menu.

**Recovery**

Use this feature to create the recovery volume by copying data from a designated master drive to a designated recovery drive.

**Note** A recovery drive is a backup drive to store data copied from the original (master) drive. A master drive is the original drive containing the source files to be copied to the recovery drive.

Follow these steps to create a recovery drive:

1. Select **Create RAID Volume** from the main menu and press <Enter>. The Create Volume Menu screen appears.

2. Specify a name for the recovery disk drive and press <Enter>.

3. When **RAID Level** is highlighted, use the up and down arrow keys to select **Recovery** and press <Enter>.

4. When **Select Disks** is highlighted, press <Enter> to select the HDD to create the recovery volume.

5. On the **Select Disks** screen, use the up and down arrow keys to select a drive to use as your master drive and press <Tab> to configure it as your master drive. Use the arrow keys to select your recovery drive and press the space bar to configure it. Press <Enter> to complete the disk selection.

6. When **RAID Capacity** is highlighted, enter your RAID volume capacity and press <Enter>. The default setting is the maximum capacity allowed.

7. When **Sync** is highlighted, use the up and down arrow keys to select the **Continuous** or **On Request** update policy. If you select **Continuous**, data on the master drive is copied to the recovery drive automatically as long as both drives are connected to the system. If you select **On Request**, data on the master drive is copied to the recovery drive when you request it.

8. Press <Enter> when the **Create Volume** item is highlighted. A warning message displays, indicating that all data on the selected disks will be lost.

9. At the **Are you sure you want to create this volume (Y/N)** prompt, press <Y> to create the RAID volume or <N> to return to the **Create Volume** menu without making changes.
Deleting a RAID Volume

Caution  Be sure to back up your data before deleting a RAID set. You will lose all data on the drives when deleting a RAID set. You also will lose the recovery image.

Follow these steps to delete a RAID volume:
1. From the main menu, select **Delete RAID Volume** and press <Enter>.
2. Use the up and down arrow keys to select the RAID set to delete and press <Del>. A warning message displays.
3. At the **Are you sure you want to delete this volume (Y/N)** prompt, press <Y> to delete the RAID volume or <N> to return to the **Delete Volume** menu.

Resetting to Non-RAID

Caution  Be careful when you reset a RAID volume HDD to a non-RAID HDD. Resetting a RAID HDD or RAID volume reformats the disk drive and deletes the internal RAID structure and contents.

Follow these steps to reset a RAID volume HDD to non-RAID:
1. From the main menu, select **Reset Disks to Non-RAID** and press <Enter>.
2. Use the up and down arrow keys to highlight the RAID set drive to reset and press the space bar to select it.
3. Press <Enter> to reset the RAID set drive. A warning message displays.
4. Press <Y> to reset the drive or <N> to return to the main menu.

Recovery Volume Options

Note  A recovery drive is a backup drive to store data copied from the original (master) drive. A master drive is the original drive containing the source files to be copied to the recovery drive.

Follow these steps to select a recovery volume option:
1. From the main menu, select **Recovery Volume Options**.
2. When **Recovery Volume Options** is highlighted, press <Enter>.
3. To boot from a recovery disk only, select **Enable Only Recovery Disk** and press <Enter>.

Note  If a recovery disk is available, its RAID volume recovery support is enabled, and the master disk is disabled.

4. To boot from the master disk that contains the original data sources only, select **Enable Only Master Disk** and press <Enter>. 
Note: If a master disk is available, its RAID volume recovery support is enabled, and the recovery disk is disabled. Any change in steps 3 or 4 stops automatic synchronization between the master and recovery drives.

5. Press <Esc> to return to the Main menu.

Exiting the Intel RSTe SATA Controller
Follow these steps to exit the Intel RSTe SATA Controller:
1. Press <ESC> to return to the Advanced menu.
2. Press <F4> to save changes and restart the system.
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• Declaration of Conformity (DoC)—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer’s declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification.

For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact. You also can visit the Worldwide Offices section of ni.com/niglobal to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.
Glossary

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Prefix</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>pico</td>
<td>10^{-12}</td>
</tr>
<tr>
<td>n</td>
<td>nano</td>
<td>10^{-9}</td>
</tr>
<tr>
<td>μ</td>
<td>micro</td>
<td>10^{-6}</td>
</tr>
<tr>
<td>m</td>
<td>milli</td>
<td>10^{-3}</td>
</tr>
<tr>
<td>k</td>
<td>kilo</td>
<td>10^{3}</td>
</tr>
<tr>
<td>M</td>
<td>mega</td>
<td>10^{6}</td>
</tr>
<tr>
<td>G</td>
<td>giga</td>
<td>10^{9}</td>
</tr>
<tr>
<td>T</td>
<td>tera</td>
<td>10^{12}</td>
</tr>
</tbody>
</table>

Symbols

° Degrees
W Ohms
% Percent

A

A Amperes
A/D Analog-to-digital. Most often used as A/D converter.
AC Alternating Current
ACPI Advanced Configuration and Power Management Interface
ANSI American National Standards Institute
API Application Programming Interface—A standardized set of subroutines or functions along with the parameters that a program can call.
APIC Advanced Programmable Interrupt Controller
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Exchange</td>
</tr>
<tr>
<td>ASIC</td>
<td>Application-Specific Integrated Circuit</td>
</tr>
<tr>
<td>ATA</td>
<td>The specification formulated in the 1980s that defines the IDE drive interface.</td>
</tr>
<tr>
<td>B</td>
<td>Bytes</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input/Output System—BIOS functions are the fundamental level of any PC or compatible computer. BIOS functions embody the basic operations needed for successful use of the computer’s hardware resources.</td>
</tr>
<tr>
<td>C</td>
<td>Celsius</td>
</tr>
<tr>
<td>CAS</td>
<td>Column Address Strobe</td>
</tr>
<tr>
<td>CMOS</td>
<td>Complementary Metal Oxide Semiconductor—A process used in making chips.</td>
</tr>
<tr>
<td>COM</td>
<td>Communications port</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>CSA</td>
<td>Carrier Serving Area</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>D/A</td>
<td>Digital-to-analog—Most often used as an abbreviation for a D/A converter (also known as DAC).</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DDR</td>
<td>Double Data Rate</td>
</tr>
<tr>
<td>DIMM</td>
<td>Dual In-line Memory Module</td>
</tr>
</tbody>
</table>
### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMA</td>
<td>Direct Memory Access—a method by which data is transferred between devices and internal memory without intervention of the central processing unit.</td>
</tr>
<tr>
<td>DMI</td>
<td>Desktop Management Interface</td>
</tr>
<tr>
<td>DRAM</td>
<td>Dynamic RAM (Random Access Memory)—Storage that the computer must refresh at frequent intervals.</td>
</tr>
<tr>
<td>EDO RAM</td>
<td>Extended Data Output RAM—a type of random access memory (RAM) chip that improves the time to read from memory on faster microprocessors such as the Intel Pentium.</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electronically Erasable Programmable Read Only Memory</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
</tr>
<tr>
<td>EPP</td>
<td>Enhanced Parallel Port</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>GB</td>
<td>Gigabytes of memory</td>
</tr>
<tr>
<td>GPIB</td>
<td>General Purpose Interface Bus (IEEE 488)</td>
</tr>
<tr>
<td>HDD</td>
<td>Hard Disk Drive</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz; cycles per second</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/output—The techniques, media, and devices used to achieve communication between machines and users.</td>
</tr>
<tr>
<td>IDE</td>
<td>Integrated Drive Electronics—Hard disk and built-in controller.</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IRQ*</td>
<td>Interrupt signal</td>
</tr>
<tr>
<td>ISA</td>
<td>Industry Standard Architecture—The original PC bus architecture, specifically the 16-bit AT bus.</td>
</tr>
<tr>
<td>KB</td>
<td>Kilobytes of memory</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network—Communications network that serves users within a confined geographical area. It is made up of servers, workstations, a network operating system, and a communications link.</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display—A display technology using polarizing filters and liquid crystal cells.</td>
</tr>
<tr>
<td>LED</td>
<td>Light-emitting diode</td>
</tr>
<tr>
<td>MAX</td>
<td>Measurement &amp; Automation Explorer</td>
</tr>
<tr>
<td>MB</td>
<td>Megabytes of memory</td>
</tr>
<tr>
<td>MPS</td>
<td>Multiprocessor Specification</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failure</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Repair</td>
</tr>
<tr>
<td>MXI</td>
<td>Multisystem eXtension Interface</td>
</tr>
<tr>
<td>N</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NI-DAQ</td>
<td>The National Instruments software for data acquisition instruments.</td>
</tr>
<tr>
<td>NI-VISA</td>
<td>The National Instruments implementation of the VISA standard—An interface-independent software that provides a unified programming interface for VXI, GPIB, and serial instruments.</td>
</tr>
<tr>
<td>P</td>
<td></td>
</tr>
<tr>
<td>PCI</td>
<td>Peripheral Component Interconnect. The PCI bus is a high-performance 32-bit or 64-bit bus with multiplexed address and data lines.</td>
</tr>
<tr>
<td>PEF</td>
<td>Platform Event Filter</td>
</tr>
<tr>
<td>PIO</td>
<td>Programmed Input/Output</td>
</tr>
<tr>
<td>POSC</td>
<td>Power On Self Configuration</td>
</tr>
<tr>
<td>POST</td>
<td>Power On Self Test</td>
</tr>
<tr>
<td>PXI</td>
<td>PCI eXtensions for Instrumentation—An open implementation of CompactPCI that adds electrical features that meet the high-performance requirements of instrumentation applications by providing triggering, local buses, and system clock capabilities. PXI also offers two-way interoperability with CompactPCI products.</td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory—The computer’s primary workspace.</td>
</tr>
<tr>
<td>RAS</td>
<td>Row Address Strobe</td>
</tr>
<tr>
<td>RMS</td>
<td>Root Mean Squared</td>
</tr>
<tr>
<td>RTC</td>
<td>Real Time Clock—An electronic circuit that maintains the time of day and also can provide timing signals for timesharing operations.</td>
</tr>
</tbody>
</table>
**Glossary**

**S**

**SATA**
Serial-ATA. *See also* **ATA**.

**SCSI**
Small Computer System Interface

**SDRAM**
A form of dynamic RAM memory that is about 20% faster than EDO RAM. SDRAM interleaves two or more internal memory arrays so that while one array is being accessed, the next one is being prepared for access. SDRAM-II is a faster version of SDRAM technology.

**SO-DIMM**
Small Outline Dual In-line Memory Module

**SPD**
Serial Presence Detect EEPROM

**SRAM**
Static RAM—A memory chip that requires power to hold its content. It does not require refresh circuitry as a dynamic RAM chip, but it does take up more space and uses more power.

**U**

**UDMA**
Ultra Direct Memory Access. *See also* **DMA**.

**USB**
Universal Serial Bus

**V**

**V**
Volts

**VGA**
Video Graphics Array—The minimum video display standard for all PCs.

**VISA**
Virtual Instrument Software Architecture—A single interface library for controlling GPIB, VXI, RS232, and other types of instruments. VISA has been standardized by the VXI Plug&Play Systems Alliance.

**VME**
Versa Module Eurocard

**VXI**
VME eXtensions for Instrumentation
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>Watts</td>
</tr>
<tr>
<td>WDT</td>
<td>Watchdog Timer</td>
</tr>
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