Intel® RAID Controller RS3UC080J

Hardware User Guide

A document providing an overview of product features, specification data, and hardware installation instructions

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Intel Server Products and Solutions

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Preface

This document provides an overview of product features, specification data, and hardware installation instructions for the Intel® RAID Controller RS3UC080J.

Document Organization

This document includes the following chapters and glossary:

- **Chapter 1 – Product Overview** – provides a product overview of the features set and support specifications
- **Chapter 2 – General Feature Overview**
- **Chapter 3 – Hardware Installation** – provides the product installation instructions
- **Chapter 4 – Safety and Regulatory**
- **Glossary of Terms**

Reference Documents and Online Articles

The following documents are available for download and will be useful to set up and use your Intel RAID controller.

Document Title	Description
What to Do when Unable to Enter BIOS Or Intel® RAID BIOS Console During Boot for Intel® Server Boards	Article ID#: 000059999- If the Intel or OEM logo screen displays during POST, the BIOS entry or Intel® RAID BIOS console command prompts are not visible. To gain access to these prompts, you need to disable the logo screen.
12 Gbps SAS or 6G SATA Data Transfer Controller Support for Intel RAID Controllers	Article ID# 000008025 - How and where the controller supports 12-Gbps SAS (6G SATA) data transfers
TA-1085—4Kn and 512e Advanced Format with Intel® RAID and Server Boards	Article ID# 000006173 - TA-1085—4Kn and 512e Advanced Format with Intel® RAID and Server Boards

Product Support Collateral Documents

In addition to this User Guide, Intel provides documentation, device driver updates, and utilities that may be necessary and/or useful for operation and support of the product described herein. Additional collateral documents supporting this product can be downloaded from the following Intel web sites:

For product documentation, go to the following Intel web site:
http://www.intel.com/content/www/us/en/search.html?keyword=rs3uc080j&toplevelcategory=Support

For product device drives and other software utilities, go to the following Intel web site:
https://downloadcenter.intel.com/product/97264/Intel-RAID-Controller-RS3UC080J

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1 Product Overview

The Intel® RAID Controller RS3UC080J is an 8-port SAS/SATA adapter card capable of supporting up to 240 SAS/SATA drives.

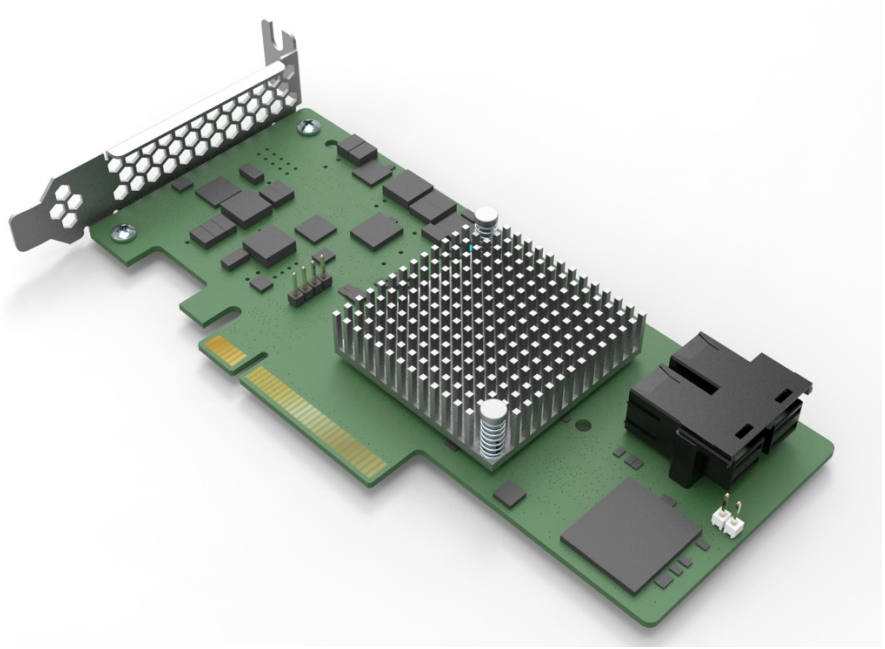
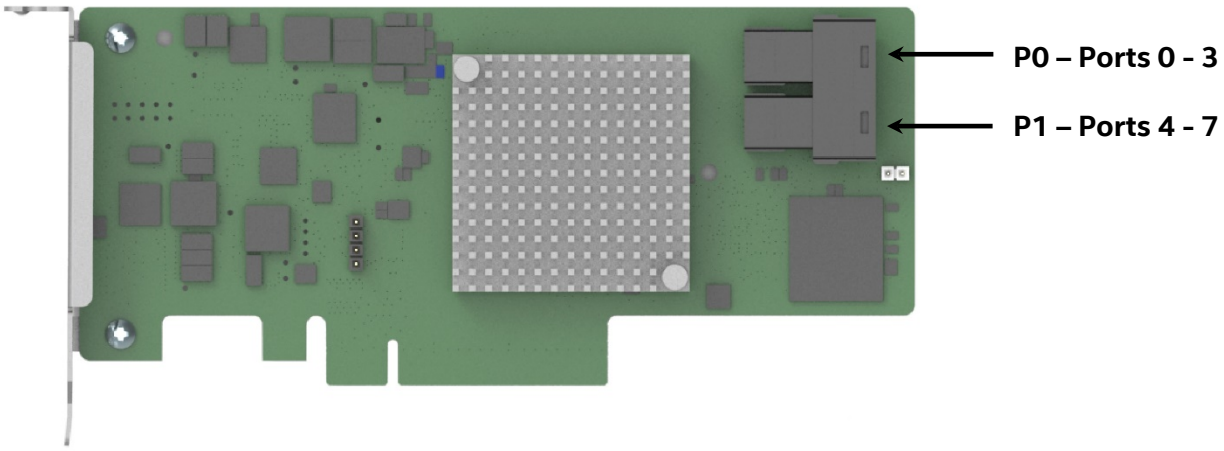


Figure 1. Intel® RAID Controller RS3UC080J

The Intel® RAID Controller RS3UC080J is ideal for direct-attached storage environments where no RAID capabilities are required. It uses the LSI 3008 SAS controller and it can reach over 1 million IOPs.

1.1 RAID Controller Layout

Top Side



Bottom Side

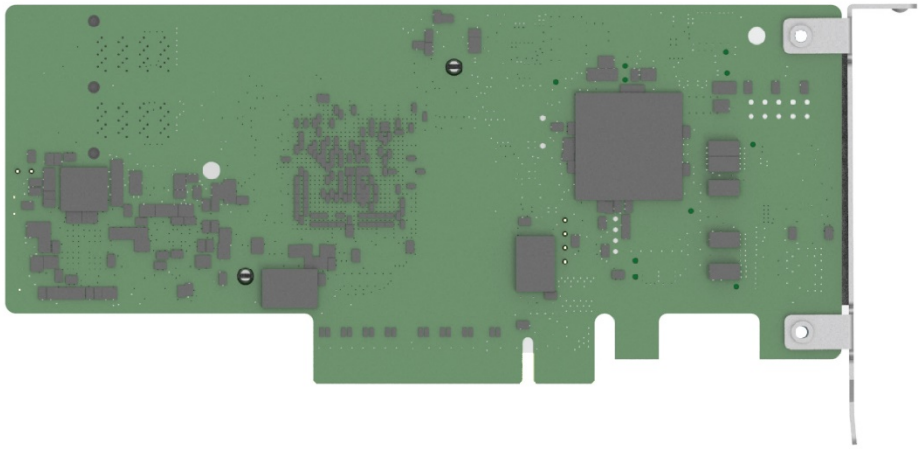


Figure 2. RAID Controller Layout

1.2 Feature Set

Table 1. Feature Set

Feature	RS3UC080J
I/O Processor	LSISAS3008: PCIe* to 12Gb/s SAS Controller
RAID Levels	N/A
Cache Memory	N/A
Form Factor	MD2
Drive Interface Connectors	2 internal 4-port Mini-SAS HD SFF-8643 connectors
PCIe* Interface	x8 PCI Express* 3.0 PCIe Performance up to 8 GT/s per lane
Data Transfer Rates	12, 6, & 3 Gbps per port SAS and 6 & 3 Gbps per port SATA
Operating Temperature	Maximum ambient: 65C
Operating System	Microsoft Window*, Linux* (SuSE*, Red Hat*) FreeBSD*, VMWare*
Drive Types	12G SAS, 6G SAS, 3G SAS, 6G SATA and 3G SATA
Maximum Physical Devices	240
Management utilities	Yes
Standard Warranty	3 years, AWR options

1.3 Performance Features

Table 2. Performance Features

Specification	RS3UC080J
PCI Express host data transfer rate	8GT/s per lane
Drive data transfer rate	Up to 12Gb/s per lane SAS, up to 6Gb/s per lane SATA
Maximum queue tags per drive	As many as the drive can accept
Maximum number of concurrent commands	10,240

1.4 Device Support Limits

Table 3. Device Support Limitations

Specification	RS3UC080J
Maximum devices per controller	240
Maximum enclosures	42 total (maximum 32 per mini SAS HD connector)

1.5 RAID Controller Specifications

The following table lists the specifications for the Intel® RAID Controller RS3UC080J

Table 4. RAID Controller Specifications

Specification	RS3UC080J
SAS controller and processor	Broadcom* SAS3008 IOC Controller
Operating voltage	+3.3 V, +12 V
Card size	PCI Express card size (64.39 mm x 139.16 mm)
Array interface to the host	PCIe* 3.0

Specification	RS3UC080J
PCI Express bus data transfer rate	Up to 8GT/s per lane x8 lane width
Serial port	4-pin RS232-compatible connector (for manufacturing use only)
SAS ports	2 internal 4-port Mini-SAS HD SFF8643 connectors
Size of flash ROM for firmware	16 MB

1.6 SAS/SATA Standards and Communication Protocols

The Intel® RAID Controller RS3UC080J supports the ANSI *Serial Attached SCSI standard, version 3.0*. In addition, the controller supports the SATA III protocol defined by the *Serial ATA specification, version 3.0*. Supporting both the SAS interface and the SATA interface, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on your RAID controller supports SAS devices, SATA devices, or both, by using the following protocols:

- SAS Serial SCSI Protocol (SSP), which enables communication with other SAS devices
- SATA, which enables communication with other SATA devices
- Serial Management Protocol (SMP), which communicates topology management information directly with an attached SAS expander device
- Serial Tunneling Protocol (STP), which enables communication with SATA devices through an attached expander

SAS technology brings a wealth of options and flexibility with the use of SAS devices and SATA devices within the same storage infrastructure. However, SAS devices and SATA devices bring individual characteristics that make each one a more suitable choice depending on the requirements of the given operating environment and storage needs. The Intel® RS3UC080J RAID Controller provides the flexibility to combine these two storage technologies on the same controller and within the same enclosure. However combining different rotational speed drives is not supported.

1.7 Safety Characteristics

All 12Gb/s Intel® RAID Controllers meet or exceed the requirements of UL flammability rating 94 V0. Each bare board is also marked with the supplier name or trademark, type, and UL flammability rating.

1.8 Electrical Characteristics

1.8.1 Operating and Nonoperating Conditions for the Intel® RAID Controller

Operating (thermal and atmospheric) limits are as follows:

- Relative humidity range is 20 percent to 80 percent noncondensing
- Airflow must be at least 200 linear feet per minute (LFPM) to avoid operating the SAS3008 processor above the maximum ambient temperature
- Temperature range: +10°C to +55°C

Non-operating (such as storage and transit) limits are as follows:

- Relative humidity range is 5 percent to 90 percent noncondensing.
- Temperature range: –40°C to +70°C.

2 General Feature Overview

2.1 Benefits of the SAS Interface

SAS is a serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. SAS is a convergence of the advantages of SATA, SCSI, and Fiber Channel, and it is the mainstay of the enterprise and high-end workstation storage markets.
The SAS interface uses the proven SCSI command set to ensure reliable data transfers, while providing the connectivity and flexibility of point-to-point serial data transfers. The serial transmission of SCSI commands eliminates clock-skew challenges. The SAS interface provides improved performance, simplified cabling, smaller connectors, lower pin count, and lower power requirements when compared to the original parallel SCSI.
SAS controllers leverage a common electrical and physical connection interface that is compatible with Serial ATA (SATA) technology. The SAS protocols and the SATA III protocols use a common thin, 7-wire connector. The SAS/SATA III connector and cable are easier to manipulate, allow connections to smaller devices, and do not inhibit airflow. The point-to-point SATA III architecture eliminates inherent difficulties created by the legacy ATA master-slave architecture, while maintaining compatibility with existing ATA firmware.

2.2 Summary of 12Gb/s Intel® RAID Controller Characteristics

2.2.1 SAS Features

- Support for 12 Gb/s, 6Gb/s, and 3Gb/s SAS data transfers per PHY
- Support for SMP to communicate topology-management information
- Support for SSP to enable communication with other SAS devices
- Support for STP to enable communication with SATA devices through an attached expander
- Provide a serial, point-to-point, enterprise-level storage interface
- Simplify cabling between devices
- Provide a scalable interface that supports up to 240 devices through the use of expanders
- Supports wide ports that consist of two, four or eight PHYs
- Supports narrow ports consisting of a single PHY
- Transfer data by using SCSI information units

2.2.2 SATA III Features

- Supports SATA III data transfers of 6Gb/s
- Supports STP data transfers of 6Gb/s
- Provide a serial, point-to-point storage interface
- Simplify cabling between devices
- Eliminate the master-slave construction used in parallel ATA
- Permit addressing of multiple SATA targets through an expander

2.2.3 Usability Features

- Drive spin-up sequencing control
- Support for the internal SAS Sideband signal SFF-8485 (SGPIO) interface

2.2.4 Flexibility Features

- Flexible programming interface to tune I/O performance
- Permit mixed connections to SAS targets or SATA III targets
- Leverage compatible connectors for SAS connections and SATA III connections
- Permit grouping of up to eight PHYs into a single SAS wide port
- Permit programming of the World Wide Name

2.3 Intel® 12 Gb/s SAS 3.0 Expander Support

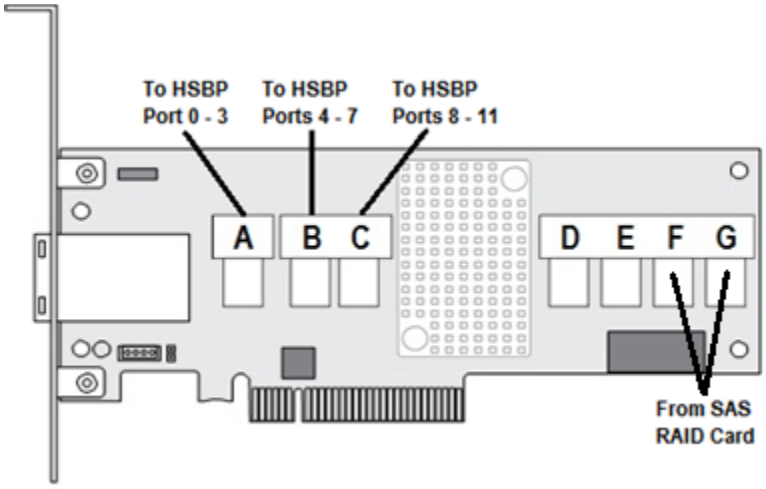
For system configurations that require more than 8 physical drives, the Intel® RAID Controller RS3UC080J has support for the following Intel® RAID Expanders:

Table 5. Supported Intel SAS Expander Options

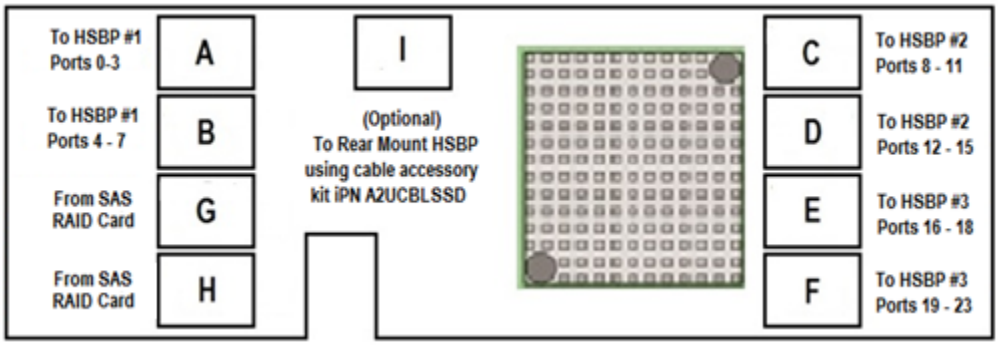
Intel Product Code	Product Description
iPC – RES3FV288  Intel® SAS Expander RES3FV288	**SAS 3.0 12 Gb/s expander** • Featuring 6Gbps data aggregation for 12Gbps data transfer with 6Gb/s devices • Low Profile MD2 PCIe* add-in card form factor • 28 internal ports and 8 external ports • Power from PCIe x1 • Mini-SAS HD (SFF-8643) Connectors **Kit includes:** (1) SAS Expander card, (2) HD-HD 250mm Expander-to-RAID card cables, PCI brackets for Low profile and Full height
iPC – RES3TV360  Intel® SAS Expander RES3TV360	**SAS 3.0 12 Gb/s expander** • Featuring 6Gbps data aggregation for 12Gbps data transfer with 6Gb/s devices • Internal mount mid-plane form factor • 36 internal ports supporting point-to-pont 12, 6, and 3 Gb/s data transfer rates • RA 4-pin power connector • Mini-SAS HD (SFF-8643) Connectors **Kit includes:** (1) SAS expander card; (1) 130mm Power cable; (1 set) Expander-to-backplane cables: (4) HD-HD 165mm, (1) HD-HD 300mm, (1) HD-HD 250mm; (3) Rubber Pads; mounting screws

2.3.1 SAS Expander Configuration

Supported Intel SAS Expanders include an array of multiport mini-SAS HD (SFF-8643) connectors. Some are used as Output connectors to a backplane, while others are used as Input connectors from the RAID Controller. The following diagrams identify the connector types for each supported SAS expander card.



Intel® SAS Expander RES3FV288



Intel® SAS Expander RES3TV360

Figure 3. Connector Types of each supported SAS Expander Card

3 Hardware Installation

Warnings

Heed safety instructions: Before working with your server product, whether you are using this guide or any other resource as a reference, pay close attention to the safety instructions. You must adhere to the assembly instructions in this guide to ensure and maintain compliance with existing product certifications and approvals. Use only the described, regulated components specified in this guide. Use of other products/components will void the UL listing and other regulatory approvals of the product and will most likely result in noncompliance with product regulations in the region(s) in which the product is sold.

System power on/off: The power button DOES NOT turn off the system AC power. To remove power from the system, you must unplug all AC power cords from the server system before you open the chassis, add, or remove any components.

Hazardous conditions, devices and cables: Hazardous electrical conditions may be present on power, telephone, and communication cables. Turn off the server and disconnect the power cord, telecommunications systems, networks, and modems attached to the server before opening it. Otherwise, personal injury or equipment damage can result.

Installing or removing jumpers: A jumper is a small plastic encased conductor that slips over two jumper pins. Some jumpers have a small tab on top that you can grip with your fingertips or with a pair of fine needle nosed pliers. If your jumpers do not have such a tab, take care when using needle nosed pliers to remove or install a jumper; grip the narrow sides of the jumper with the pliers, never the wide sides. Gripping the wide sides can damage the contacts inside the jumper, causing intermittent problems with the function controlled by that jumper. Take care to grip with, but not squeeze, the pliers or other tool you use to remove a jumper, or you may bend or break the pins on the board.

Electrostatic Discharge (ESD)

Electrostatic discharge can cause damage to your computer or the components within it. ESD can occur without the user feeling a shock while working inside the system chassis or while improperly handling electronic devices like processors, memory or other storage devices, and add-in cards.

Intel recommends the following steps be taken when performing any procedures described within this document or while performing service to any computer system.

- Where available, all system integration and/or service should be performed at a properly equipped ESD workstation
- Wear ESD protective gear like a grounded antistatic wrist strap, sole grounders, and/or conductive shoes
- Wear an anti-static smock or gown to cover any clothing that may generate an electrostatic charge
- Remove all jewelry
- Disconnect all cables and cords attached to the server before performing any integration or service
- Touch any unpainted metal surface of the chassis before performing any integration or service
- Hold all circuit boards and other electronic components by their edges only
- After removing electronic devices from the system or from their protective packaging, place them component side up on to a grounded anti-static surface or conductive foam pad. **Do not** place electronic devices on to the outside of any protective packaging.

3.1 RAID Controller Installation

3.1.1 Requirements

The following items are required to install an Intel® RAID Controller:

- Intel® RAID Controller
- Intel server board based server system with support for an Intel RAID Controller
- Internal SAS/SATA data cables
- SAS drives or SATA drives

3.1.2 Packing List

1 – Intel RAID Controller
2 – Low profile mounting bracket
3 – Attention Document
4 – Warranty Document

Note: Intel RAID Products do not include SAS / SATA data cables. Appropriate SAS / SATA data cables may be included with your server system or must be purchased separately.

3.1.3 Installation Instructions

1. Unpack the Intel® RAID Controller.
   Unpack your RAID Controller. Inspect it for damage. If it appears damaged, contact your Intel Customer and Technical Support representative.
2. Turn off the power to the computer, and disconnect the AC power cords
3. Remove the computer cover. Refer to the system documentation for instructions.
4. Install the RAID Controller.
   a) Remove the riser card (the controller can be installed on any riser card)
   b) Remove the filler panel
   c) Insert the controller in the desired slot. Press down gently, but firmly to make sure that the card is seated correctly in the slot.
      Secure the bracket with the bracket screw.

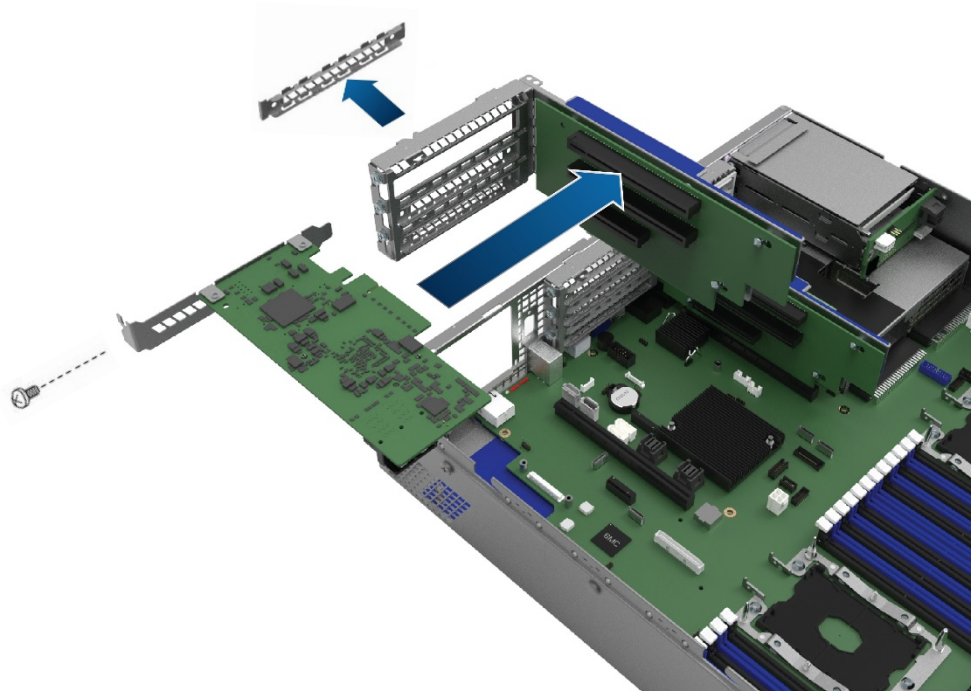


Figure 4 RAID Controller Installation (insert controller in slot)

d) Insert back the riser card, press down gently, but firmly

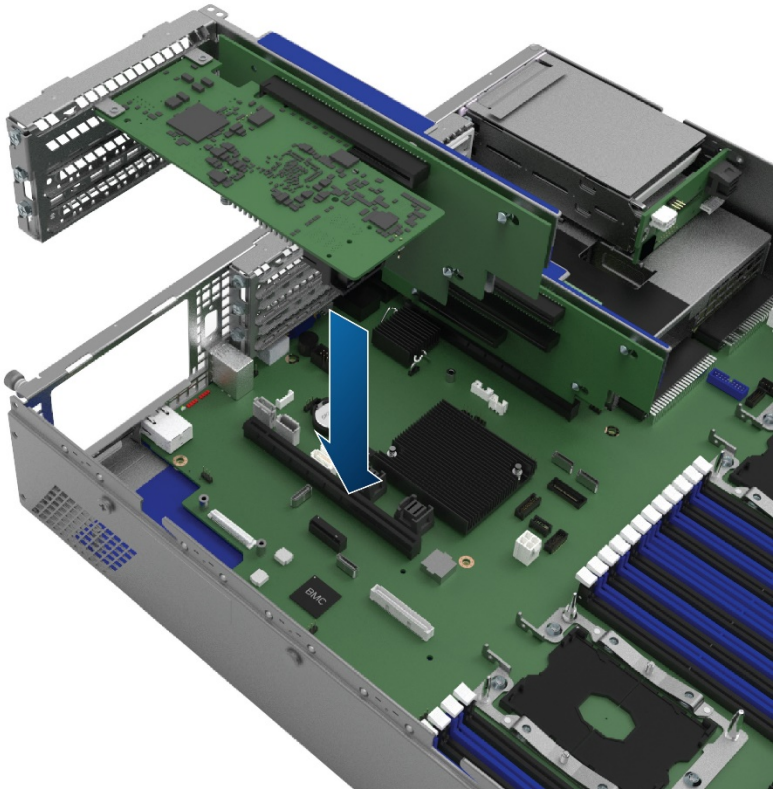


Figure 5 RAID Controller Installation (insert riser card)

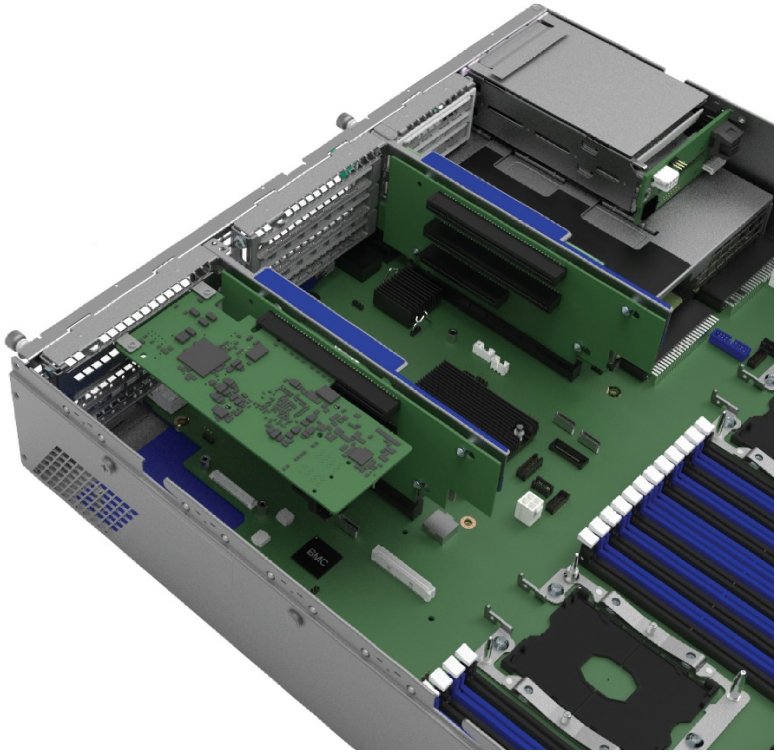


Figure 6 RAID Controller Installation (controller installed)

5. Install SAS and / or SATA drives in the host computer case. Refer to the documentation for the devices for any pre-installation configuration requirements.
6. Connect internal SAS / SATA data cables to appropriate Drives/Backplane/or Expander card
7. Carefully route SAS / SATA data cables back to the Intel RAID Controller
8. Attach SAS / SATA data cables to the Intel RAID Controller
9. Reinstall the computer cover, and reconnect the AC power cords to the system

The hardware installation is now complete and the Intel RAID Controller is ready to be configured. For complete Intel RAID Controller configuration information, refer to the ***Intel® RAID Software Users Guide*** available to download from the Intel Support Site: http://support.intel.com

4 Safety and Regulatory (Class A)

Intel RAID products typically have a variety of individual component level certifications; however final regulatory compliance is based on the combination of the RAID card being integrated within an Intel Server System.

Intended Application – The RAID products are evaluated as Information Technology Equipment (ITE), which are intended to be integrated into Intel server systems that will be installed in offices, schools, computer rooms, and similar commercial type locations. The suitability of this product for other product categories and environments (such as: medical, industrial, telecommunications, NEBS, residential, alarm systems, test equipment, etc.), other than an ITE application, may require further evaluation.

4.1 Product Safety Compliance

- UL60950 – CSA 60950(USA / Canada)
- EN60950 (Europe)
- IEC60950 (International)
- CB Certificate & Report, IEC60950 (report to include all country national deviations)
- CE - Low Voltage Directive 2006/95/EC (Europe)

4.2 Product EMC Compliance – Class A Compliance

- FCC /ICES-003 - Emissions (USA/Canada) Verification
- CISPR 22 – Emissions (International)
- EN55022 - Emissions (Europe)
- EN55024 - Immunity (Europe)
- CE – EMC Directive 2004/108 EC (Europe)
- VCCI Emissions (Japan)
- AS/NZS 3548 Emissions (Australia / New Zealand)
- BSMI CNS13438 Emissions (Taiwan)
- KC Certification (Korea)

4.3 Product Environmental Compliance

Intel has a system in place to restrict the use of banned substances in accordance with worldwide regulatory requirements. A Material Declaration Data Sheet is available for Intel products. For more reference on material restrictions and compliance you can view Intel's Environmental Product Content Specification at http://supplier.intel.com/ehs/environmental.htm.

- Europe - European Directive 2002/95/EC
  - Restriction of Hazardous Substances (RoHS)
    Threshold limits and banned substances are noted below.
    Quantity limit of 0.1% by mass (1000 PPM) for:
    Lead, Mercury, Hexavalent Chromium,
    Polybrominated Biphenyls Diphenyl Ethers (PBB/PBDE)
    Quantity limit of 0.01% by mass (100 PPM) for:
    Cadmium (who owns submitting declaration.

- California Code of Regulations, Title 22, Division 4.5, Chapter 33: Best Management Practices for Perchlorate Materials
- China – Restriction of Hazardous Substances (China RoHS)
- WEEE Directive (Europe)
- Packaging Directive (Europe)
- REACH Directive (Europe)

Glossary

Term	Description
BIOS	Acronym for Basic Input/Output System. Software that provides basic read/write capability. Usually kept as firmware (ROM-based). The system BIOS on the motherboard of a computer boots and controls the system. The BIOS on your host adapter acts as an extension of the system BIOS.
configuration	Refers to the way a computer is set up, the combined hardware components (computer, monitor, keyboard, and peripheral devices) that make up a computer system, or the software settings that allow the hardware components to communicate with each other.
device driver	A program that permits a microprocessor (through the operating system) to direct the operation of a peripheral device.
domain validation	A software procedure in which a host queries a device to determine its ability to communicate at the negotiated data rate.
drive group	A group of physical drives that combines the storage space on the drives into a single segment of storage space. A hot spare drive does not actively participate in a drive group.
EEPROM	Acronym for Electronically Erasable Programmable Read-Only Memory. It is a memory chip that typically stores configuration information, as it provides stable storage for long periods without electricity and can be reprogrammed. See NVRAM.
external SAS device	A SAS device installed outside the computer cabinet. These devices are connected using specific types of shielded cables.
Fusion-MPT architecture	An acronym for Fusion-Message Passing Technology architecture. Fusion-MPT consists of several main elements: Fusion-MPT firmware, the Fiber Channel and SCSI hardware, and the operating system-level drivers that support these architectures. Fusion-MPT architecture offers a single binary, operating system driver that supports both Fiber Channel and SCSI devices.
host	The computer system in which a RAID controller is installed. It uses the RAID controller to transfer information to and from devices attached to the SCSI bus.
host adapter board	A circuit board or integrated circuit that provides a device connection to the computer system.
hot spare	An idle, powered on, standby drive that is ready for immediate use in case of drive failure. A hot spare does not contain any user data. A hot spare can be dedicated to a single redundant array or it can be part of the global hot-spare pool for all arrays managed by the controller. When a drive fails, the controller firmware automatically replaces and rebuilds the data from the failed drive to the hot spare. Data can be rebuilt only from virtual drives with redundancy (RAID levels 1, 5, 6, 10, 50, and 60; not RAID level 0), and the hot spare must have sufficient capacity.
internal SAS device	A SAS device installed inside the computer cabinet. These devices are connected by using a shielded cable.
main memory	The part of computer memory that is directly accessible by the CPU (usually synonymous with RAM).
NVRAM	Acronym for nonvolatile random access memory. An EEPROM (electronically erasable read-only memory) chip that stores configuration information. See EEPROM.
PCI	Acronym for peripheral component interconnect. A high-performance, local bus specification that allows the connection of devices directly to computer memory. The PCI Local Bus allows transparent upgrades from 32-bit data path at 33 MHz to 64-bit data path at 33 MHz, and from 32-bit data path at 66 MHz to 64-bit data path at 66 MHz.
PCI Express	Acronym for peripheral component interconnect Express. A high-performance, local bus specification that allows the connection of devices directly to computer memory. PCI Express is a two-way, serial connection that transfers data on two pairs of point- to-point data lines. PCI Express goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile, server, communications, and embedded devices.
peripheral devices	A piece of hardware (such as a video monitor, drive, printer, or CD-ROM) used with a computer and under the control of the computer. SCSI peripherals are controlled through an Intel® RAID Controller (host adapter).
PHY	The interface required to transmit and receive data packets transferred across the SAS bus. Each PHY can form one side of the physical link in a connection with a PHY on a different SAS device. The physical link contains four wires that form two differential signal pairs. One differential pair transmits signals, while the other differential pair receives signals. Both differential pairs operate simultaneously and allow concurrent data transmission in both the receive and the transmit directions.

Term	Description
RAID	Acronym for Redundant Array of Independent Disks (originally Redundant Array of Inexpensive Disks). An array (group) of multiple independent drives managed together to yield higher reliability, performance, or both exceeding that of a single drive. The RAID array appears to the controller as a single storage unit. I/O is expedited because several drives can be accessed simultaneously. Redundant RAID levels (RAID levels 1, 5, 6, 10, 50, and 60) provide data protection.
SAS	Acronym for Serial Attached SCSI. A serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. The SAS interface provides improved performance, simplified cabling, smaller connections, lower pin count, and lower power requirements when compared to parallel SCSI. SAS controllers leverage a common electrical and physical connection interface that is compatible with Serial ATA. The SAS controllers support the ANSI *Serial Attached SCSI Standard, Version 2.0*. In addition, the controller supports the Serial ATA III (SATA III) protocol defined by the *Serial ATA Specification, Version 3.0*. Supporting both the SAS interface and the SATA III interface, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments. Each port on the SAS RAID controller supports SAS devices, SATA devices, or both.
SAS device	Any device that conforms to the SAS standard and is attached to the SAS bus by a SAS cable. This includes SAS RAID controllers (host adapters) and SAS peripherals.
SATA	Acronym for Serial Advanced Technology Attachment. A physical storage interface standard, SATA is a serial link that provides point-to-point connections between devices. The thinner serial cables allow for better airflow within the system and permit smaller chassis designs.
SMP	Acronym for Serial Management Protocol. SMP communicates topology management information directly with an attached SAS expander device. Each PHY on the controller can function as an SMP initiator.
SSP	Acronym for Serial SCSI Protocol. SSP enables communication with other SAS devices. Each PHY on the SAS controller can function as an SSP initiator.
STP	Acronym for Serial Tunneling Protocol. STP enables communication with a SATA device through an attached expander. Each PHY on the SAS controller can function as an STP initiator.