



# **Intel® Storage Server SSR212MC2**

## ***Technical Product Specification***

**Revision 1.2**

**EPSD Technical Support & Services Group**

---

## *Revision History*

<b>Date</b>	<b>Revision Number</b>	<b>Modifications</b>
April 24, 2007	1.0	Release copy.
May 23, 2007	1.1	Corrected Battery Backup product code, clarified expansion slots, corrected RAID sku product code nomenclature.
July 10, 2007	1.2	Added AC Power consumption tables to section 2.1.

## ***Disclaimers***

Information in this document is provided in connection with Intel® products. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Intel products are not intended for use in medical, life saving, or life sustaining applications. Intel may make changes to specifications and product descriptions at any time, without notice.

Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.

The Intel® Storage Server SSR212MC2 may contain design defects or errors known as errata that may cause the product to deviate from published specifications. Current characterized errata are available on request.

Intel system boards contain a number of high-density VLSI and power delivery components that need adequate airflow to cool. Intel's own chassis are designed and tested to meet the intended thermal requirements of these components when the fully integrated system is used. It is the responsibility of the system integrator that chooses not to use Intel developed system building blocks to consult vendor datasheets and operating parameters to determine the amount of air flow required for their specific application and environmental conditions. Intel Corporation cannot be held responsible if components fail or the system board does not operate correctly when used outside any of their published operating or non-operating limits.

Intel, Pentium, Itanium, and Xeon are trademarks or registered trademarks of Intel Corporation.

\*Other brands and names may be claimed as the property of others.

Copyright © Intel Corporation 2003 - 2007.

# Table of Contents

<b>1. Feature Summary</b>	<b>1</b>
1.1 System Components	5
1.2 System Board Feature Set	8
1.3 Serial Attached SCSI (SAS) Host Bus Adapter	9
1.4 Hot Swap Backplane	9
1.5 Enclosure Management Card	10
1.5.1 Summary Of Card Features	10
1.5.2 VSC410 Storage Management Controller	10
1.6 SAS Expander	11
1.6.1 Embedded Processor	12
1.6.2 Memory Interface & Device Initialization	12
Expander Port Configuration	13
1.7 Chassis Dimensions and Weight	14
1.8 Back Panel I/O Ports and Features	15
1.9 Front Panel and HDD Bays	16
1.9.1 Front/Rear Panel Controls and Indicators	17
1.10 Fan Monitoring	18
1.10 Rack and Cabinet Mounting Options	18
<b>2. Power Sub-System</b>	<b>19</b>
2.1 Power Supply Enclosure	19
2.1.1 Hot Swapping Power Modules	20
2.1.2 Power Supply Outputs	20
<b>3. System Cooling Module</b>	<b>22</b>
3.1 Fan Control	22
<b>4. Chassis Bays</b>	<b>23</b>
4.1 Hard Disk Drive Bays	24
4.1.1 Hard Disk Drive Carrier	25
<b>5. Internal Boot Drives (optional)</b>	<b>27</b>
5.1 SAS	27
5.2 SATA	27
<b>6. System Interconnection</b>	<b>28</b>
6.1 Internal Chassis Cables	28

6.1.1	SAS Expander/SAS HBA.....	28
6.1.1.1	SAS Host Connector.....	28
6.1.2	Enclosure Management Card/Backplane .....	29
6.1.2.1	Power Connectors .....	29
6.1.2.2	Front Panel Cable.....	29
6.1.3	Intel® Server Board S5000PSL.....	30
6.1.3.1	USB Header.....	30
6.1.4	Intel® RAID Controller SRCAS144E .....	30
6.1.4.1	Battery Backup. ....	30
6.2	External Rear I/O Panel Connectors .....	31
6.3	External Front Panel Connectors.....	31
<b>7.</b>	<b>Regulatory Information.....</b>	<b>32</b>
6.1	Product Regulation Requirements.....	32
7.1.1	Product Safety Compliance .....	32
7.1.2	Product EMC Compliance – Class A Compliance .....	32
7.1.3	Certifications / Registrations / Declarations .....	33
7.1.4	Component Regulation Requirement .....	33
7.1.5	Product Ecology Requirements .....	34
7.2	Restriction of Hazardous Substances (RoHS).....	34
<b>8.</b>	<b>Environmental Limits.....</b>	<b>35</b>
8.1	System Office Environment .....	35
8.2	System Environmental Testing .....	35
8.3	Environmental Limits .....	36
<b>9.</b>	<b>Calculated MTBF .....</b>	<b>37</b>
	<b>Glossary.....</b>	<b>I</b>

# List of Figures

Figure 1. Intel® Storage Server SSR212MC2 .....	1
Figure 2. Intel® Storage Server SSR212MC2R Block Diagram .....	5
Figure 3. Intel® Storage Server SSR212MC2 Block Diagram .....	6
Figure 4. System Components .....	7
Figure 5: Vitesse* VSC410 Block Diagram .....	11
Figure 6: PMC* PM8388 Block Diagram .....	12
Figure 7: Back Panel I/O Ports .....	15
Figure 8: Chassis Front and Rear .....	16
Figure 9: Front Panel .....	17
Figure 10: Rack Mounting .....	18
Figure 11: Power Supply Module .....	20
Figure 12: Cooling Module .....	22
Figure 13: Drive Carrier Removal .....	23
Figure 14: Hard Disk Drive Bays .....	25
Figure 15: Hard Drive Carrier Assembly .....	26

## List of Tables

Table 1: Intel® Storage Server SSR212MC2 Hardware Feature Summary .....	2
Table 2: Intel® Server Board S5000PSL features .....	8
Table 3: Intel® RAID Controller SRCAS144E features .....	9
Table 4: SATA/SAS Hot Swap backplane features .....	9
Table 5: SXP Port Configuration .....	13
Table 6: Chassis Dimensions and Weight .....	14
Table 7: Front/Rear Control Button Functions .....	17
Table 8: Front LED Indicator Status .....	17
Table 9: AC Input Current .....	19
Table 10: AC Power Consumption (with SATA drives) .....	19
Table 11: AC Power Consumption (with SAS drives) .....	19
Table 12: Enclosure DC Output Summary .....	20
Table 13: Power Supply LED Indicators .....	21
Table 14: Drive Numbering .....	24
Table 15: SAS 4i Host Connector .....	28
Table 16: EM Card PWR_A Connector .....	29
Table 17: EM Card PWR_B Connector .....	29
Table 18: Front Panel Cable .....	29
Table 19: USB 2.0 Connector .....	30
Table 20: System Office Environment Summary .....	35
Table 21: Operating and Non-Operating Environmental Limits .....	36
Table 22: Component MTBF Numbers .....	37

This page intentionally left blank



# 1. Feature Summary

---

This Technical Product Specification provides detailed information about the hardware components of the Intel® Storage Server SSR212MC2.

The Intel® Storage Server SSR212MC2 is available in two configuration/sku's: with or without an Intel® RAID Controller SRCSAS144E (product codes SSR212MC2R and SSR212MC2, respectively), and includes a 2U chassis, Intel® Server Board S5000PSL with support for either one or two Dual-Core (5100 sequence) or Quad-Core (5300 sequence) Intel® Xeon® processors, twelve SATA/SAS hard disk drive carriers, dual Intel® PRO/1000 Network connections, and a single 850 W power supply (dual redundant 1+1 capable).

Intel®-based system boards and chassis have feature sets designed to support the high-density storage market.



Figure 1. Intel® Storage Server SSR212MC2

Table 1: Intel® Storage Server SSR212MC2 Hardware Feature Summary

<b>Raw Storage Capacity</b>	Expandable to 3.0 TB – using twelve 250 GB drives. Expandable to 4.8 TB – using twelve 400 GB drives. Expandable to 6.0 TB – using twelve 500 GB drives. Expandable to 9.0 TB – using twelve 750 GB drives Expandable to 12.0 TB – using twelve 1 TB drives
<b>External Drive Bays</b>	12 Hot Pluggable.
<b>Hard Disk Drive Supported (external storage)</b>	3.5 inch SATA , SAS. <b>NOTE: For specific drive family and capacities supported, please refer to the SSR212MC2 Tested Hardware and OS List (THOL).</b>
<b>Hard Disk Drive Supported (internal boot)</b>	2.5 inch SATA, SAS. <b>NOTE: For specific drive family and capacities supported, please refer to the SSR212MC2 Tested Hardware and OS List (THOL).</b>
<b>Processor</b>	Support for one or two Dual-Core (5100 sequence) or Quad-Core (5300 sequence) Intel® Xeon® processors. <b>NOTE: The Intel® Storage Server SSR212MC2 does not ship with processors installed. Please refer to the SSR212MC2 Configuration Guide for a list of supported processors.</b>
<b>Memory Capacity</b>	Expandable to 32 GB maximum. <b>NOTE: The Intel® Storage Server SSR212MC2 does not ship with memory installed. Please refer to the SSR212MC2 Tested Memory List for a list of supported memory.</b>
<b>Memory Type</b>	FBDIMM.
<b>DIMM Slots</b>	Eight.
<b>Enclosure Controller</b>	On-board Vitesse** VSC410 micro-controller.
<b>Temperature Sensor</b>	Two temperature sensors are located on the backplane and baseboard that allows drive cage temperature monitoring by enclosure management.
<b>Network Connectivity</b>	Dual GB Ethernet.
<b>Front Panel</b>	
<b>Buttons and Switches</b>	3x: Power, Reset, ID.
<b>LEDs</b>	3x: Fault, ID, Power.
<b>Hard Disk Drive Carrier</b>	
<b>LEDs</b>	2x: Activity, Fault.
<b>Back Panel</b>	
<b>Buttons and Switches</b>	2x: ID LED button, NMI button.
<b>I/O Connectors</b>	1x DB-9 Serial port, 2x RJ-45 Ethernet ports, 1x DB-15 Video connector, 4x 2.0 USB port, 1x Stacked PS/2 Mouse/Keyboard connector.
<b>Power Receptacle</b>	1x IEC AC per installed power supply module.
<b>Chassis</b>	
<b>Form Factor</b>	2U rack-mount chassis
<b>Height</b>	87.9 mm, 3.46 in
<b>Width</b>	447 mm, 17.6 in (across body of chassis)
<b>Depth</b>	707 mm, 27.83 in (from rack posts to max extremity of chassis)

<b>Weight</b>	As shipped (zero drives): approximately 20 kg, 44 pounds Fully configured (twelve drives): approximately 30 kg, 66 pounds Shipping container: 3.2 kg, 7 pounds
<b>Color</b>	Black
<b>Rack Support</b>	Rail mount, compatible with four-post rack mount only, and compliant to the SSI Server Rack specification and EIA 310-D.
<b>System Cooling</b>	
<b>Fans</b>	Chassis includes ten hot-swappable redundant system fans for cooling the hard drives, baseboard and SAS Host Bus Adapter (HBA) card.
<b>Power</b>	
<b>Configuration</b>	850 W continuous, 1+1 redundant power supplies. Intel Storage System SSR212MC2 ships with one 850W power supply
<b>Environment</b>	
<b>Ambient Temperature</b>	Operating (system): 10 degrees Celsius to +35 degrees Celsius, with maximum change not to exceed 10 degrees Celsius per hour; non-operating (system): -40 degrees Celsius to +70 degrees Celsius.
<b>Relative Humidity</b>	Non-operating: 90% @ 35 degrees Celsius non-condensing
<b>Acoustics</b>	< 7.0 BA (rack-mount) in an idle state in a normal office environment (23 degrees Celsius)
<b>Electrostatic Discharge</b>	15 KV per Intel test specification
<b>Safety Compliance</b>	
<b>Argentina</b>	IRAM
<b>Canada</b>	UL60950 – CSA (60950 (UL and cUL)
<b>China</b>	GB4943- CNCA Certification
<b>Europe, CE Mark</b>	EN60950 (complies with 73/23/EEC)
<b>Germany</b>	GS License
<b>International</b>	IEC60950 (CB Report and Certificate)
<b>Nordic Countries</b>	EMKO-TSE (74-SEC) 207/94
<b>Russia</b>	GOST 50377-92
<b>United States</b>	UL– 60950 – CSA 60950 (UL and cUL)
<b>Electromagnetic Capability (Class A) (EMC)</b>	
<b>Australia/New Zealand</b>	AS/NZS 3548 (based on CISPR 22)
<b>Canada</b>	ICES-003
<b>China</b>	GB 9254 - CNCA Certification GB 17625 - (Harmonics) CNCA Certification
<b>Europe, CE Mark</b>	EN55022; EN55024 & EN61000-3-2;-3-3 (complies with 89/336/EEC)
<b>International</b>	CISPR 22
<b>Japan</b>	VCCI
<b>Korea</b>	RRL, MIC 1997-41 & 1997-42
<b>Russia</b>	GOST 29216-91 & 50628-95
<b>Taiwan</b>	CNS13438
<b>United States</b>	FCC, Part 15
<b>RoHS</b>	European Directive 2002/95/EC

## 1.1 System Components

A block diagram of the SSR212MC2R sku (with RAID card) is shown below.

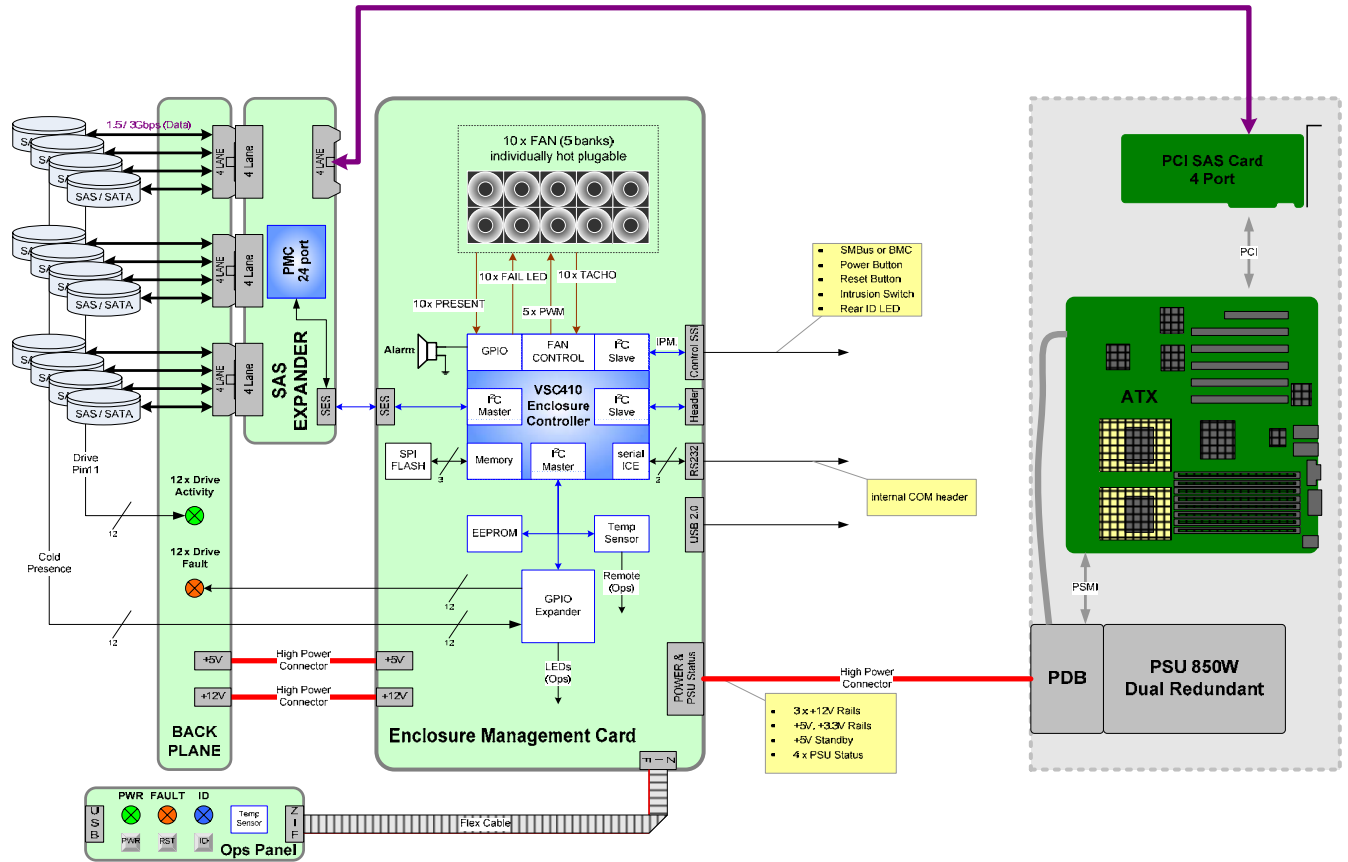


Figure 2. Intel® Storage Server SSR212MC2R Block Diagram

A block diagram of the SSR212MC2 sku (without RAID card) is shown below.

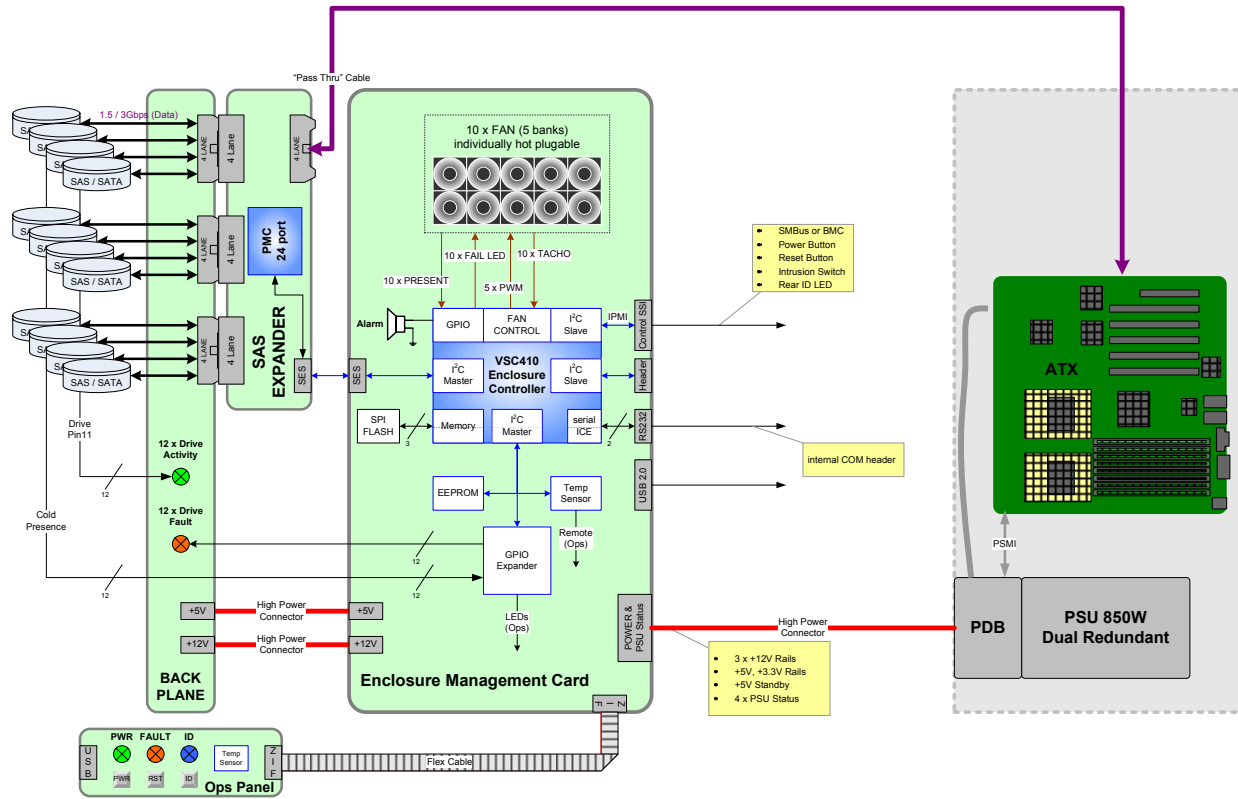


Figure 3. Intel® Storage Server SSR212MC2 Block Diagram

The components included with the storage system are diagrammed below.

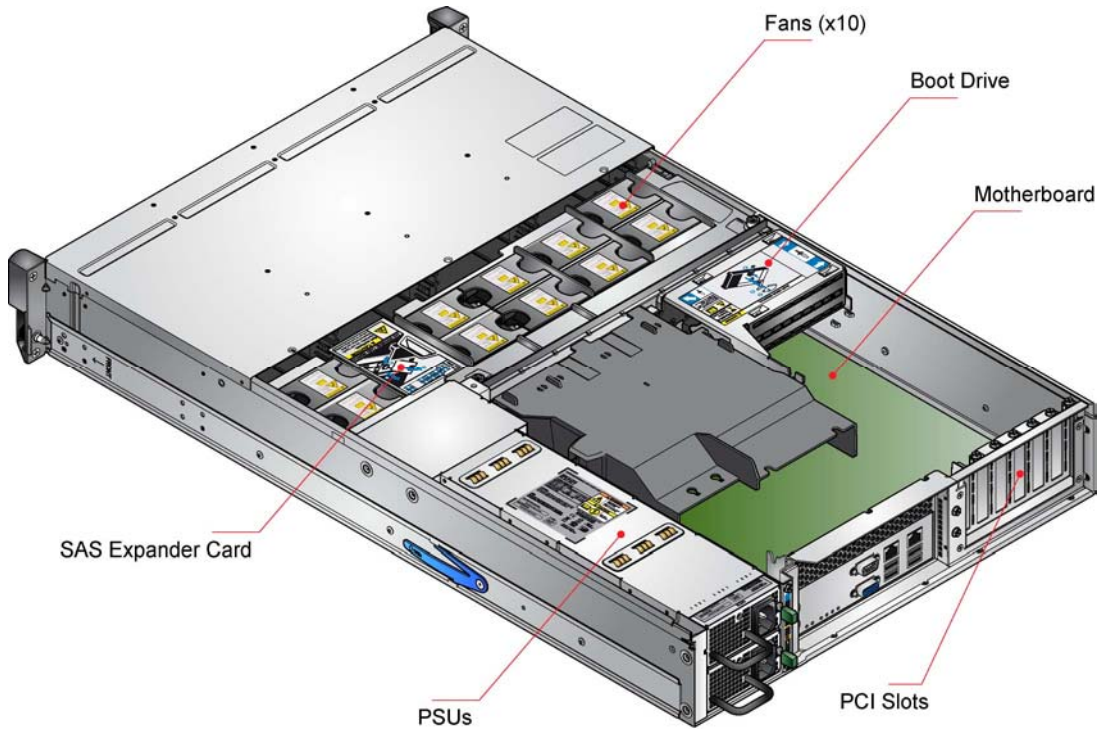


Figure 4. System Components

## 1.2 System Board Feature Set

The Intel® Server Board S5000PSL provides the following feature set, as implemented in the Intel Storage System SSR212MC2:

**Table 2: Intel® Server Board S5000PSL features**

Feature	Description
Processors	Socket J (771-pin LGA sockets) supporting one or two Dual-Core (5100 sequence) or Quad-Core (5300 sequence) Intel® Xeon® processors, with system bus speeds of 1066 MHz and 1333 MHz. <b>NOTE: The Intel® Storage Server SSR212MC2 does not include processors. See the SSR212MC2 Configuration Guide for a list of supported processors.</b>
Memory	Eight DIMM sockets supporting fully buffered DIMM technology (FBDIMM) memory. 240-pin DDR2-533 and DDR2-677 FBDIMMs can be used. <b>NOTE: The type of memory selected (DDR2-533 or DDR2-667) should be matched with the type of processor used. See the SSR212MC2 Tested Memory List for a list of supported memory modules.</b>
Chipset	Intel® S5000P chipset, consisting of: Intel® 5000P Memory Controller Hub, and Intel® ESB2-E I/O Controller.
Video	2D Graphics Accelerator: ATI* ES1000 Video Controller w/ 16MB of video DDR SDRAM memory.
Connectors/ Headers	<ul style="list-style-type: none"> <li>▪ Stacked PS/2* ports for keyboard and mouse</li> <li>▪ Stacked video / DB9 serial port A connector</li> <li>▪ Two RJ45 / 2xUSB connectors for 10 / 100 / 1000 Mb and USB 2.0 support</li> <li>▪ One USB 2x5 pin header, which supports two USB ports</li> <li>▪ One USB port Type A connector</li> <li>▪ One DH10 serial port B header</li> <li>▪ Two SATA connectors and four SAS connectors</li> <li>▪ One ATA100 40-pin connector</li> <li>▪ SSI-compliant front panel header</li> <li>▪ SSI-compliant 24-pin main power connector, supporting the ATX-12 V standard on the first 20 pins</li> </ul>
Expansion Slots: Add-in PCI, PCI-X*, PCI Express* Cards	<ul style="list-style-type: none"> <li>▪ Two low profile PCI-X 64-bit slot with up to 100/133-MHz support (bus segment PXA) <b>NOTE: one slot occupied by the BBU, if ordered with an Intel® RAID Controller SRCASAS144E (product code SSR212MC2R).</b></li> <li>▪ Two low profile PCI Express* x4 slots (bus segments PE1 &amp; PE2)</li> <li>▪ Two low profile PCI Express* x8 slots (bus segments PE5 &amp; PE7) <b>NOTE: one slot occupied if ordered with an Intel® RAID Controller SRCASAS144E (product code SSR212MC2R).</b></li> </ul>
LAN	Two 10 / 100 / 1000 Intel® 82563EB PHYs supporting Intel® I/O Acceleration Technology (Intel® I/OAT).

Please refer to the Intel® Server Board S5000PSL Technical Product Specification available at <http://support.intel.com> for more information on the Storage System SSR212MC2's server board.

### 1.3 Serial Attached SCSI (SAS) Host Bus Adapter

The Intel® Storage Server SSR212MC2R sku ships with a single Intel® RAID Controller SRCAS144E, x4 PCI Express to SAS Host Bus Adapter (HBA). The SAS HBA board provides the following feature set:

**Table 3: Intel® RAID Controller SRCAS144E features**

Feature	Intel® RAID Controller SRCAS144E
RAID levels	0, 1, 5, 10, 50
Number of devices	Up to 32 devices per controller <b>NOTE: Up to 12 front accessible carrier mounted hard disk drives are supported in the Intel® Storage Server SSR212MC2. The remaining 20 devices may be supported via the external SAS connector &amp; external JBOD.</b>
Device types	SAS or SATA hard drives
Data transfer rate	300 MB/s per port
PCI bus	x4 PCI Express*
Memory	128 MB ECC DDR2 400 SDRAM Integrated on the Controller
Battery backup	External battery module (AXRIBBU1)
SAS connector	One internal SSF8087 connector and one external SFF8470 connector.
IOP	Intel® 80333 I/O processor, which performs hardware exclusive OR (XOR) assistance
Card dimensions	7.71 inches by 2.525 inches
Serial port	4-pin serial debug (requires transceiver)
Compatible devices	32 physical devices, 64 logical drive, mixed capacity, mixed SATA and SAS (not recommended)
Firmware	4 Mbit in flash ROM

Please refer to the Intel® RAID Controller SRCAS144E Hardware Users Guide available at <http://support.intel.com> for more information.

### 1.4 Hot Swap Backplane

The SATA/SAS Hot Swap backplane board provides the following feature set:

**Table 4: SATA/SAS Hot Swap backplane features**

Feature	Description
Supports up to 12 drives.	Slots provided for docking up to twelve 1.5 or 3.0 Gigabits per second (Gb/s) SAS or SATA hot swap hard drives
Enclosure Management Controller	<ul style="list-style-type: none"> <li>On-board Vitesse** VSC055 micro-controller with 256Kbit external SRAM memory</li> <li>2 SAS Host Controller I<sup>2</sup>C Interfaces</li> <li>SATA and SAS extension compatibility</li> <li>Hot swap support for up to 12 SAS or SATA Drives</li> </ul>
FRU/Configuration EEPROM	A Vitesse** VSC055* provides a serial EEPROM memory for storage of configuration and product FRU information.



Feature	Description
Drive Status LEDs	Support for separate drive status LEDs (via pin 11) that are visible at the front of each drive carrier. These LED's indicate the following: <ul style="list-style-type: none"> <li>• Green LED –               <ul style="list-style-type: none"> <li>○ ON, drive spinning, but idle.</li> <li>○ ON, no drive present.</li> <li>○ BLINKING, I/O activity.</li> <li>○ OFF, drive not spun up.</li> </ul> </li> <li>• Amber LED –               <ul style="list-style-type: none"> <li>○ ON, drive fault.</li> </ul> </li> </ul>

## 1.5 Enclosure Management Card

### 1.5.1 Summary Of Card Features

- Vitesse\* VSC410 Baseboard and Storage Management Controller (SEP)
  - embedded 32-bit RISC core with 8Kbytes of SRAM
  - SPI memory interface
  - Firmware Upgradeability through serial port interface
  - I<sup>2</sup>C/IPMI communication with ATX motherboard
  - I<sup>2</sup>C/SES communication with SAS Expander Card
  - I<sup>2</sup>C communication to local management peripherals
- 8 Mbit of Serial Flash Memory for code storage
- Drive fault and presence detection
- Support for up to 10 hot-swap fan modules with fault and presence detection
- Closed-loop thermal control through temperature monitoring and fan speed control
- no dependency on host system BIOS and software
- PSU status monitoring
- audible alarm control
- EEPROM for FRU data storage
- JTAG test & debug access
- dedicated Card ID and Firmware ID Bit Monitoring
- connectivity hub to backplane, ops panel, host system and PSU
- chassis intrusion switch

### 1.5.2 VSC410 Storage Management Controller

The VSC410 is a highly integrated controller for baseboard, storage or embedded system management. It contains a high-performance 32-bit RISC engine, four master/slave mode Two-Wire Serial interfaces, two general purpose UART, two 32-bit timers, up to 40 bits of general purpose I/O, 8Kbytes of high-speed SRAM, a SPI memory interface and an EJTAG port for firmware debug.

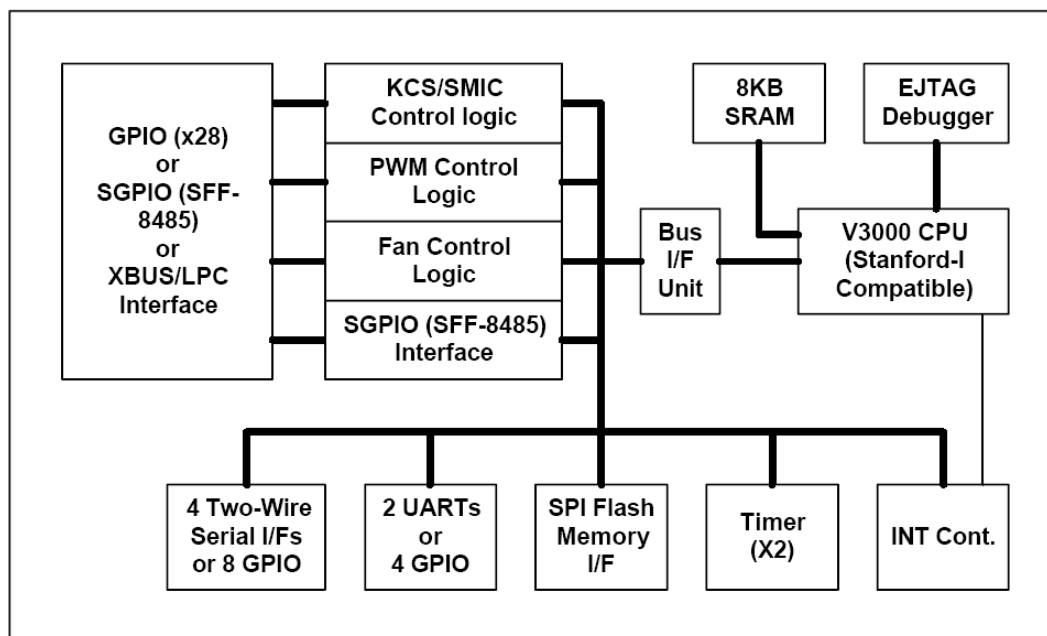


Figure 5: Vitesse\* VSC410 Block Diagram

A PLL is used to generate the internal core clock of 40.0MHz from an external 4.0MHz clock source or crystal. Additional external component are limited to a single SPI Flash memory device and Two-Wire Serial peripherals dedicated to system management functions.

## 1.6 SAS Expander

The PMC-Sierra\* **PM8388 SXP 24x3G** device is a 24-port SAS Expander device featuring low latency connection arbitration, table routing, arbitrary SAS wide ports, SAS SSP/STP targets, integrated RISC processor for SAS SMP functions and SES support.

All target ports support spin-up control and the STP bridge function allowing either a SAS or SATA target device to be attached. The PM8388 device supports table routing of up to 1024 entries, direct routing and subtractive routing methods. The non-blocking crossbar in the data path allows any-port to any-port connections including arbitrary wide port configurations.

The PM8388 device provides in-band access to the Expander internal state information via proprietary commands within the integrated SMP function. The PM8388 device provides three multi-master TWI interfaces with independent reset for device configuration or control of peripheral devices. One UART interface is provided for debugging support.

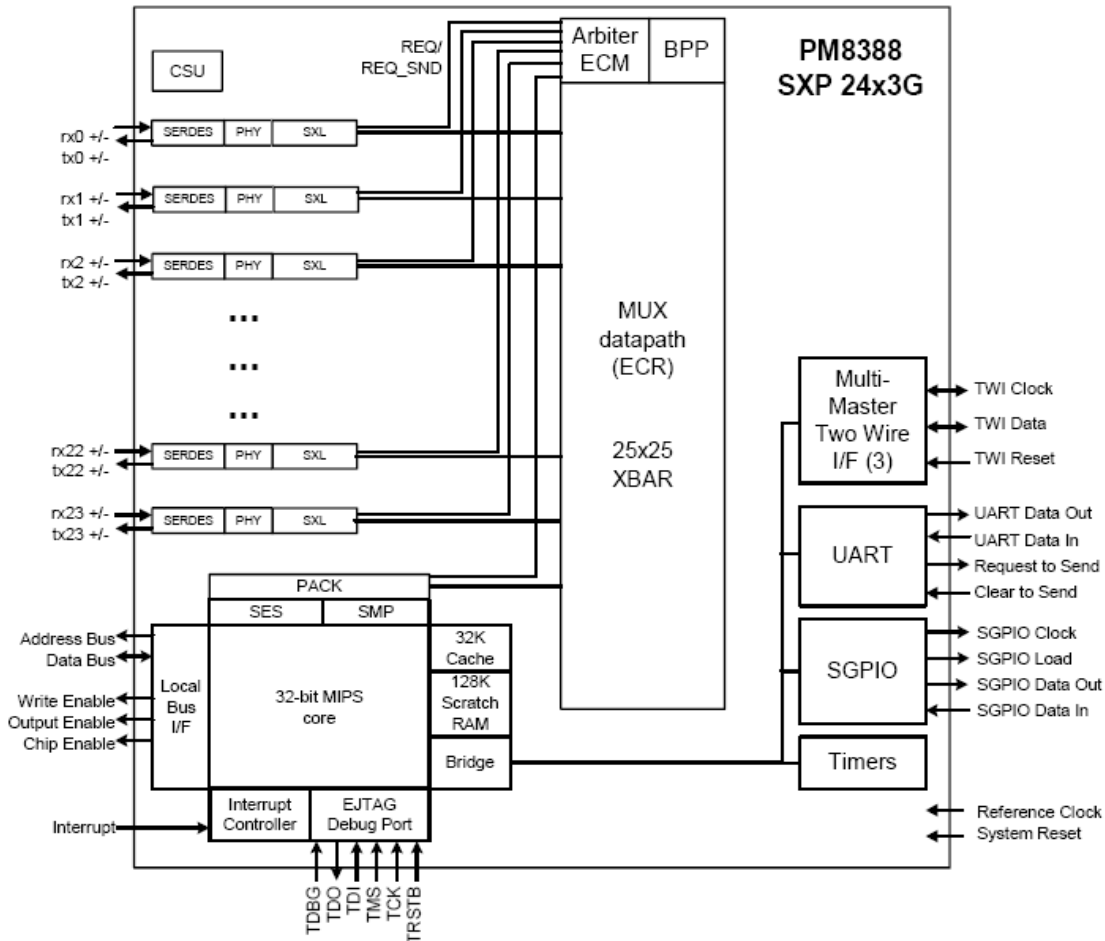


Figure 6: PMC\* PM8388 Block Diagram

### 1.6.1 Embedded Processor

The embedded RISC Processor is a MIPS Technologies\* MIPS4K with an EJTAG debugging interface.

It supports the SMP protocol and SES and is connected as a virtual port with the device base SAS address. SMP commands are uploaded from Flash memory.

### 1.6.2 Memory Interface & Device Initialization

The PM8388 device has a 16-bit wide asynchronous memory interface. It is able to address 4 banks of Flash or SRAM of 2 Mbytes each. The memory banks can be 8-bit or 16-bit wide.

The Flash Memory Interface provides a way to configure device features during the reset sequence. After system reset the processor loads an 8-Kbyte initialization string.

This initialization string contains information such as the SAS base address of the PM8388 device, identification of a subtractive port, per port configuration of the transmitter pre-emphasis level, per port configuration of receiver equalization level, per port configuration of the transmit swing, HDD spin-up delay values, HDD spin-up delay interval values, GPIO control and manufacturer specific information.

Optionally, the initialization string can point to an external EEPROM. This EEPROM is used to store initialization parameters that are card-specific, like the SAS Base address. Once read, the parameters from the EEPROM will replace those from Flash memory.

### Expander Port Configuration

The PM8388 supports 24 ports. 12 of those ports are connected to disk drives with a fixed port-drive slot mapping. Four ports are used for host connection to a SAS HBA in the server sub system. Four other ports are reserved for expansion purpose and are routed to a dedicated SAS-4i connector on the expander card. The remaining four ports are not used and must be disabled.

**Table 5: SXP Port Configuration**

PM8388	Connects To	PM8388	Connects To
Port0	Drive 1	Port12	Expansion 1
Port1	Drive 0	Port13	Drive 7
Port2	Drive 2	Port14	Host 0
Port3	Drive 3	Port15	Drive 10
Port4	N/C	Port16	Drive 5
Port5	N/C	Port17	Expansion 2
Port6	N/C	Port18	Drive 6
Port7	Expansion 3	Port19	Host 1
Port8	Expansion 0	Port20	Drive 9
Port9	Drive 4	Port21	Drive 8
Port10	N/C	Port22	Host 2
Port11	Drive 11	Port23	Host 3

## 1.7 Chassis Dimensions and Weight

**Table 6: Chassis Dimensions and Weight**

Height	87.9 mm	3.46 inches
Width (across mounting flange)	483 mm	19.01 inches
Width (across body of chassis)	443.4 mm	17.46 inches
Depth (from rack posts to rear of PCI bulkhead)	666 mm	26.22 inches
Depth (from rack posts to extremity of chassis)	707 mm	27.83 inches
Depth (from flange to furthest extremity at Front Panel cover)	30 mm	1.18 inches
Weight		
Chassis - as shipped (0 drives)	20 kilogram	44 pounds
Chassis - fully configured (12 drives)	30 kilogram	66 pounds
Shipping container	3.2 kilogram	7 pounds

### 1.8 Back Panel I/O Ports and Features

The Input/Output (I/O) connectors are integrated to the back panel. The figure below shows the Back Panel I/O ports.

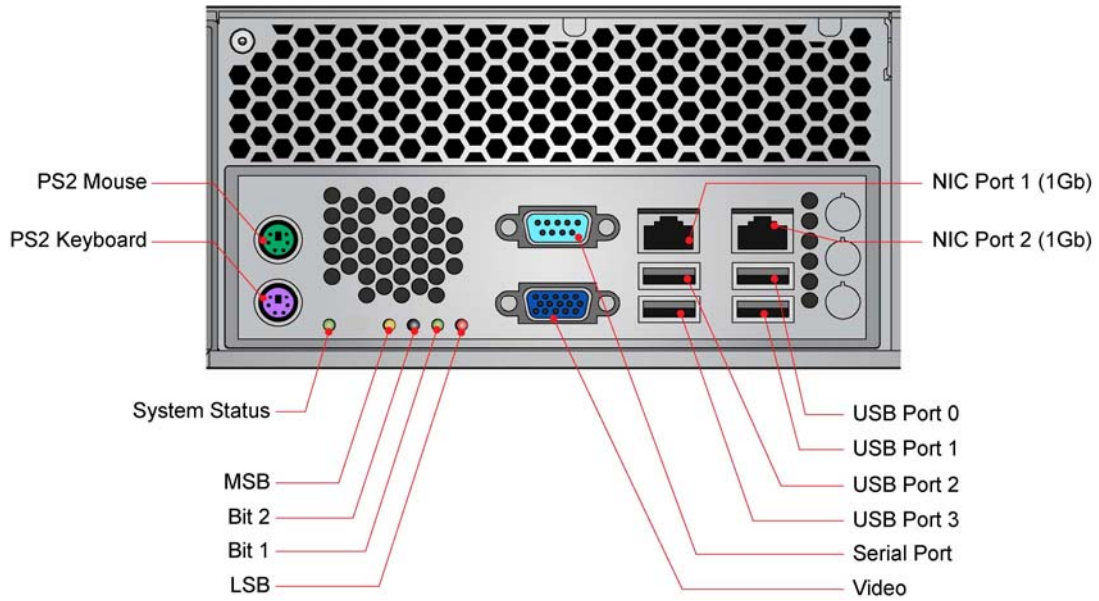


Figure 7: Back Panel I/O Ports

## 1.9 Front Panel and HDD Bays

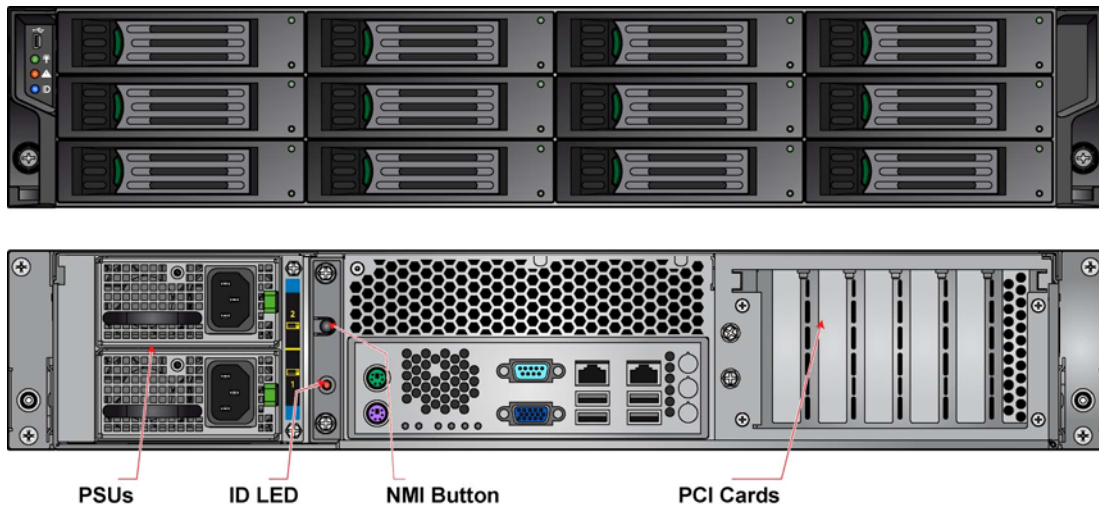


Figure 8: Chassis Front and Rear

### 1.9.1 Front/Rear Panel Controls and Indicators

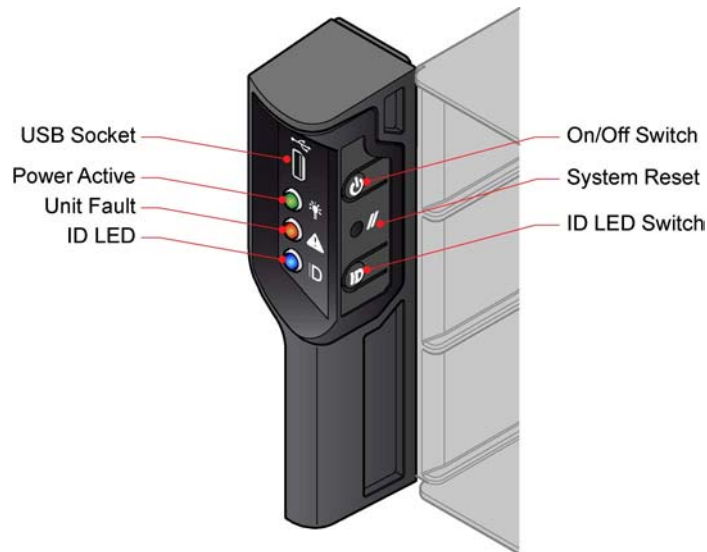
The front/rear panel controls and indicators are defined below:

**Table 7: Front/Rear Control Button Functions**

On/Off Switch (front mounted)	Toggles the system power on and off.
System Reset (front mounted)	Reboots the system.
ID LED Switch (front & rear mounted)	Illuminates the blue system identification LED.
NMI (rear mounted)	Non Maskable Interrupt.

**Table 8: Front LED Indicator Status**

Power Active	Continuous green light indicates the system has power applied to it. No light indicates the system does not have power applied to it (other than 5 V standby power).
Unit Fault	Continuous amber light indicates fault present.
ID LED	The blue system identification LED is used to help identify a system for servicing. This is especially useful when the system is installed within a high density rack or cabinet that is populated with several similar systems.



**Figure 9: Front Panel**



## 1.10 Fan Monitoring

The fans provided in the Storage System SSR212MC2 contain a tachometer signal that can be monitored by enclosure management software.

## 1.10 Rack and Cabinet Mounting Options

The chassis was designed to support cabinets that are 19 in (483 mm) wide by up to 36 in (914 mm) deep, and are compliant to the SSI Server Rack specification and EIA 310-D. A set of Rack Mounting Rails are provided and will accommodate either square or round hole rack mounting methods.

When mounting the system into a cabinet, the front mount brackets are attached to the front of the chassis, and a set of rear support brackets are attached to the back of the cabinet. This allows the weight of the system to be as evenly distributed as possible.

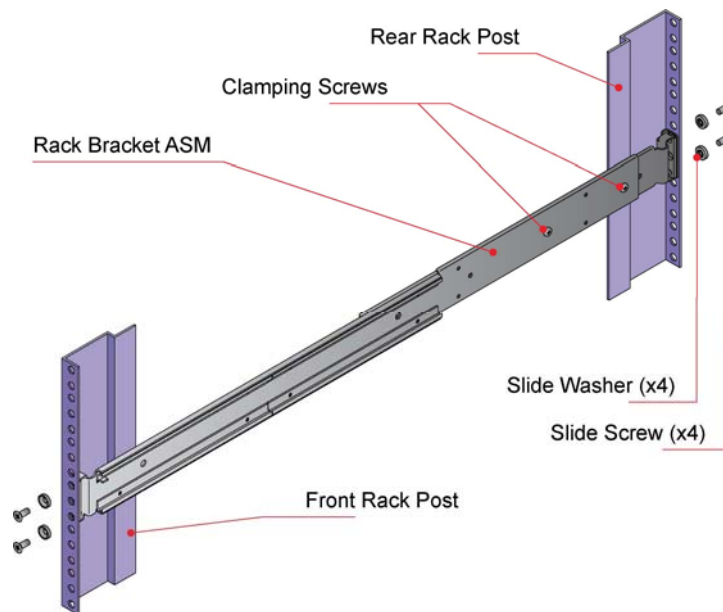


Figure 10: Rack Mounting

## 2. Power Sub-System

---

This section provides an overview of the Storage System SSR212MC2 power supply sub-system; the *power supply enclosure* and the *power supply module*.

**NOTE:** The Storage System SSR212MC2 ships with one 850 Watt power supply module, mounted in the lower slot.

### 2.1 Power Supply Enclosure

The Storage System SSR212MC2 accommodates one or two 850 Watt (W) redundant power supply modules.

**Table 9: AC Input Current**

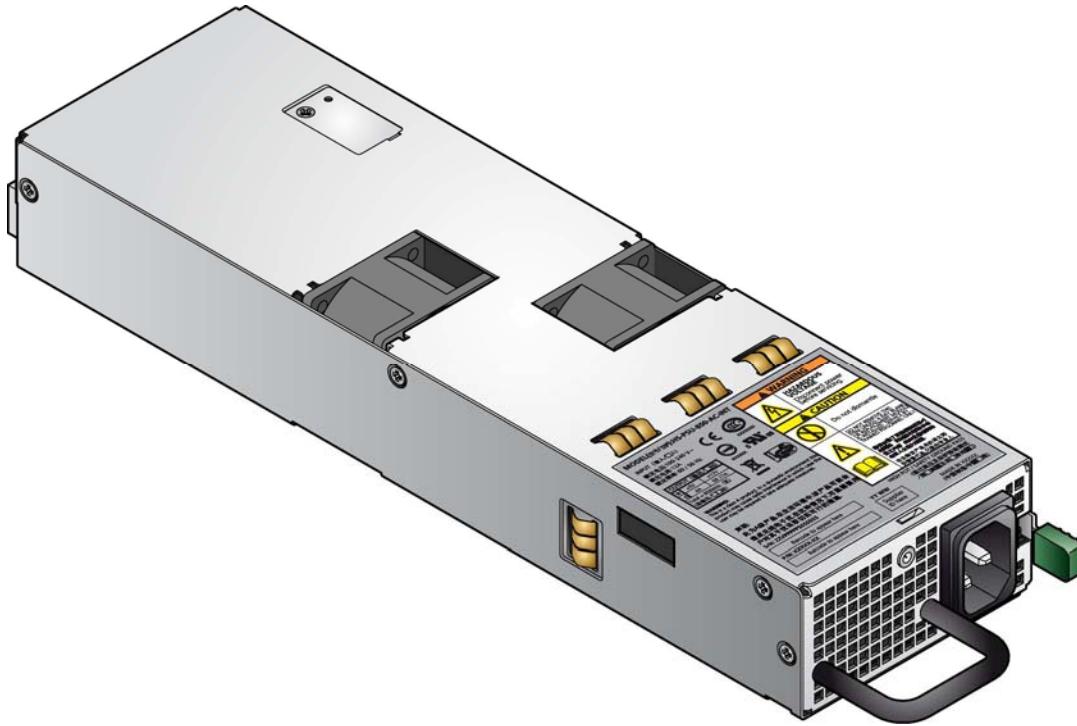
PARAMETER	MIN	RATED	MAX	Max Inrush Current
Voltage	90 V <sub>rms</sub>	100 to 240 V <sub>rms</sub>	264 V <sub>rms</sub>	25 A <sub>peak</sub>
Frequency	47 Hz	50 to 60	63 Hz	

**Table 10: AC Power Consumption (with SATA drives)**

<b>System Configuration: w/ one power supply module, 8 GB memory, single 5120 CPU, 12x Seagate 750GB Barracuda ES drives.</b>	<b>AC Input Voltage/Freq</b>	<b>AC Power Consumption</b>
CPU and Ethernet ports all idle.	110V/60Hz nominal	465 W
Heavy I/O, 80% CPU utilization, max Ethernet traffic.	110V/60Hz nominal	520 W
CPU and Ethernet ports all idle.	230V/50Hz nominal	450 W
Heavy I/O, 80% CPU utilization, max Ethernet traffic.	230V/50Hz nominal	505 W

**Table 11: AC Power Consumption (with SAS drives)**

<b>System Configuration: w/ one power supply module, 8 GB memory, single 5120 CPU, 12x Seagate 300GB Cheetah 15K.5 drives</b>	<b>AC Input Voltage/Freq</b>	<b>AC Power Consumption</b>
CPU and Ethernet ports all idle.	110V/60Hz nominal	552 W
Heavy I/O, 80% CPU utilization, max Ethernet traffic.	110V/60Hz nominal	605 W
CPU and Ethernet ports all idle.	230V/50Hz nominal	538 W
Heavy I/O, 80% CPU utilization, max Ethernet traffic.	230V/50Hz nominal	590 W



**Figure 11: Power Supply Module**

The system can operate with one failed module without loss of performance until the failed module is replaced. The modules can be replaced without powering down or disturbing system operation. The power supply is designed to minimize EMI. Each Power Supply Module contains two 40mm x 28mm fans.

### 2.1.1 Hot Swapping Power Modules

The Storage System SSR212MC2 power supply assembly is capable of supporting hot swapping of power supply modules in a 1+1 configuration.

### 2.1.2 Power Supply Outputs

The Storage System SSR212MC2 power system supports one or two 850 W Power Supply module's in a 1+1 redundant configuration. The Power Supply Enclosure provides ten DC output rails; six +12V rails, one +5V rail, one +3.3V rail, one +5Vsb rail, one -12V rail.

**Table 12: Enclosure DC Output Summary**

Rail	+12 V1-V6	+5 V	+3.3 V	+5 Vsb	-12 V
Max Load	16 A (each rail)	44 A	24 A	2.5 A	0.5 A

The module provides a handle to assist in insertion and extraction and can be inserted and extracted without the assistance of tools.

### 2.1.2.1 Power Supply LED Indicator

The power supply module provides a single external bi-color LED to indicate the status of the power supply. When AC is applied to the Power Supply Unit (PSU) and standby voltages are available, the LED will blink green. The LED will be solid on green to indicate that all the power outputs are available. The LED will be solid on amber to indicate that the power supply has failed, shutdown due to over current, shutdown due to over temperature, or is indicating a predictive failure. Refer to the following table for conditions of the LED.

**Table 13: Power Supply LED Indicators**

<b>POWER SUPPLY CONDITION</b>	<b>Power Supply LED</b>
No AC power to all PSU	OFF
No AC power to this PSU only	AMBER
AC present / Only Standby Outputs On	BLINK GREEN
Power supply Direct Current (DC) outputs ON and OK	GREEN
Power supply failure (includes over voltage, over temperature)	AMBER
Voltage Regulator Module (VRM) failure (cage related)	BLINK GREEN
240VA limit (cage related)	BLINK GREEN
Current limit	AMBER

## 3. System Cooling Module

---

The Storage System SSR212MC2 includes ten individual fans that collectively make up the cooling module. Each fan can be removed (Hot Swapped) individually for ease of maintenance. The Power Supply Module contains two fans for cooling.

### 3.1 Fan Control

Each fan within the module is capable of supporting multiple speeds. At normal room ambient of 23 degrees Celsius (C), the fans will run at slow speed for best acoustic performance. If the external temperature of the system increases, the backplane fan control circuitry will increase fan speed to compensate for the increased ambient.

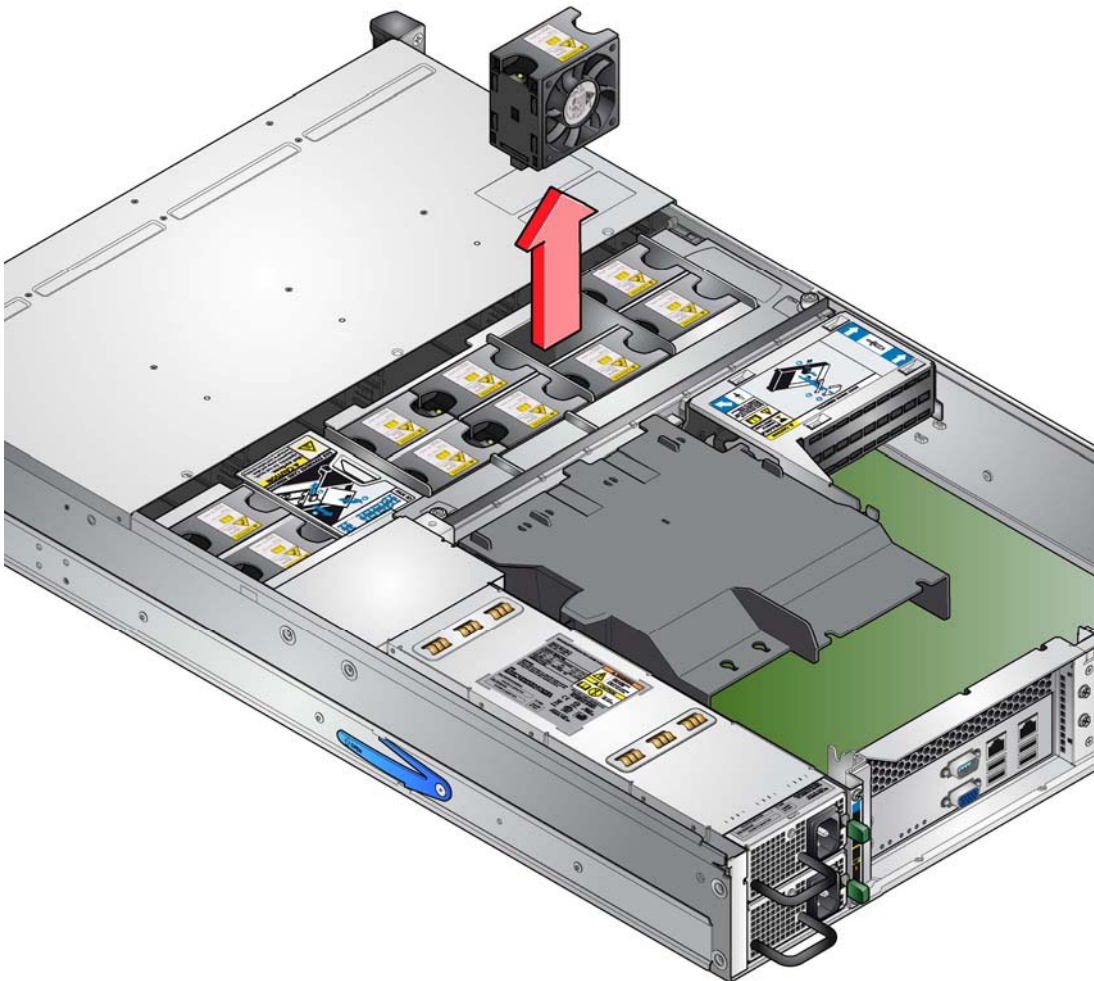


Figure 12: Cooling Module

## 4. Chassis Bays

---

The Storage System SSR212MC2 chassis provides twelve hard drive bays at the front of the chassis. All hard drive bays may be populated with a carrier-mounted 3.5 inch SATA or SAS hard disk drive.

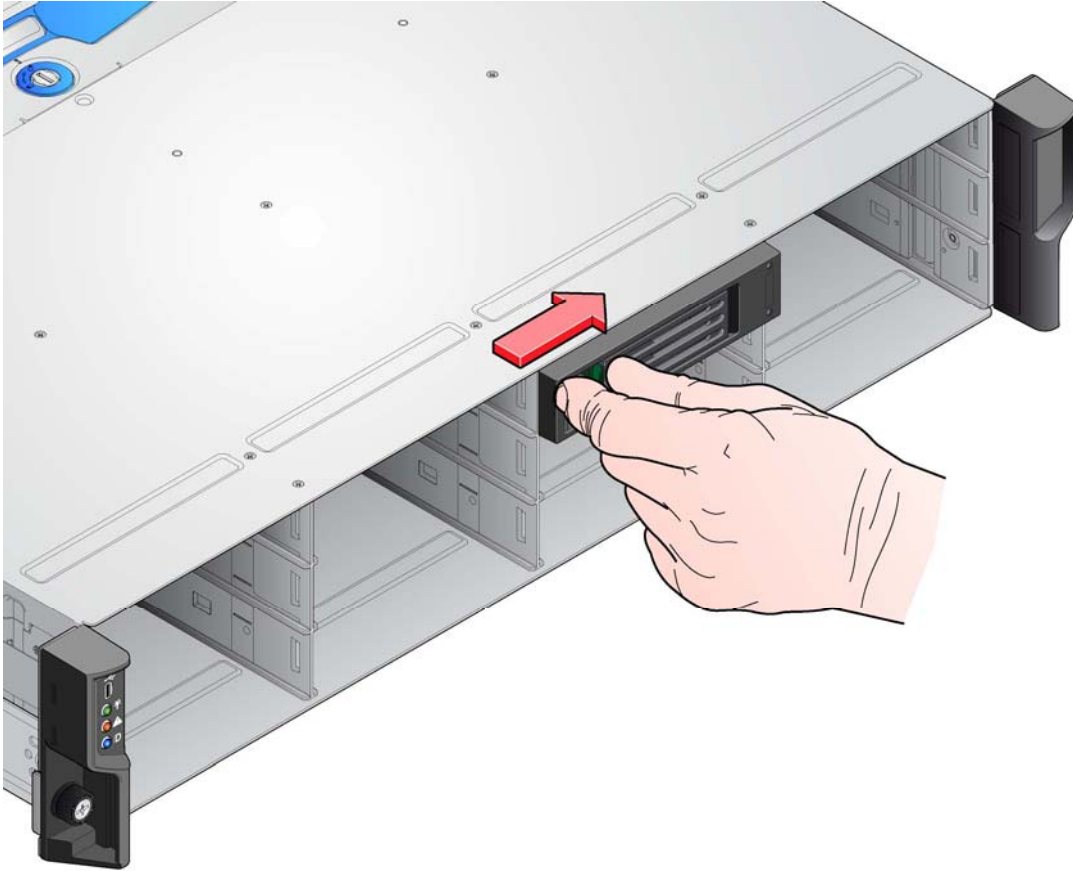


Figure 13: Drive Carrier Removal

## 4.1 Hard Disk Drive Bays

The Storage System SSR212MC2 chassis can support up to twelve carrier-mounted SATA or SAS, 3.5 inch x 1 inch, hard disk drives. The drives may be “electrically” hot-swapped while the system power is applied, but caution should be taken before hot-swapping while the system is functioning under OS/Application control (i.e., your OS/Application must support hot-swap), or data may be lost.

**NOTE:**

All drive bays (1 thru 12) are controlled by the single Intel® RAID Controller SRCSAS144E.

**Table 14: Drive Numbering**

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>

- 1) HDD labels are provided in your Storage System SSR212MC2 shipping container to number the drives 1 thru 12.
- 2) If a failed drive needs replacing, it should be replaced with the exact same manufacturer, model, and capacity.

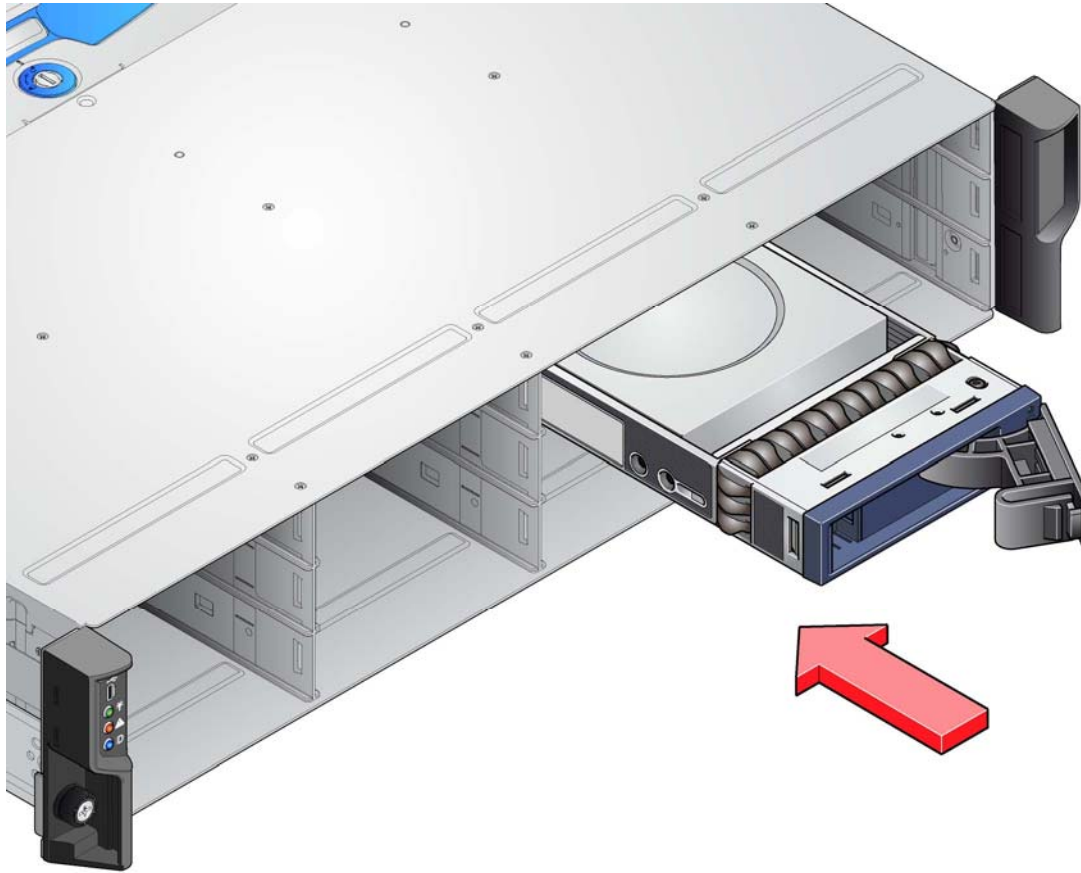


Figure 14: Hard Disk Drive Bays

#### 4.1.1 Hard Disk Drive Carrier

Each hard drive used in the system must be mounted to a drive carrier, making insertion and extraction of the drive from the chassis very simple. Each drive tray has its own dual purpose latching mechanism that is used to both insert/extract drives from the chassis and lock the carrier in place, and also has a safety locking mechanism to aid in the prevention of accidental removal of a drive. After the drive is inserted and latched, the locking feature is enabled by rotating the locking mechanism using the provided Torx\* or “star” bit tool, such that the latch can not be depressed to remove the drive. To remove the drive, turn the locking mechanism until the latch can be depressed to remove the drive. Each drive carrier also supports a light pipe providing a drive status indicator, located on the backplane, to be viewable from the front of the chassis.





Figure 15: Hard Drive Carrier Assembly

## 5. Internal Boot Drives (optional)

---

Included inside the Intel® Storage Server SSR212MC2 is a dual boot drive enclosure, that includes the cabling to accommodate either one or two optional SAS or SATA drives.

### 5.1 SAS

One or two 2.5" SAS drives can be mounted in the internal Boot Drive Enclosure, and used to store the Operating System and Applications.

### 5.2 SATA

One or two 2.5" SATA drives can be mounted in the internal Boot Drive Enclosure, and used to store the Operating System and Applications.

**NOTE: Please reference the latest revision of the SSR212MC2 Tested Hardware and Operating System List (THOL) to determine which 2.5" Hard Disk Drives are supported.**

## 6. System Interconnection

---

### 6.1 Internal Chassis Cables

The following cables are provided:

#### 6.1.1 SAS Expander/SAS HBA

6.1.1.1 SAS Host Connector: FCI 10045646-002 Header, SAS 4i, 1×32 way, vertical, SMD.

Table 15: SAS 4i Host Connector

Pin	Signal Name	Pin	Signal Name
1	GND	17	N.C.
2	Host0_PORT3	18	N.C.
3	Host0_PORT2	19	N.C.
4	GND	20	GND
5	Host0_PORT1	21	Host2_PORT3
6	Host0_PORT0	22	Host2_PORT2
7	GND	23	GND
8	Host1_PORT3	24	Host2_PORT1
9	Host1_PORT2	25	Host2_PORT0
10	GND	26	GND
11	Host1_PORT1	27	Host3_PORT3
12	Host1_PORT0	28	Host3_PORT2
13	GND	29	GND
14	N.C.	30	Host3_PORT1
15	N.C.	31	Host3_PORT0
16	N.C.	32	GND

## 6.1.2 Enclosure Management Card/Backplane

6.1.2.1 Power Connectors: 2 × Samtec IPS1-105-01-S-D-RA, Socket, 2×5 way, right angle, PIH

**Table 16: EM Card PWR\_A Connector**

Pin	Signal Name	Pin	Signal Name
1	+12V5	2	+12V5
3	GND	4	+12V5
5	GND	6	GND
7	GND	8	GND
9	+5V	10	+5V

**Table 17: EM Card PWR\_B Connector**

Pin	Signal Name	Pin	Signal Name
1	+12V6	2	+12V6
3	GND	4	+12V6
5	GND	6	GND
7	GND	8	GND
9	+5V	10	+5V

6.1.2.2 Front Panel Cable: Molex 51296-1893, ZIF socket, 1×18 way, 0.5mm pitch, right angle, SMD.

**Table 18: Front Panel Cable**

Pin	Signal Name	Description
1	LED_ID-	ID LED Cathode terminal
2	LED_FAIL-	FAIL LED Cathode terminal
3	GND	Ground
4	BTN_ID+	ID Switch terminal
5	BTN_RST-	Reset Switch terminal 1
6	BTN_RST+	Reset Switch terminal 2
7	BTN_PWR-	Power Switch terminal 1

8	BTN_PWR+	Power Switch terminal 2
9	GND	Ground
10	REM_D+	remote sensor positive side
11	REM_D-	remote sensor negative side
12	GND	Ground
13	USB_PWR	USB +5V Power
14	GND	Ground
15	USB_D+	USB differential Data +
16	USB_D-	USB differential Data –
17	GND	Ground
18	+5VSB	+5V Stand-By Power

### 6.1.3 Intel® Server Board S500PSL

6.1.3.1 One USB Header located under the Boot Drive Enclosure. If this header is to be used for an internal boot DOM, etc., the Front Panel mini-USB cable must be removed from the header, thus disabling the Front Panel mini-USB port.

Samtec TSW-105-07-T-S-004 Header, 5 way, 0.1” pitch, vertical, Pin 4 keyed, PIH.

**Table 19: USB 2.0 Connector**

Pin	Signal Name
1	USB_PWR
2	USB_D-
3	USB_D+
–	–
5	GND

**NOTE:** the Boot Drive Enclosure must be removed to access the USB header.

### 6.1.4 Intel® RAID Controller SRCSAS144E

6.1.4.1 One Battery Backup connector cable that provides connectivity between the Intel® RAID Controller SRCSAS144E and the Battery Backup Unit (BBU) mounted in the PCI Slot 6 position.

## 6.2 External Rear I/O Panel Connectors

The Storage System SSR212MC2 provides an aperture for the rear I/O ports. The following I/O ports available:

- Two RJ-45 LAN connectors
- One DB-9 Serial Port
- One Stacked PS2 port for keyboard & mouse
- One DB15 video connector
- Four USB 2.0 ports

## 6.3 External Front Panel Connectors

The Storage System SSR212MC2 provides a mini-USB port on the front panel.

**NOTE: A USB adapter is included in the shipping box to convert the USB “Mini 5 pin” port to a standard USB “A” type port.**

## 7. Regulatory Information

---

### 6.1 Product Regulation Requirements

**Intended Application** – This product was evaluated as Information Technology Equipment (ITE), which may 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.

#### 7.1.1 Product Safety Compliance

UL60950 – CSA 60950(USA / Canada)  
EN60950 (Europe)  
IEC60950 (International)  
CB Certificate & Report, IEC60950 (report to include all country national deviations)  
GS License (Germany)  
GOST R 50377-92 - License (Russia)  
Belarus License (Belarus)  
Ukraine License (Ukraine)  
CE - Low Voltage Directive 73/23/EEE (Europe)  
IRAM Certification (Argentina)  
GB4943- CNCA Certification (China)

#### 7.1.2 Product EMC Compliance – Class A Compliance

**Note:** Legally the product is required to comply with Class A emission requirements as it is intended for a commercial type market place. Intel targets 10db margin to Class A Limits

FCC /ICES-003 - Emissions (USA/Canada) Verification  
CISPR 22 – Emissions (International)  
EN55022 - Emissions (Europe)  
EN55024 - Immunity (Europe)  
EN61000-3-2 - Harmonics (Europe)  
EN61000-3-3 - Voltage Flicker (Europe)  
CE – EMC Directive 89/336/EEC (Europe)  
VCCI Emissions (Japan)  
AS/NZS 3548 Emissions (Australia / New Zealand)  
BSMI CNS13438 Emissions (Taiwan)  
GOST R 29216-91 Emissions (Russia)  
GOST R 50628-95 Immunity (Russia)  
Belarus License (Belarus)  
Ukraine License (Ukraine)  
RRL MIC Notice No. 1997-41 (EMC) & 1997-42 (EMI) (Korea)  
GB 9254 - CNCA Certification (China)  
GB 17625 - (Harmonics) CNCA Certification (China)

### 7.1.3 Certifications / Registrations / Declarations

UL Certification (US/Canada)  
CE Declaration of Conformity (CENELEC Europe)  
FCC/ICES-003 Class A Attestation (USA/Canada)  
VCCI Certification (Japan)  
C-Tick Declaration of Conformity (Australia)  
MED Declaration of Conformity (New Zealand)  
BSMI Certification (Taiwan)  
GOST R Certification / License (Russia)  
Belarus Certification / License (Belarus)  
RRL Certification (Korea)  
IRAM Certification (Argentina)  
Ecology Declaration (International)  
GB4943- CNCA Certification (China)

### 7.1.4 Component Regulation Requirement Need to Support System Level Certifications

Component Power Supplies must have the following certifications:

- UL, cUL
- German Bauart
- CNCA China Certification
- Ctick DOC
- BSMI DOC
- RRL License
- CE DOC

CB Report (including all national deviations).

All peripheral devices, such as CD ROMS, Disk drives, Tape drives shall have the following certifications: UL or CSA NRTL, CSA or cUL, and TUV or VDE and SEMKO or NEMKO or DEMKO or FIMKO, CE, and FCC.

All Fans shall have the minimum certifications: UL and TUV or VDE

All current limiting devices shall have UL and TUV or VDE certifications and shall be suitable rated for the application where the device in its application complies with IEC60950.

All lithium batteries shall be UL recognized and battery circuits are to have suitable reverse bias current protection for the application it is used in.

All printed wiring boards shall be rated UL94V-0 and be sourced from a UL approved printed wiring board manufacturer.

All connectors shall be UL recognized and have a UL flame rating of UL94V-0.

All wiring harnesses shall be sourced from a UL approved wiring harness manufacturer. SELV Cable to be rated minimum 80 V.

All plastics used must be made of a UL recognized material, and have the appropriate flame ratings mandated by IEC60950 per system level requirements. All plastics parts shall be manufactured by an UL approved fabricator and the parts shall be marked with the appropriate UL traceability markings. Markings to include:

Plastic Fabricators name and/or UL Fabricator ID

Material Name (for example GE, C2800)

Date Code

Product safety label must be printed on UL approved label stock and printer ribbon. Alternatively labels can be purchased from a UL approved label manufacturer.



The product must be marked with the correct regulatory markings to support the certifications that are specified.

Product documentation shall incorporate all safety required information to conform to certifiers and regulators and the certifications issued for the product.

### 7.1.5 Product Ecology Requirements

All materials, parts and subassemblies must not contain restricted materials as defined in Intel's Environmental Product Content Specification of Suppliers and Outsourced Manufacturers – <http://supplier.intel.com/ehs/environmental.htm>.

All plastic parts shall not use brominated flame retardant or any other halogenated retardants that are not accepted by environmental programs such as Blue Angels, Nordic White Swan, and Swedish TCO.

All plastic parts that weigh >25gm shall be marked with the ISO11469 requirements for recycling. Example >PC/ABS< .

Packaging materials may not contain more than 100 ppm (total) of lead, cadmium, chromium or mercury.

If sold as a retail product, packaging materials must be marked with applicable recycling logos for Europe (green dot) and Japan (Eco-marks).

Product documentation shall incorporate all safety required information to conform to certifiers and regulators and the certifications issued for the product.

All cords and cables shall contain < 100 ppm of cadmium.

## 7.2 Restriction of Hazardous Substances (RoHS)

Intel has a system in place to restrict the use of banned substances in accordance with the European Directive 2002/95/EC. Compliance is based on declaration that materials banned in the RoHS Directive are either (1) below all applicable substance threshold limits or (2) an approved/pending RoHS exemption applies.

**Note:** RoHS implementing details are not fully defined and may change.

Threshold limits and banned substances are noted below.

- Quantity limit of 0.1% by mass (1000 PPM) for:
  - o Lead
  - o Mercury
  - o Hexavalent Chromium
  - o Polybrominated Biphenyls Diphenyl Ethers (PBDE)
- Quantity limit of 0.01% by mass (100 PPM) for:
  - o Cadmium

## 8. Environmental Limits

---

### 8.1 System Office Environment

**Table 20: System Office Environment Summary**

Parameter	Limits
Operating Temperature	10 degrees celcius to +35 degrees celcius with the maximum rate of change not to exceed 10 degrees celcius per hour.
Non-Operating Temperature	-40 degrees celcius to +70 degrees celcius
Non-Operating Humidity	95%, non-condensing at 35 degrees celcius
Acoustic noise	7.0 BA (Rackmount) in an active state at typical office ambient temperature. (23 ± degrees celcius)
Operating Shock	No errors with a half sine wave shock of 2 G (with 11 millisecond duration)
Package Shock	Operational after a 24 inch free fall, although cosmetic damage may be present (chassis weight 30 lbs)
Electrostatic Discharge (ESD)	±15 Kilovolt (KV) per Intel® Environmental test specification
System Cooling Requirement in British Thermal Units (BTU) per Hour	3600 BTU/hour (at 850W)

### 8.2 System Environmental Testing

The system has been tested per the *Intel® Environmental Standards Handbook*, Intel document number 662394-03. These tests include:

- Temperature Operating and Non-Operating
- Humidity Non-Operating
- Packaged and Unpackaged Shock
- Packaged and Unpackaged Vibration
- AC Voltage, Frequency and Source Interrupt
- AC Surge
- Acoustics
- ESD
- EMC Radiated Investigation

### 8.3 Environmental Limits

The following table summarizes environmental limits, both operating and non-operating.

**Table 21: Operating and Non-Operating Environmental Limits**

<b>Temperature</b>	<b>Specification</b>
Non-operating	-40 degrees celcius to 70 degrees celcius
Operating Temperature	10 degrees celcius to 35 degrees celcius
Thermal Map	Must not exceed maximum Integrated Circuit (IC) junction temperature as specified in the component data sheets (CPDs).
<b>Thermal Shock</b>	<b>Specification</b>
Non-operating	-40 degrees celcius to 70 degrees celcius
<b>Humidity</b>	<b>Specification</b>
Non-operating	92% Relative Humidity (RH) at +50 degrees celcius
<b>Vibration</b>	<b>Specification</b>
Non-Operating:	2.2 Grms 5-500Hz for the unpackaged and 1.09 Grms 5-500Hz for the packaged.
<b>Shock</b>	<b>Specification</b>
Non-operating	25 G, 11 millisecond (msec)
<b>ESD</b>	<b>Specification</b>
Operating	Test (air) to 15 KV and (contact) to 2-8KV with limited errors.
<b>EMI</b>	<b>Specification</b>
Operating	Required to meet EMI emission requirements, tested as part of system.

## 9. Calculated MTBF

---

The Mean Time Between Failures (MTBF) for the Storage System SSR212MC2 is calculated at 30,800 hours operating at 35 degrees C. The following table shows the MTBF numbers for individual components within the chassis, and does not include hard disk drives.

**Table 22: Component MTBF Numbers**

<b>Subassembly</b>	
<b>(System in 35 °C ambient air)</b>	<b>MTBF (hours)</b>
System Board (S5000PSL)	98,000
850 W Power Supply & PDB	84,000
Hot Swap SAS Backplane	1,440,000
Fan Tray & Interposer	371,000
Fans (5x)	1,000,000
Front Panel board	24,000,000
SRCSAS144E SAS Eight Channel RAID adapter	255,000
Battery Backup Unit for SRCSAS144E SAS Eight Channel RAID adapter	504,000

## Glossary

Word / Acronym	Definition
A	Ampere
AC	Alternating Current
ACA	Australian Communication Authority
ACPI	Advanced Configuration and Power Interface
ANSI	American National Standards Institute
ATA	AT Attachment
BA	Decibel Average
BMC	Baseboard Management Controller
BTU	British Thermal Units
C	Celsius
CF	Compact Flash®
CMOS	Complementary Metal Oxide Silicon
CPD	Component Data Sheet
D2D	DC-to-DC
dBA	Decibel Average
DDR	Double Data Rate
DIMM	Dual Inline Memory Module
DMA	Direct Memory Access
DOM	Disk On Module
ECC	Error Correcting Code
EEB	Entry-Level Electronics Bay
EEPROM	Electrical Erasable Programmable Read-Only Memory
EMC	Electro Magnetic Compatibility
EMP	Emergency Management Port
ESD	Electrostatic Discharge
FC	Fibre Channel
FP	Front Panel
FRB	Fault Resilient Boot
FRU	Field Replaceable Unit
FW	Firmware
FWH	Firmware Hub
G	Giga (1.024 x 10 <sup>9</sup> )
GB	Gigabyte
Gb/s	Gigabits per Second
GHz	Gigahertz
HBA	Host Bus Adapter
HDD	Hard Disk Drive
HSBP	Hot Swap Backplane
Hz	Hertz
IBL	Intel Business Link

IC	Integrated Circuit
ICH	I/O Controller Hub
IDC	Internet Database Connector
IDE	Integrated Drive Electronics
IMM	Intel® Management Module
I/O	Input/Output
iSCSI	Internet Protocol Small Computer System Interface
ITE	Information Technology Equipment
K	Kilo (1.024 x 10 <sup>3</sup> )
KB	Kilobyte
KV	Kilovolt
KHz	Kilohertz
LAN	Local Area Network
LED	Light-Emitting Diode
LPC	Low-Pin Count
MB	Megabyte
Mb/s	Megabits per second
MCH	Memory Controller Hub
MHz	Megahertz
mm	Millimeter
msec	Millisecond
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
NIC	Network Interface Card
OTP	Over-Temperature Protection
OVP	Over-Voltage Protection
PCI	Peripheral Component Interconnect
PDB	Power Distribution Board
PFC	Power Factor Correction
PIO	Programmed Input/Output
PLD	Programmable Logic Device
PSON	Power Supply On
PSU	Power Supply Unit
PWT	Processor Wind Tunnel
RAID	Redundant Array of Inexpensive Disks
RH	Relative Humidity
RI	Ring Indicate
SAN	Storage Area Network
SAS	Serial Attached SCSI
SCA	Single Connector Attachment
SCC	Storage Control Console
SDR	Sensor Data Record
SDRAM	Synchronous Dynamic Random Access Memory
SE	Single-Ended
SMBIOS	System Management Basic Input/Output System

SOIC	Small Outline Integrated Circuit
SRAM	Static Random Access Memory
SSI	Server System Infrastructure
TQFP	Thin Quad Flat Pack
TB	Terabyte
UART	Universal Asynchronous Receiver Transmitter
μF	Micro Farad (1 x 10 <sup>-6</sup> Farads)
μS	Micro Second (1 x 10 <sup>-6</sup> Second)
USB	Universal Serial Bus
V	Volt
VA	Volt-Amp
VCCI	Voluntary Control Council for Interference
VQFP	Very Thin Quad Flat Pack
VRM	Voltage Regulator Module
W	Watt