RM14604/08
RB14604/08
Technical Product Specification

A document providing an overview of product features, functions, architecture, and support specifications

Revision 1.22

Mar 2017

Chenbro RM Product Marketing

Revision History

Date	Revision Number	Modifications
2016/11/18	R1.0	Initial release
2016/12/13	R1.1	Modified version
2017/01/06	R1.2	Add RM14608 Spec
2017/03/27	R1.21	Add Warning information
2017/03/29	R1.22	Add Safety Instructions

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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 the AC power cord from the wall outlet. Make sure the AC power cord is unplugged 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.

Electrostatic discharge (ESD) and ESD protection: ESD can damage disk drives, boards, and other parts. We recommend that you perform all procedures in this chapter only at an ESD workstation. If one is not available, provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground - any unpainted metal surface - on your server when handling parts.

ESD and handling boards: Always handle boards carefully. They can be extremely sensitive to ESD. Hold boards only by their edges. After removing a board from its protective wrapper or from the server, place the board component side up on a grounded, static free surface. Use a conductive foam pad if available but not the board wrapper. Do not slide board over any surface.

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.

Safety Instructions – Rack Mount

"Rack Mount Instructions – The following or similar rack-mount instructions are included with the installation instructions:

A) Elevated Operating Ambient – If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.

B) Reduced Air Flow – Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.

C) Mechanical Loading – Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.

D) Circuit Overloading – Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

E) Reliable Earthing – Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips)."

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1. Introduction

This document describes the embedded functionality and available features of the integrated server system which includes: the chassis layout, system boards, power subsystem, cooling subsystem, storage subsystem options, and available installable options. Note that some system features are provided as configurable options and may not be included standard in every system configuration offered.

Server board specific detail can be obtained by referencing the *Intel®Server Board* S1200SP *Technical Product Specification*.

NOTE: Some of the documents listed in the following table are classified as "Chenbro Confidential". These documents are made available under a Non-Disclosure Agreement (NDA) with Chenbro and must be ordered through your local Chenbro representative.

Table 1.**Reference Documents**

Document Title	Document Classification
RM14604/08 Datasheet	Chenbro Confidential
RM14604/08 Sales kit	Chenbro Confidential
RM14604/08 System Test Report	Chenbro Confidential
Intel® Server Board S1200SP Family Technical Product Specification 1.0	Intel Confidential

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

1.1 Chapter Outline

This document is divided into the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – Product Overview
- Chapter 3 – System Power
- Chapter 4 – Thermal Management
- Chapter 5 – System Storage and Peripherals Drive Bay Overview
- Chapter 6 – Front Control Panel and I/O Panel Overview
- Chapter 7 – PCIe* Riser Card Support
- Chapter 8 – Intel® I/O Module Support
- Chapter 9 – Basic and Advanced Server Management Features
- Appendix A – Integration and Usage Tips
- Appendix B – POST Code Diagnostic LED Decoder
- Appendix C – POST Code Errors
- Appendix D – High Temperature Ambient Info

1.2 Server Board Use Disclaimer

Intel Corporation server boards support add-in peripherals and contain a number of high-density VLSI and power delivery components that need adequate airflow to cool. Chenbro ensures through its own chassis development and testing that when Intel® server building blocks are used

together, the fully integrated system will meet the intended thermal requirements of these components. It is the responsibility of the system integrator who chooses not to use Chenbro-developed server building blocks to consult vendor datasheets and operating parameters to determine the amount of airflow required for their specific application and environmental conditions. Chenbro Corporation cannot be held responsible if components fail or the server board does not operate correctly when used outside any of their published operating or non-operating limits.

1.3 Product Errata

Shipping product may have features or functionality that may deviate from published specifications. These deviations are generally discovered after the product has gone into formal production. Chenbro terms these deviations as product Errata. Known product Errata will be updated in the Product TPS for the given product which can be downloaded from the following Chenbro web site:

http://www.chenbro.com

2. Product Overview

This chapter provides a high-level overview of the system features and available options as supported in different system models within this product. Greater detail for each major sub-system, feature, or option is provided in the following chapters.

Table 2. Chenbro RM14604/08 Feature Set

Feature	Description
Chassis Type	1U Rack Mount Chassis
Server Board	Intel Server Board S1200SP
Processor Support	▪ One LGA1151 (Socket H4) product socket ▪ Support for one Intel® Xeon® E3-1200 V5 processor without processor graphics (GT0 or 4+0) ▪ Maximum supported Thermal Design Power (TDP) of up to 80W. ▪ 8 GT/s point-to-point DMI 3.0 interface to PCH
Memory	▪ Two memory channels, four memory DIMM Slots (Two memory DIMMs per channel) ▪ Support for 2133 MT/s Unbuffered DIMMs (UDIMM DDR4 ECC memory)
Chipset	Intel®C236 Platform Controller Hub (PCH) chipset
External I/O connections	▪ 1xDB-15 video connector ▪ Two Gigabit Ethernet Ports ▪ Dedicated RJ-45 server management port ▪ Two USB 2.0 connectors on back panel ▪ Two USB 3.0 connectors on back panel ▪ Two USB 3.0 connectors on front panel
Internal I/O connectors /headers	▪ One Type-A USB 2.0 connector ▪ One 2x5 pin connector providing front panel support for two USB 2.0 ports ▪ One 2x10 pin connector providing front panel support for two USB 2.0/3.0 ports
Intel I/O Module Accessory Options	The server board includes a proprietary on-board connector allowing for the installation of a variety of available Intel I/O modules.An installed I/O module can be supported in addition to standard on-board features and add-in PCIe* card. The Following Intel®I/O Modules are supported: ▪ AXX4P1GBPWLIOM – Quad port 1GbEI/O based on Intel®Ethernet Controller I350 ▪ AXX10GBNIAIOM – Dual SFP+ port 10GbEbased on Intel®82599 10 Gigabit Ethernet Controller ▪ AXX10GBTWLIOM3 – Dual RJ-45 port 10GBASE-T based on Intel®Ethernet Controller X540
System Fans	▪ Three managed 40mm single rotor system fans ▪ One power supply fan for each installed power supply module

Riser Card Support	▪ One x16 PCIe* 3.0 Riser Card 84H314610-023 on a x8 Riser slot (slot-6)
Video	▪ Integrated 2D video controller ▪ 16 MB DDR3 Memory
On-board storage controllers and options	▪ 8x SATA connectors up to 6Gbps. ▪ 1x SATADOM connector (SATA port 4) ▪ 1x 75 pin connector for M.2 SATA SSD (2242 form factor) ▪ Embedded Software SATA RAID ◦ Intel®RSTe 4 SW RAID through onboard SATA connectors provides SATA RAID 0/1/10/5. ◦ Intel®Embedded Server RAID Technology II through onboard SATA connectors provides SATA RAID 0/1/10 and optional RAID 5 support provided by the Intel®RAID Activation Key RKSATA8R5
Security	Intel®Trusted Platform Module (TPM) 1.2 based on LPC
Server Management	▪ Integrated Base boaaard Management Controller.IPMI 2.0 compliant ▪ Support for Intel Server Management Software ▪ On-board RJ45 management port ▪ Advanced Server Management via an Intel Remote Management Module 4 Lite(Accessory Option)
Power Supply Options	▪ The server system supports two options for Power Supply: ◦ 1 x 400w Power Supply (Fixed)
Storage Bay Options	**Hot Swap Backplane Options:** **NOTE:** All available backplane options have support for SAS 3.0 (12 Gb/sec) ▪ 4 x 3.5” SAS/SATA backplane ▪ 4 x 3.5” Mini-SAS HD backplane ▪ 8 x 2.5” SAS/SATA backplane
Supported Rack Mount Kit Accessory Options	▪ 84H314610-003—Tool-less Slide Rail

2.1 Operating System Support

As of this writing, the Chenbro Product RM14604/08 provides support for the following operating systems. This list will be updated as new operating systems are validated by Chenbro.

Table 3. Operating System Support List

Operating System	Operating System Validation Level(P)
Windows Server 2012* R2 with Hyper-Vx64 & EFI	P1
Red Hat Enterprise Linux* 7.0 with KVM x64 & UEFI	P1
SuSELinux Enterprise Server* 12 with XEN x64	P1
Red Hat Enterprise Linux 6U5 with KVM x64 & UEFI	P2
VMWare ESXi* 5.5 U3	P2

SuSELinux Enterprise Server 11 SP4 with XEN x64	P2
Windows Server 2008 R2 SP1	P2
Windows 7*	P2
Ubuntu* 14.04	P2
FreeBSD* 10.1	P3
CentOS* 7.0	P3

Table 4. Operating System Validation Levels

Operating System Validation Levels	P1	P2	P3
Basic Installation testing	Yes	Yes	Yes
Test all on-board I/O features in all modes	Yes		
Adapter\Peripheral Compatibility & Stress testing	Yes		
Technical Support Level	T1	T2	T3

See the following sections for additional information regarding validation levels and technical support levels as referenced in Table 4.

2.1.1 OS Validation Levels

Basic installation testing is performed with each supported operating system. The testing validates that the system can install the operating system and that the base hardware feature set is functional. A small set of peripherals is used for installation purposes only. Add-in adapter cards are not tested.

Adapter compatibility validation (CV) testing uses test suites to gain an accurate view of how the server performs with a wide variety of adapters under the primary supported operating systems. These tests are designed to show hardware compatibility between the cards and the server platform and include functional testing only. No heavy stressing of the systems or the cards is performed for CV testing.

Stress Testing uses configurations that include add-in adapters in all available slots for a 48-hour (two-day), or a 72-hour (three-day) test run without injecting errors. Each configuration passes an installation test and a Network/Disk Stress test. Any fatal errors that occur require a complete test restart.

2.1.2 OS Technical Support Levels

T1: Chenbro will provide support for issues involving the installation and/or functionality of a specified operating system as configured with or without supported adapters and/or peripherals.

T2: Chenbro will provide and test operating system drivers for each of the server board's integrated controllers, provided that the controller vendor has a driver available upon request. Vendors will not be required by Chenbro to develop drivers for operating systems that they do not already support. Chenbro will NOT provide support for issues related to the use of any add-in adapters or peripherals installed in the server system when an operating system that received only basic installation testing is in use.

T3: Chenbro will not provide technical support for an open source operating system. All questions and issues related to an open source operating system must be submitted to and supported by the open source community supporting the given operating system.

2.2 System Features Overview

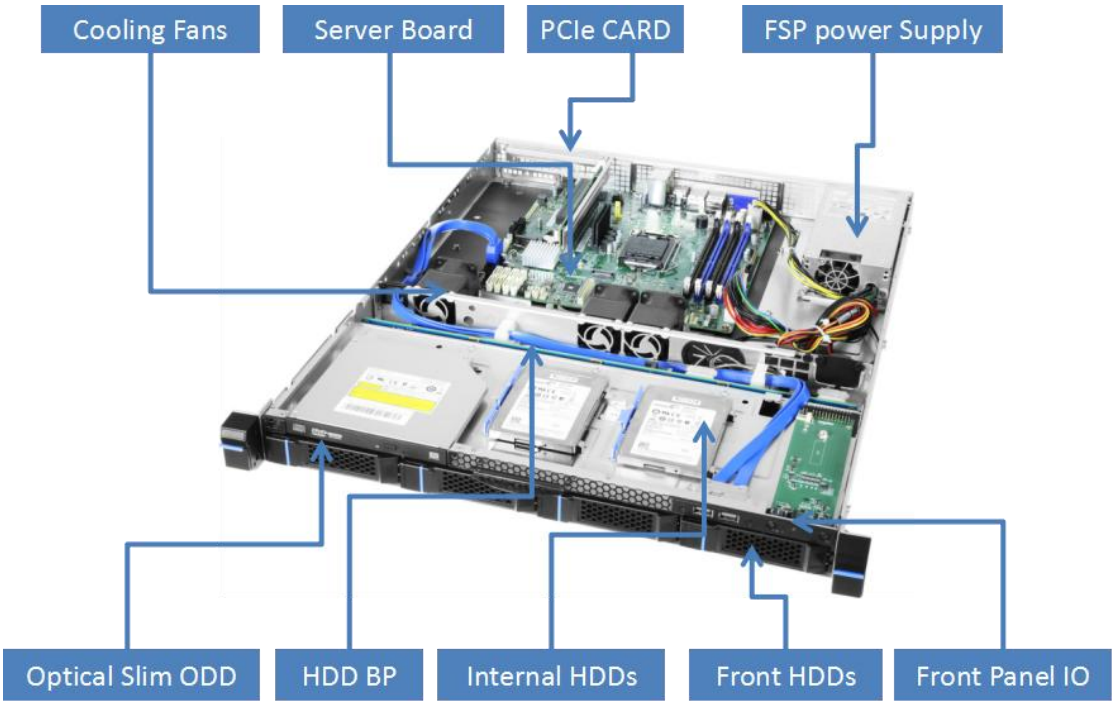


Figure 1.System Components Overview-RM14604

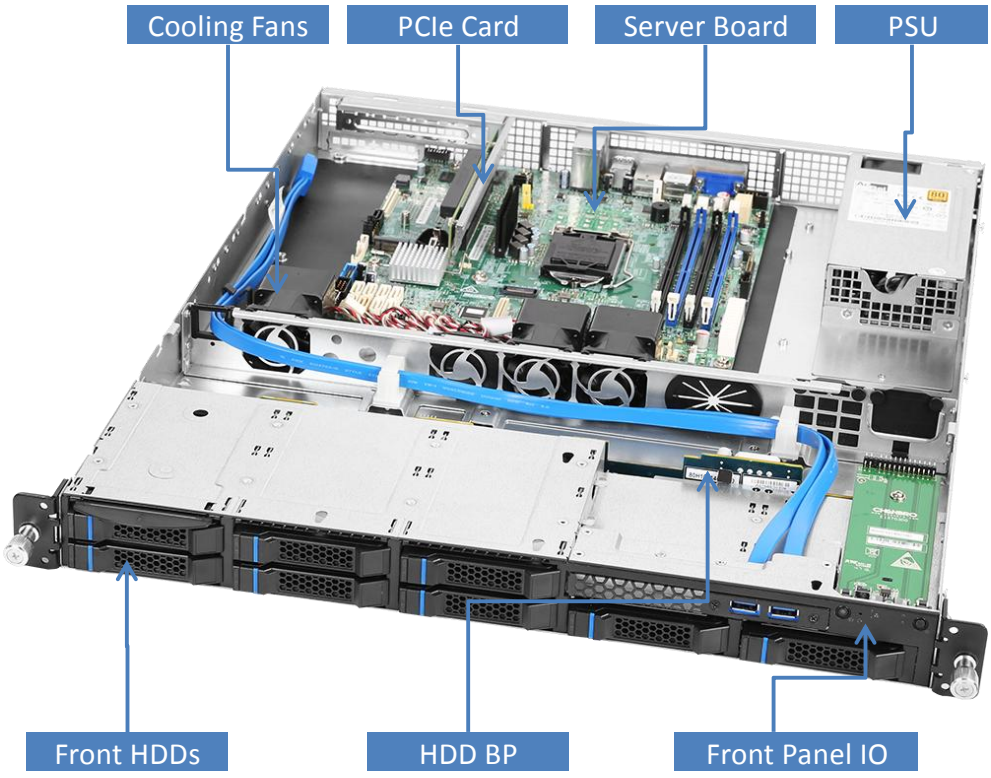


Figure 2.System Components Overview-RM14608

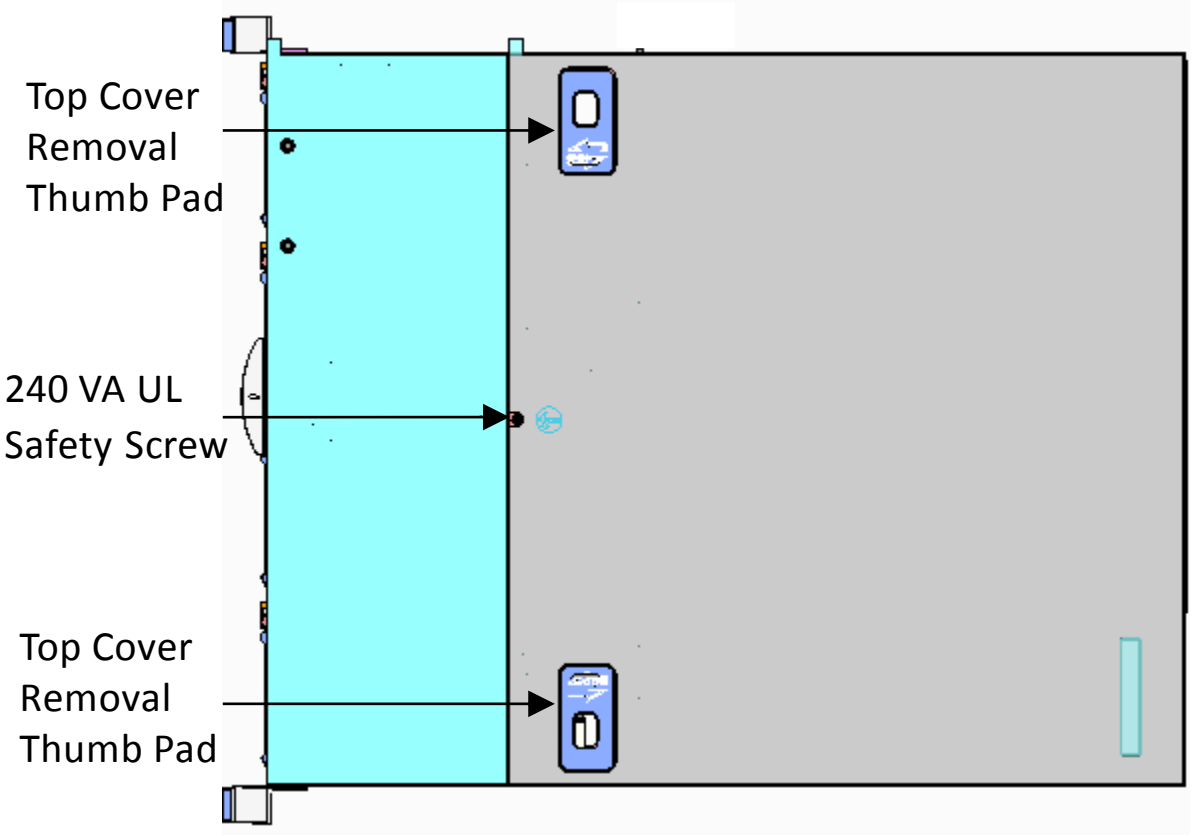


Figure 3.Top Cover Features

2.3 Server Board Features Overview

The following illustration provides a general overview of the server board, identifying key feature and component locations. Please refer to *Intel® Server Board S1200SP Technical Product Specification* for more information.

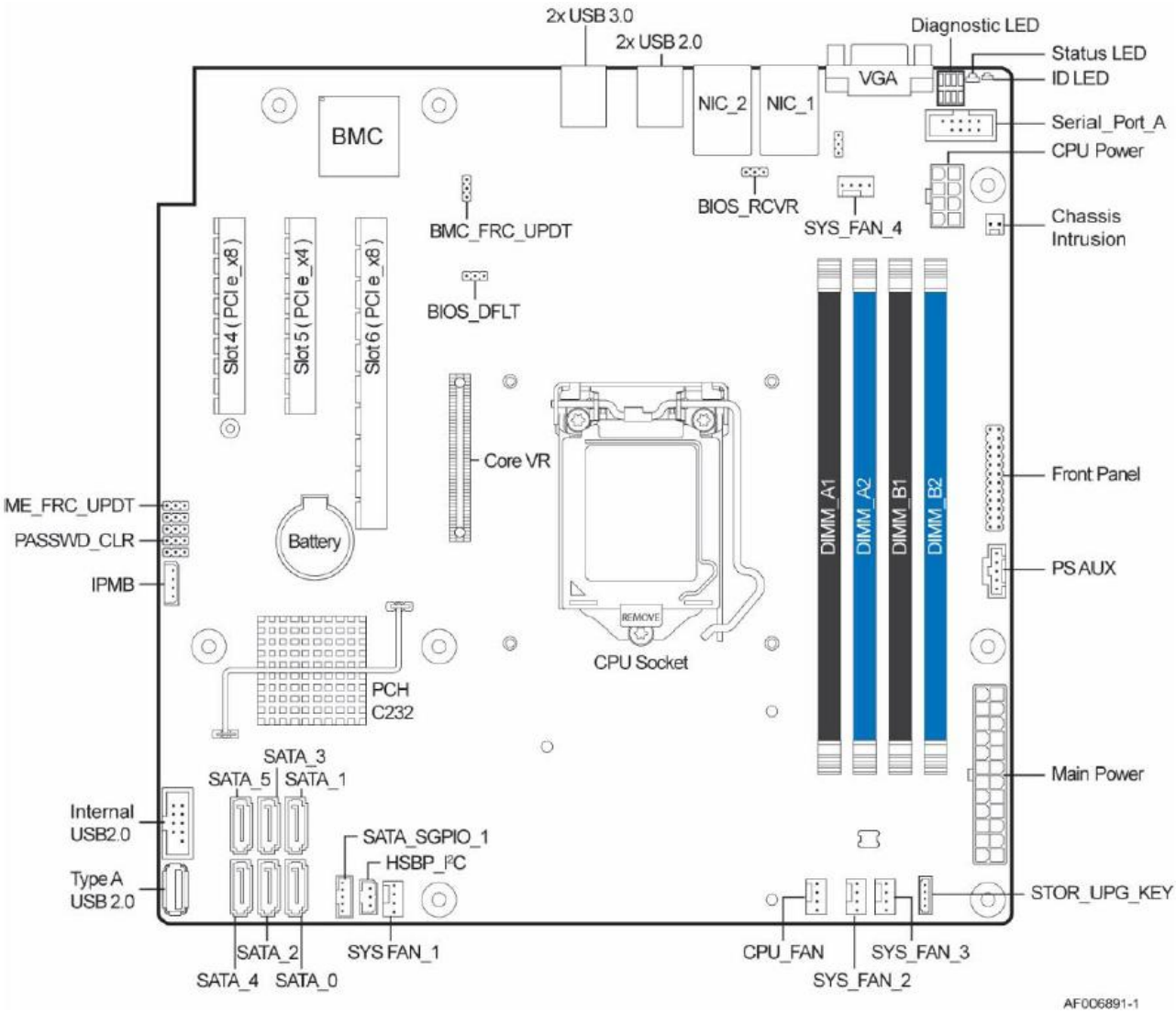


Figure 4.Server Board S1200SPS Features

The server board includes several LEDs to identify system status. The following illustrations define supported LEDs and identify their location.

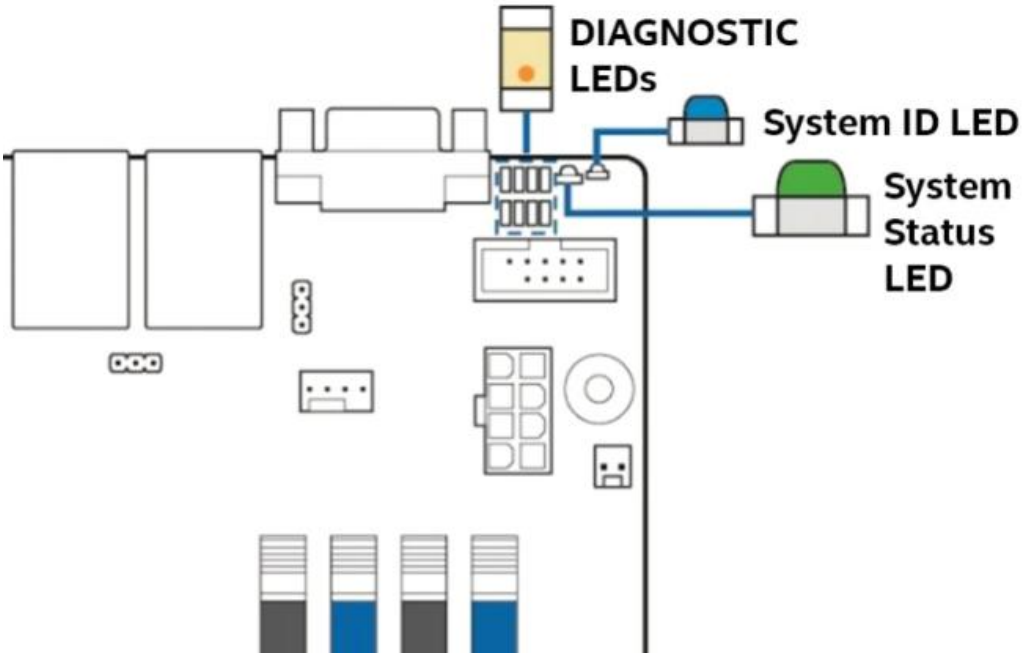


Figure 5.On-board Diagnostic LEDs

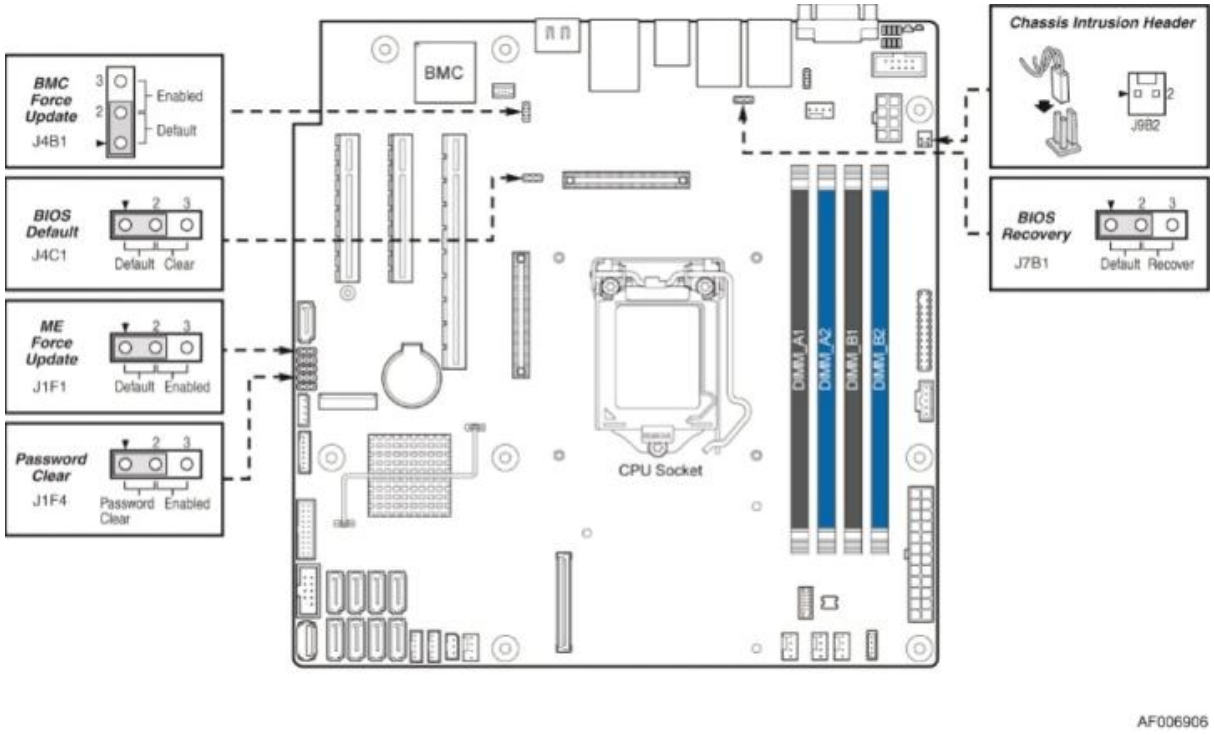


Figure 6.System Reset and Configuration Jumpers

2.4 Back Panel Features

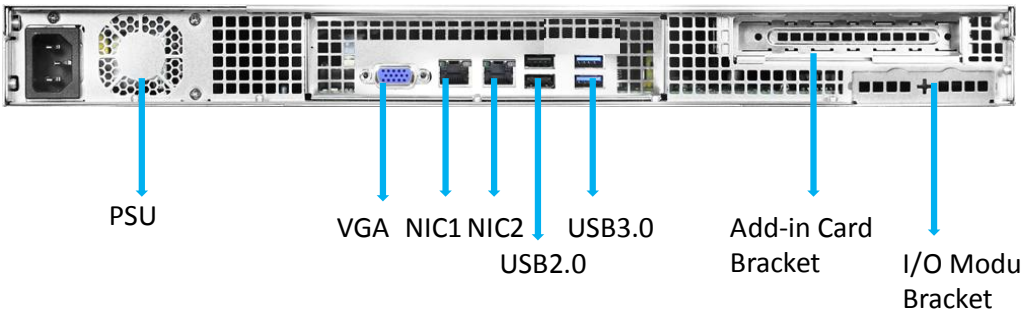


Figure 7. Back Panel Features

2.5 Front Control Panel

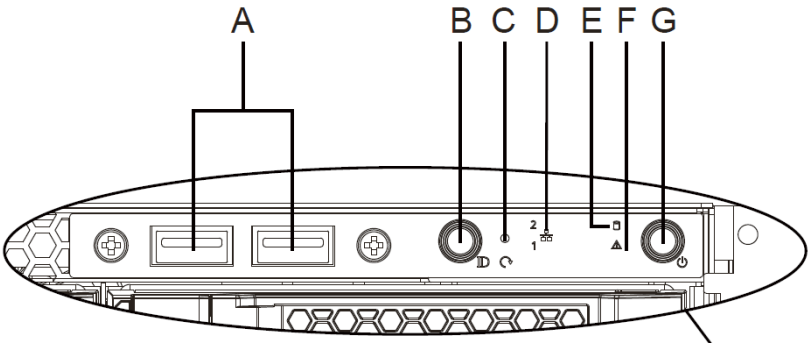


Figure 8.Front Control Panel

Table 5. Front Control Panel Options

Label	Description
A	USB 2.0 /3.0port
B	ID Switch
C	System Reset Button
D	LAN1,LAN2 Activity LED
E	HDD Activity LED
F	System Status LED
G	Power on Button and LED

2.6 Front Drive Bay Options

Figure 9.3.5'' Drive Bay-4 Drive Configuration(RM14604)

Figure 10.2.5'' Drive Bay-8 Drive Configuration(RM14608)

2.7 System Dimensions

2.7.1 Chassis Dimensions

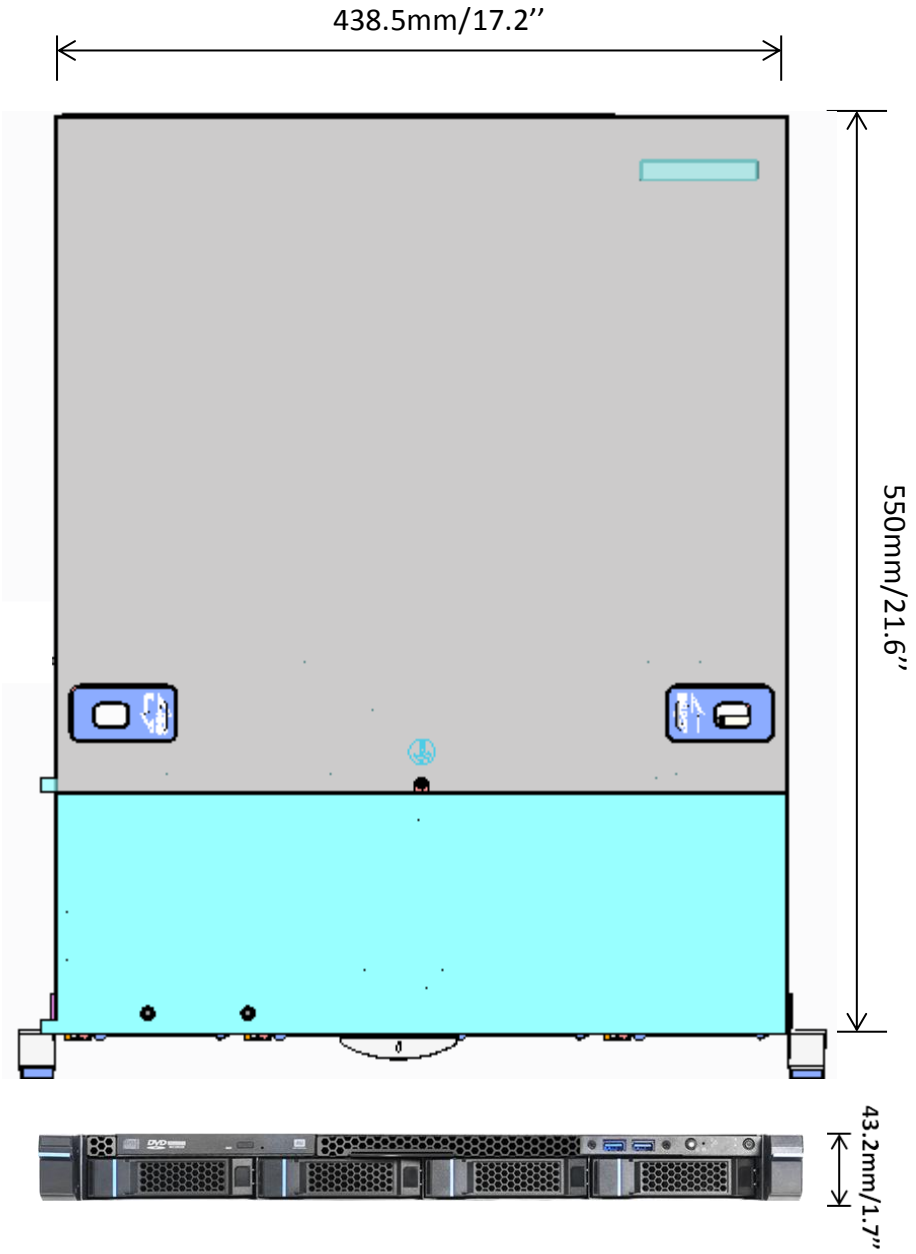


Figure 11. Chassis Dimensions

2.7.2 HDD Tray Dimensions

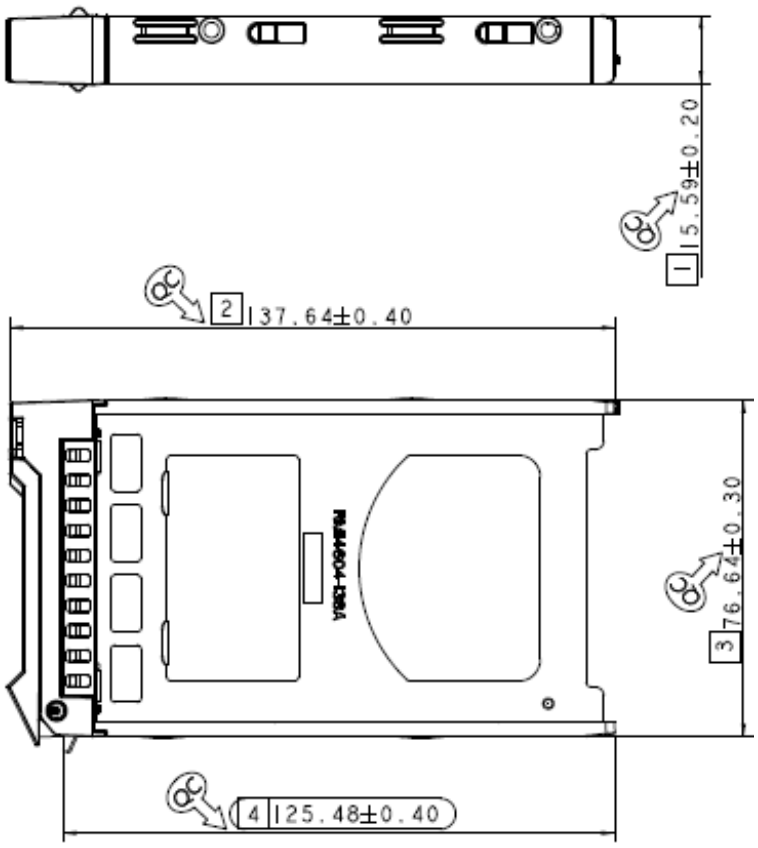


Figure 12. 3.5" HDD Tray Dimensions

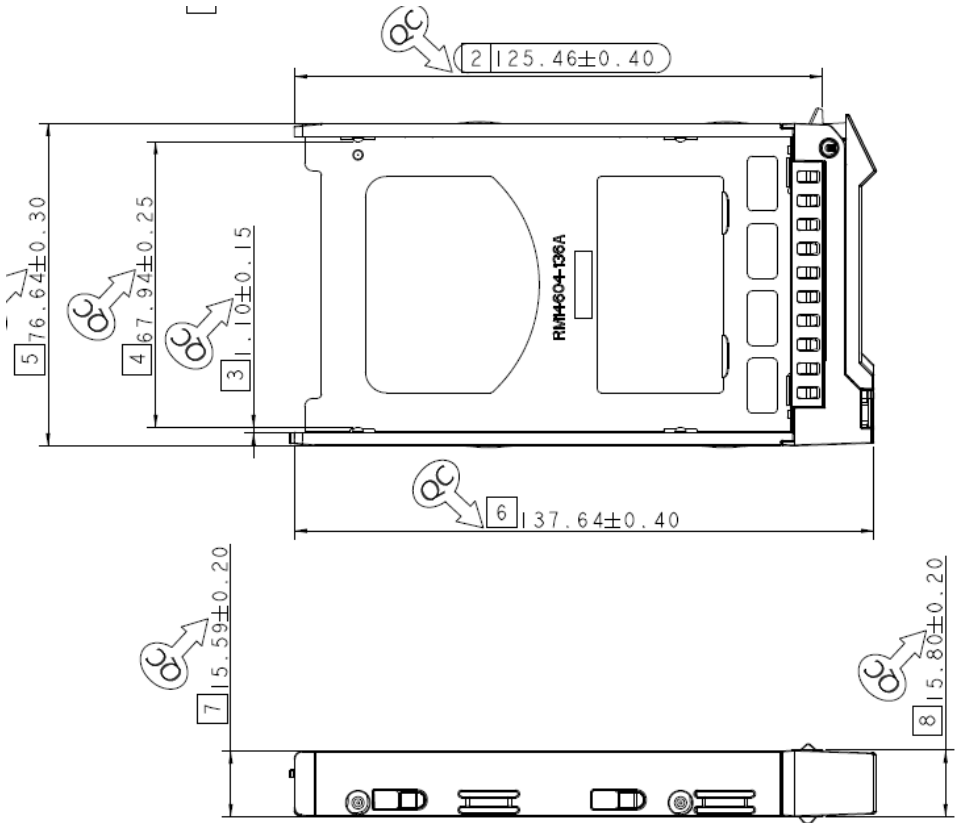


Figure 13. 2.5" HDD Tray Dimensions

2.7.3 Pull-out Tag Label Emboss Dimensions

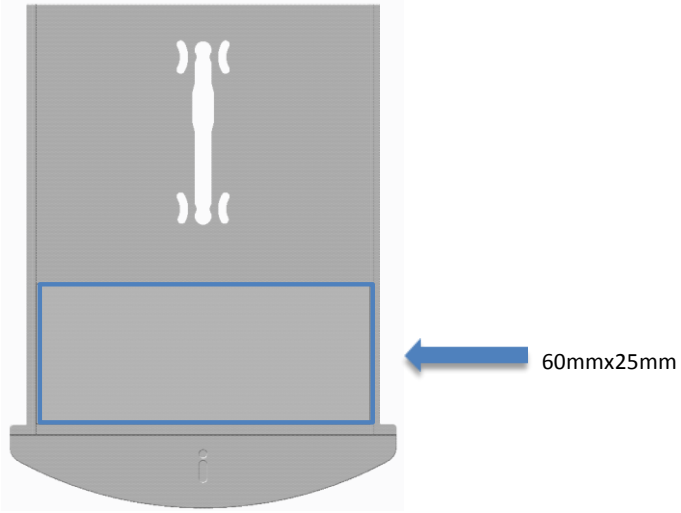


Figure 14. Pull-out Tag Label Emboss Dimensions

2.8 Available Rack Mounting Kit Options

Advisory Note – Available rack and cabinet mounting kits are not designed to support shipment of the server system while installed in a rack. If you chose to do so, Chenbro advises you verify your shipping configuration with appropriate shock and vibration testing, before shipment. Chenbro does not perform shipping tests which cover the complex combination of unique rack offerings and custom packaging options.

Caution: Exceeding the rail kit's specified maximum weight limit or misalignment of the server in the rack may result in failure of the rack rails, resulting in damage to the system or personal injury. Two people or the use of a mechanical assist tool to install and align the server into the rack is highly recommended.

Available Rack mounting kits:

- **84H314610-003 (Tool-less)**– Vale plus short rail
  - 560mm max travel length
  - 123 lbs. (56 Kg) max support weight
  - Stab-in system install
  - x8 #10-32 screws to mount rail kit on rack flange (screw kit come with rail kit assembling) - No cable management arm support

2.9 System Level Environmental Limits

The following table defines the system level operating and non-operating environmental limits.

Table 6. System Environmental Limits Summary

Parameter		Limits
Temperature	Operating	ASHRAE Class A2 – Continuous Operation. 10º C to 35º C (50º F to 95º F) with the maximum rate of change not to exceed 10°Cper hour ASHARE Class A3 – Includes operation up to 40°C for up to 900 hours per year. Refer to Appendix E for detailed guidance.
	Shipping	-20º Cto 70º C(-4º F to 158º F)

Altitude	Operating	Support operation up to 3050m with ASHRAEclass de-ratings.
Humidity	Shipping	50% to 90%, non-condensing with a maximum wet bulb of 28° C (at temperatures from 25° Cto 35° C)
Shock	Operating	Half sine, 2 g, 11 mSec
	Unpackaged	Trapezoidal, 25 g, velocity change is based on packaged weight
	Packaged	ISTA (International Safe Transit Association) Test Procedure 3A 2008
Vibration	Unpackaged	5 Hz to 500 Hz 2.20 g RMS random
	Packaged	ISTA (International Safe Transit Association) Test Procedure 3A 2008
AC-DC	Voltage	90 V to 132 V and 180 V to 264 V
	Frequency	47 Hz to 63 Hz
	Source Interrupt	No loss of data for power line drop-out of 12 mSec
	Surge Non-operating and operating	Unidirectional
	Line to earth Only	ACLeads 2.0 kV I/O Leads 1.0 kV DCLeads 0.5 kV
ESD	Air Discharged	12.0 kV
	Contact Discharge	8.0 kV
Acoustics Sound Power Measured	Power in Watts	400 W
	Servers/Rack Mount Sound Power Level (in BA)	7.0

2.10 System Packaging

The original Chenbro packaging, in which the server system is delivered, is designed to provide protection to a fully configured system and was tested to meet ISTA (International Safe Transit Association) Test Procedure 1A (2008). The packaging was also designed to be re-used for shipment after system integration has been completed.

The original packaging includes –the shipping box, and various protective inner packaging components. The box and packaging components are designed to function together as a protective packaging system. When reused, all of the original packaging material must be used, including box and each inner packaging component. In addition, all inner packaging components MUST be reinstalled in the proper location to ensure adequate protection of the system for subsequent shipment.

NOTE: The design of the inner packaging components does not prevent improper placement within the packaging assembly. There is only one correct packaging assembly that will allow the package to meet the ISTA (International Safe Transit Association) Test Procedure 1A (2008) limits.

Failure to follow the specified packaging assembly instructions may result in damage to the system during shipment.

2.10.1 RM14604/08 Weight Information

Table 7. RM14604/08 Weight Information

Product	Net Weight（kg）	Gross Weight（kg）	Net Weight (Lbs.)	Gross Weight (Lbs.)
RM14604	7.5	10.0	16.5	22.0
RB14604	10.5	13.0	23.2	28.6
RM14608	7.5	10.0	16.5	22.0
RB14608	10.5	13.0	23.2	28.6

NOTE: An L6 system does not include processors, memory, drives, or add-in cards. It is the system configuration as shipped from Chenbro. Integrated system weights (System configurations that include the items above) will vary depending on the final system configuration. For the 1U product, a fully integrated un-packaged system can weigh up to 40 Lbs. (18+ Kg).

2.10.2 RM14604/08 Order Code

Table 8. RM14604/08 Order Code

Product	Order code	
RM14604	RM14604M3	RM14604T3
RB14604	RB14604T3F1XSPS	
RM14608	RM14608M3F0X	
RB14608	RB14608M3R2XSPS	

3. System Power

This chapter provides a high level overview of the features and functions related to system power.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

3.1 General Description And Scope

This is the specification of Model FSP400-60FGGBA;AC-line powered switching power supply with active PFC(Power Factor Correction) circuit, meet EN61000-3-2 and with Full Range Input features. Designed and manufactured by FSP GROUP.

The 5Vsb power is less than 0.5Winput at power off mode (PS_ON input at high state) which is comply with EuP Lot 6 year 2013 requirement.

The specification below is intended to describe as detailedly as possible the functions and performance of the subject power supply. Any comment or additional requirements to this specification from our customers will be highly appreciated and treated as a new target for us to approach.

Figure 15. 400W AC Fixed Power Supply

WARNING: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used batteries according to manufacturer's instructions.

1. Attach the PSU bracket (base) on the chassis bottom and secure the bracket with three screws as shown (from outer to inner)
2. Install the PSU into chassis and ensure that alignment screws holes and bracket match up. (Note: PSU has been bundled with bracket from PSU vendor already)
3. Secure the PSU with two screws on the chassis bottom.
4. Secure the PSU with three screws on the rear window.

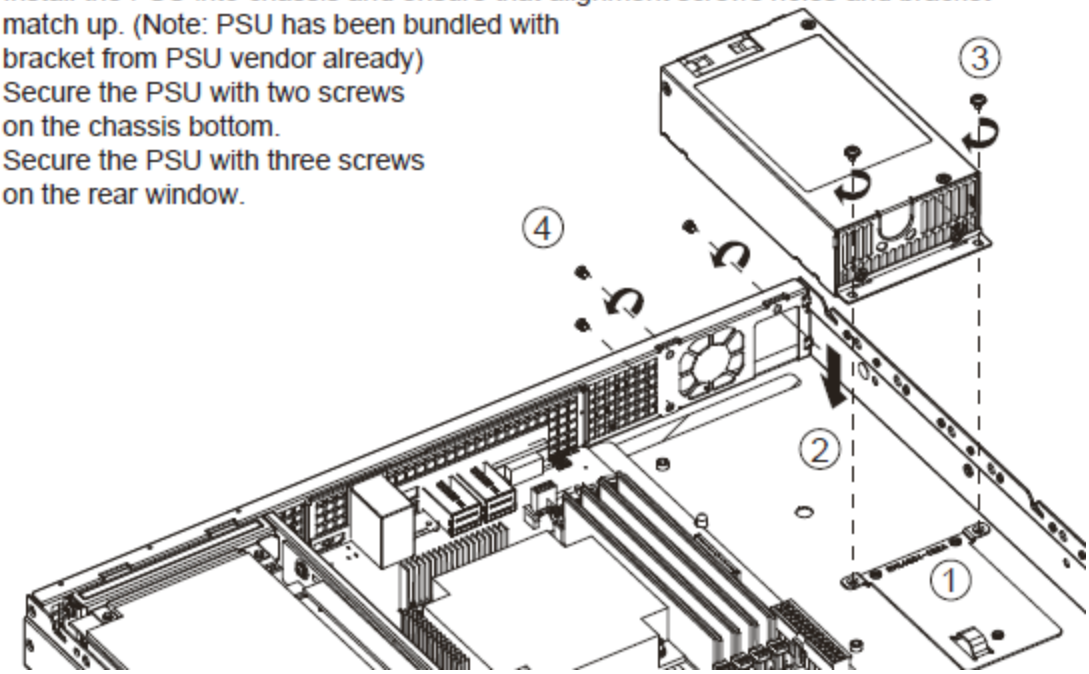


Figure 16. Power Supply installation

Indicates to unplug all AC power cord(s) to disconnect AC power.

3.2 Reference Documents

The subject power supply will meet the EMI requirements and obtain main safety approvals as following:

3.2.1 EMI Regulatory

- FCC Port 15 Subpart J, Class ‘B’ 115 Vac operation.
- CISPR 22 Class ‘B’ 230 Vac operation.

3.2.2 Power Supply Module Mechanical Overview

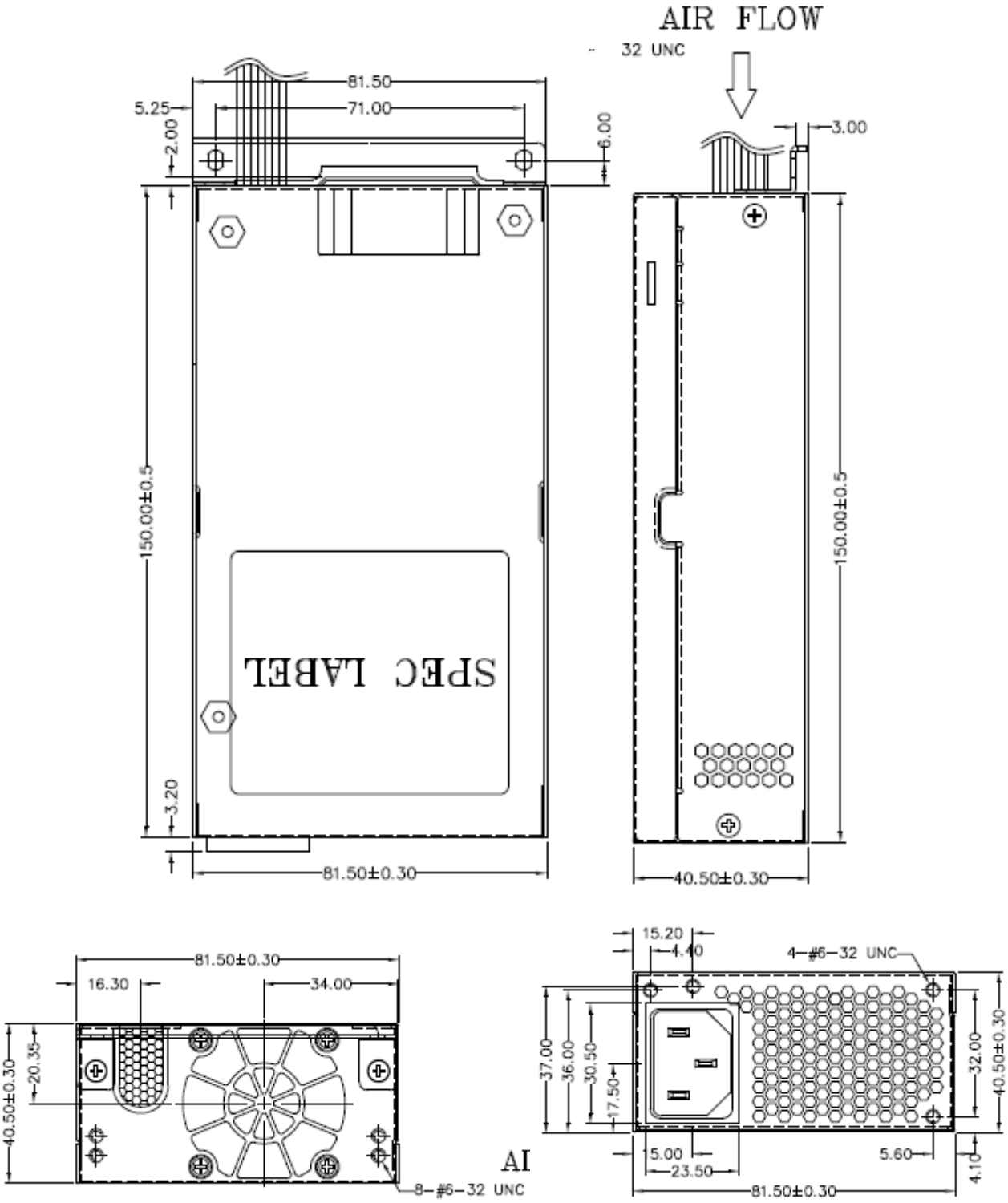


Figure 17. 400W Power Supply Mechanical drawings

3.3 Electrical Requirements

3.3.1 Output Electrical Requirements

The subject power supply will meet all electrical specifications below ,over the full operation temperature range and dynamic load regulation.

3.3.1.1 Output Rating

Table 9. Output Rating

Output	Nominal	Regulation	Ripple/Noise	Min	Max	Peak
1	+3.3V	±5%	50mV	0.1A	14.0A	
2	+5V	±5%	50mV	0.1A	16.0A	
3	+12V1	±5%	120mV	0.1A	18.0A	
4	+12V2	±5%	120mV	0.2A	18.0A	
5	-12V	±10%	120mV	0A	0.5A	
6	+5VSB	±5%	50mV	0A	3.0A	

(1) The +3.3V and +5V total output shall not exceed 90watts.

(2) Total output for this subject power supply is 400watts

(3) Ripple and noise measurements shall be made under all specified load conditions through a single pole pass filter with 20MHz cutoff frequency. Outputs shall bypassed at the connector with a 0.1uf ceramic disk capacitor and a 47uF electrolytic capacitor to simulate system loading.

3.3.1.2 Load Capacity Specifications

The cross regulation defined as follows, the voltage regulation limits DC include DC Output ripple & noise.

Table 10. Load Capacity Specifications

LOAD	+3.3V	+5V	+12V1	+12V2	-12V	+5VSB
1	7.35A	8.41A	13.26A	13.62A	0.37A	2.21A
2	0.1A	16A	0.1A	0.2A	0A	2A
3	14A	0.1A	0.1A	0.2A	0A	3A
4	0.1A	0.1A	18A	0.2A	0A	1A
5	0.1A	0.1A	0.1A	18A	0A	3A
6	3.68A	4.2A	6.63A	6.63A	0.18A	1.1A
7	0.1A	0.1A	15A	18A	0.1A	0.4A
8	0.1A	0.1A	18A	15A	0.1A	0.4A
9	1.47A	1.68A	2.65 A	2.65A	0.07A	0.44A
10	0.1A	0.1A	0.1A	0.2A	0A	0A

3.3.1.3 Hold-Up Time (@FULL LOAD)

1. 115V / 60Hz : 12 mSec. Minimum.
2. 230V / 50Hz : 17 mSec. Minimum.

The output voltage will remain within specification,in the event that the input power is removed or interrupted,for the duration of one cycle of the input frequency.The interruption may occur at any point in the AC voltage cycle.The power good signal shall remain high during this test.

3.3.1.4 Output Rise Time

(10% To 90% Of Final Output Value, @FULL LOAD)

115V-rms or 230V-rms +5Vdc : 20ms Maximum

3.3.1.5 Over Voltage Protection

Table 11.Over Voltage Protection

Voltage Source	Protection Point
+3.3Vdc	5V
+5Vdc	7V
+12V1dc +12V2dc	16V

3.3.1.6 Short Circuit Protection

Output short circuit is defined to be a short circuit load of less than 0.1 ohm.

In the event of an output short circuit condition on +3.3V,+5V or +12V output,the power supply will shutdown and latch off without damage to the power supply. The power supply shall return to normal operation after the short circuit has been removed and the power switch has been turned off for no more than 2 seconds.(DC PS/ON OFF)

In the event of an output short circuit condition on -12V output, the power supply will not be damaged.The power supply shall return to normal operation as soon as the short circuit has been removed.and the power switch has been turned off for no more than 2 seconds. (DC PS/ON OFF)

3.3.1.7 Over Current Protection

Table 12.Over Current Protection

V	(A) Limit
+12V1	22A~32A
+12V2	22A~32A
+5V	22A~40A
+3.3V	~40A

3.3.1.8 Power Good Signal

The power good signal is a TTL compatible signal for the purpose of initiating an orderly star-up procedure under normal input operating conditions.This signal is asserted(low) until +5Vdc has reached 4.75 volts during power up. Characteristics:

TTL signal asserted(low state) : less than 0.5V while sinking 10mA.

TTL signal asserted(high state) : greater than 4.75V while sourcing 500uA.

High state output impedance: less or equal to 1Kohm from output to common.

Table 13.Power Good Signal

POWER GOOD @ 115/230V, FULL LOAD	100 – 500mSec
POWER FAIL @ 115/230V, FULL LOAD	1 mSec. minimum

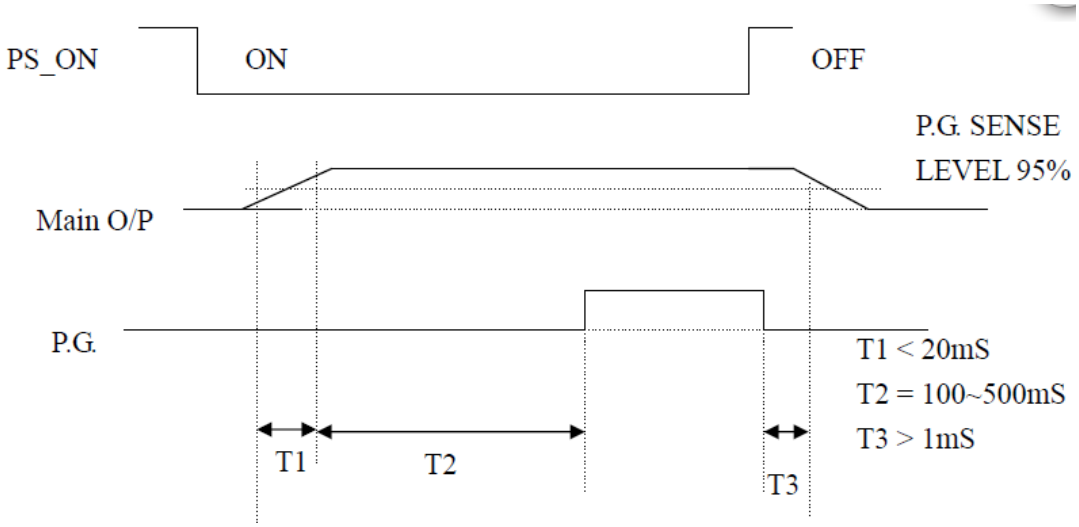


Figure 18.Power Good Signal

3.3.2 Transient Load Requirement

Table 14.Transient Load Requirement

Output	ΔStep Load Size	Load Slew Rate	Capacitive Load
+3.3V	30% of max load	0.5 A/μs	3300 μF
+5V	30% of max load	0.5 A/μs	3300 μF
+12V1,+12V2	30% of max load	1.0 A/μs	3300 μF

3.3.3 Input Electrical Specifications

3.3.3.1 Voltage Range

Table 15. Voltage Range

Parameter		Units
V-in Range	90 – 264	V-rms

3.3.3.2 Input Frequency

Table 16.Input Frequency

Input Frequency	47-63Hz

3.3.3.3 Inrush Current

Table 17.Inrush Current

115V	No damage
230V	No damage

(Cold star – 25 deg.C) (No damage)

3.3.3.4 Input Line Current

Table 18.Input Line Current

115V	6 Amps – rms maximum
230V	3 Amps – rms maximum

3.3.4 Efficifency

	Full load (100%)	Typical load (50%)	Light load (20%)
115VAC	87%	90%	87%
230VAC	87%	90%	87%

(loading shown in Amps)

Loading	+12V1	+12V2	+5V	+3.3V	-12V	+5Vsb
Full (100%)	13.26A	13.26A	8.41A	7.35A	0.37A	2.21A
Typical (50%)	6.63A	6.63A	4.2A	3.68A	0.18A	1.1A
Light (20%)	2.65A	2.65A	1.68A	1.47A	0.07A	0.44A

3.3.5 Standby Power Consumption (5Vsb)

Input Power < 0.5W @ 5Vsb/45mA & 230Vac input

PS_ON input signal @ High State

Table 19. ACLine Sag Transient Performance – 400W Power Supply

ACLine Sag (10sec interval between each sagging)				
Duration	Sag	Operating ACVoltage	Line Frequency	Performance Criteria
Continuous	10%	Nominal ACVoltage ranges	50/60Hz	No loss of function or performance
1 to 12ms	100%	Nominal ACVoltage ranges	50/60Hz	No loss of function or performance
> 12ms	>30%	Nominal ACVoltage ranges	50/60Hz	Loss of function acceptable, self-recoverable

Table 20. AC Line Surge Transient Performance – 400W Power Supply

ACLine Surge				
Duration	Surge	Operating ACVoltage	Line Frequency	Performance Criteria
Continuous	10%	Nominal ACVoltages	50/60Hz	No loss of function or performance
0 to ½ AC cycle	30%	Nominal ACVoltages	50/60Hz	No loss of function or performance

3.3.6 PS_ON#

PS_ON# is an active-low, TTL-compatible signal that allows a motherboard to remotely control the power supply in conjunction with features such as soft on/off, Wake on LAN+, or wake-on-modem. When PS_ON# is pulled to TTL low, the power supply should turn on the five main DC output rails:

+12VDC, +5VDC, +3.3VDC, and -12VDC. When PS_ON# is pulled to TTL high or open-circuited, the DC output rails should not deliver current and should be held at zero potential with respect to ground. PS_ON# has no effect on the +5VSB output, which is always enabled whenever the AC power is present. Table 19 lists PS_ON# signal characteristics.

The power supply shall provide an internal pull-up to TTL high. The power supply shall also provide debounce circuitry on PS_ON# to prevent it from oscillating on/off at startup when activated by a mechanical switch. The DC output enable circuitry must be SELV-compliant.

Table 21. PS_ON# Signal Characteristics

	Min	Max
V_{IL},Input Low Voltage	0.0V	0.8V
I_{IL},Input Low Current (Vin = 0.4V)		-1.6mA
V_{IH},Input High Voltage (Iin =-200μA)	2.0V	
V_{IH} OPEN circuit, Iin=0		5.25V

3.4 Environmental Requirements

The power supply will be compliant with each item in this specification for the following Environmental conditions.

3.4.1 Temperature Range

Table 22.Temperature Range

Operationg	400W	0 to +50 deg.C
Storage		-20 to +80 deg.C

3.4.2 Humidity

Table 23.Humidity

Operationg	85% RH,Non-condensing
Storage	95% RH,Non-condensing

3.4.3 Vibration

The subject power supply will withstand the following imposed conditions without experiencing non-recoverable failure or deviation from specified output characteristics.

Vibration Operationm0.01g2/Hz at 5Hz sloping to 0.02 g2/Hz at 20Hz,and maintaining 0.02 g2/Hz from 20 Hz to 500Hz.The area under the PSD curve is 3.13 gRMs.The duration shall be 20 minutes per axis for all three axes on all samples.

Plane of vibration to be along three mutually perpendicular axes.

3.4.4 Shock

The subject power supply will withstand the following imposed conditions without experiencing non-recoverable failure or deviation from specified output characteristics.

Storage 40G,9 mSec.half-sine wave pulse in both directions on three mutually perpendicular axes.

Operation 10G,11 mSec.half-sine wave pulse in both directions on three mutually perpendicular axes.

3.5 Safety

3.5.1 Leakage Current

The leakage current from AC to safety ground will not exceed 3.5 mA-rms at 264Vac, 50Hz.

3.6 Electormagnetic Compatibility

3.6.1 Lime Conducted EMI

The subject power supply will meet FCC class B requirements under full load conditions.

3.6.2 Radiated EMI

The power supply will meet FCC and CISPR 22 requierments under normal load conditions.

3.7 Labelling

The power supply will be permanent,legible and complied with all agency requirements.

3.7.1 Model Number Label

Labels will be affixed to the sides of the power supply showing the following.

- Manufacturer's name and logo.
- Model no., serial no., revision level,location of manufacturer.
- The total power output and the maximum load for each output.
- AC input rating.

3.7.2 DC Output Identification

Each output connector will be labeled.

3.8 Reliability

The power supply have a minimum predicted MTBF(MIL-HDBK-217) of 100000 hours of continuous operation at 25oC,maximum-output load, and nominal AC input voltage.

4. Thermal Management

The fully integrated system is designed to operate at external ambient temperatures of between 10°C and 35°C. Working with integrated platform management, several features within the system are designed to move air in a front to back direction, through the system and over critical components to prevent them from overheating and allow the system to operate with best performance.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

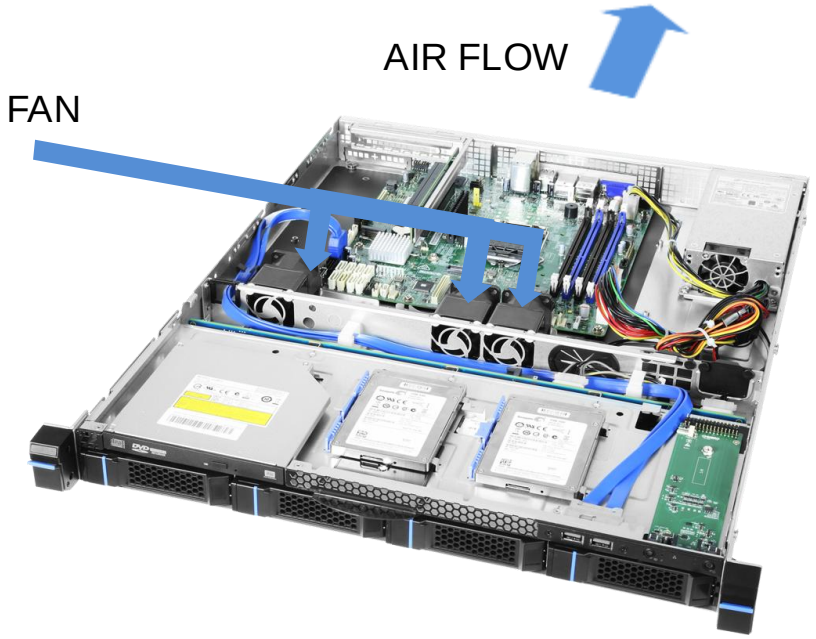


Figure 19.System Air Flow and Fan Identification

The following table provides air flow data associated with one of the system models within RM14604/08, and is provided for reference purposes only. The data was derived from actual wind tunnel test methods and measurements using fully configured (worst case) system configurations. Lesser system configurations may produce slightly different data results. In addition, the CFM data was derived using server management utilities that utilize platform sensor data, and may vary slightly from the data listed in the tables.

Table 24. System Volumetric Air Flow

4X3.5" Front End			
All System Fan	PSU Fan	w/o PSU(CFM)	w/ PSU(CFM)
100%	Auto	42.6	44.19
85%		35.3	37.2
75%		31.1	32.4
65%		26.7	27.6
55%		22.3	22.7

45%		18.1	18.2
35%		13.5	14.0
20%		7.5	7.7

RM14604/08 is thermally designed and developed in compliance with ASHRAE Class A2 environment guidance; however, there is extra thermal margin for all components in the system, so ASHRAE Class A3 environment conditions can be thermally supported.

Note: ASHARE Class A3 – Includes operation up to 40°C for up to 900 hours per year. Refer to Appendix D for detailed HTA guidance.

The installation and functionality of several system components are used to maintain system thermals. They include three managed 40mm single rotor system fans, fans integrated into each installed power supply module, an air duct, populated drive carriers, and a CPU heat sink. Drive carriers can be populated with a storage device (SSD or Hard Disk Drive) or supplied drive blank.

4.1 Thermal Operation and Configuration Requirements

To keep the system operating within supported maximum thermal limits, the system must meet the following operating and configuration guidelines:

- The system is designed for sustained operation on ambient temperature up to 35°C (ASHRAE Class A2)
- All externally accessed drive bays must be populated. Drive carriers can be populated with a storage device (SSD or HDD) or supplied drive blank
- When the system is operating, the air duct must be installed at all times
- The system top cover must be installed at all times when the system is in operation in order to have proper air flow

4.2 Thermal Management Overview

In order to maintain the necessary airflow within the system, all of the previously listed components need to be properly installed. For best system performance, the external ambient temperature should remain below 35°C and all system fans (all rotors) should be operational.

NOTE: All system fans are controlled independent of each other. The fan control system may adjust fan speeds for different fans based on increasing/decreasing temperatures in different thermal zones within the chassis.

In the event that system temperatures should continue to increase with the system fans operating at their maximum speed, platform management may begin to throttle bandwidth of either the memory subsystem or the processors or both, in order to keep components from overheating and keep the system operational. Throttling of these subsystems will continue until system temperatures are reduced below preprogrammed limits.

The power supply will be protected against over temperature conditions caused by excessive ambient temperature. In an over-temperature protection condition, the power supply module will shut down.

4.2.1 Fan Speed Control

The baseboard management controller (BMC) supports monitoring and control of fan speed (RPM). Each fan is associated with a fan speed sensor that detects fan failure.
The system fans are divided into fan domains, each of which has a separate fan speed control signal and a separate configurable fan control policy. A fan domain can have a set of temperature and fan sensors associated with it. These are used to determine the current fan domain state.

4.2.2 Programmable Fan PWM Offset

The system provides a BIOS Setup option to boost the system fan speed by a programmable positive offset or a “Max” setting. Setting the programmable offset causes the BMC to add the offset to the fan speeds to which it would otherwise be driving the fans. The Max setting causes the BMC to replace the domain minimum speed with alternate domain minimums that also are programmable through SDRs.

This capability is offered to provide system administrators the option to manually configure fan speeds in instances where the fan speed optimized for a given platform may not be sufficient when a high end add-in adapter is configured into the system. This enables easier usage of the fan speed control to support Intel as well as third party chassis and better support of ambient temperatures higher than 35°C.

4.2.3 Fan Domains

System fan speeds are controlled through pulse width modulation (PWM) signals, which are driven separately for each domain by integrated PWM hardware. Fan speed is changed by adjusting the duty cycle, which is the percentage of time the signal is driven high in each pulse.

The BMCcontrols the average duty cycle of each PWM signal through direct manipulation of the integrated PWM control registers.

The same device may drive multiple PWM signals.

4.2.4 Nominal Fan Speed

A fan domain’s nominal fan speed can be configured as static (fixed value) or controlled by the state of one or more associated temperature sensors.

Chenbro customized SDRrecords are used to configure which temperature sensors are associated with which fan control domains and the algorithmic relationship between the temperature and fan speed. Multiple Chenbro customized SDRs can reference or control the same fan control domain; and multiple Chenbro customized SDRs can reference the same temperature sensors.

The PWM duty-cycle value for a domain is computed as a percentage using one or more instances of a stepwise linear algorithm and a clamp algorithm. The transition from one computed nominal fan speed

(PWM value) to another is ramped over time to minimize audible transitions. The ramp rate is configurable by means of the OEM SDR.

Multiple stepwise linear and clamp controls can be defined for each fan domain and used simultaneously.

For each domain, the BMC uses the maximum of the domain’s stepwise linear control contributions and the sum of the domain’s clamp control contributions to compute the domain’s PWM value, except that a stepwise linear instance can be configured to provide the domain maximum.

Hysteresis can be specified to minimize fan speed oscillation and to smooth fan speed transitions. If a Tcontrol SDR record does not contain a hysteresis definition, for example, an SDR adhering to

a legacy format, the BMC assumes a hysteresis value of zero.

4.2.5 Thermal and Acoustic Management

This feature refers to enhanced fan management to keep the system optimally cooled while reducing the amount of noise generated by the system fans. Aggressive acoustics standards might require a trade-off between fan speed and system performance parameters that contribute to the cooling requirements and primarily memory bandwidth. The BIOS, BMC, and SDRs work together to provide control over how this trade-off is determined.

This capability requires the BMC to access temperature sensors on the individual memory DIMMs. Additionally, closed-loop thermal throttling is only supported with buffered DIMMs.

4.2.6 Thermal Sensor Input to Fan Speed Control

The BMC uses various IPMI sensors as input to the fan speed control. Some of the sensors are IPMI models of actual physical sensors whereas some are “virtual” sensors whose values are derived from physical sensors using calculations and/or tabular information.

The following IPMI thermal sensors are used as input to fan speed control:

- Front Panel Temperature Sensor[1]
- CPU Margin Sensors[2,4,5]
- DIMM Thermal Margin Sensors[2,4]
- Exit Air Temperature Sensor[1, 7, 9]
- PCH Temperature Sensor[3,5]
- Add-In Intel SAS Module Temperature Sensors[6]
- PSU Thermal Sensor[3, 8]
- CPU VRTemperature Sensors[5]
- DIMM VRTemperature Sensors[5]
- BMC Temperature Sensor[3, 6]
- Global Aggregate Thermal Margin Sensors[7]
- Hot Swap Backplane Temperature Sensors
- I/O Module Temperature Sensor (With option installed)
- Intel®SAS Module (With option installed)

Notes:

1. For fan speed control in Chenbro chassis
2. Temperature margin from throttling threshold
3. Absolute temperature
4. PECI value or margin value
5. On-die sensor
6. On-board sensor
7. Virtual sensor
8. Available only when PSU has PMBus
9. Calculated estimate

A simple modul is shown in the following figure which gives a high level representation of how the fan speed control structure creates the resulting fan speeds

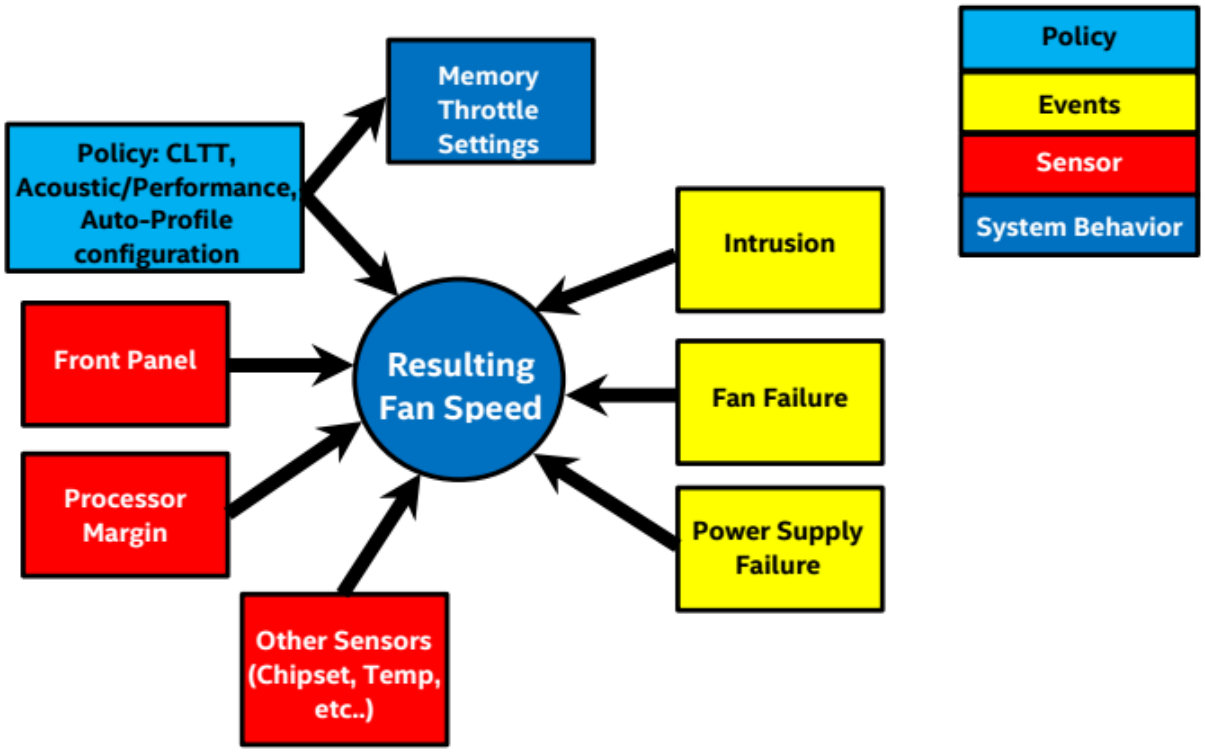


Figure 20.Fan Control Model

4.3 System Fans

Three single rotor 40 x 28mm (Up to 56mm) system fans, and dedicated fans for the installed power supply modules provide the primary airflow for the system.

The system includes three system fans (see Figure17). The fans are held in place by fitting them over mounting pins coming up from the chassis base.

The Fixed Power Supply option of this product comes with a dedicated fan inside the Power Supply Module.

The Power Supply integrates a Power supply Cage with a fixed single rotor 40x25mm fan. It is responsible for airflow through the power supply module. The fans are managed by the fan control system. Should the fan fail, the power supply will shut down.

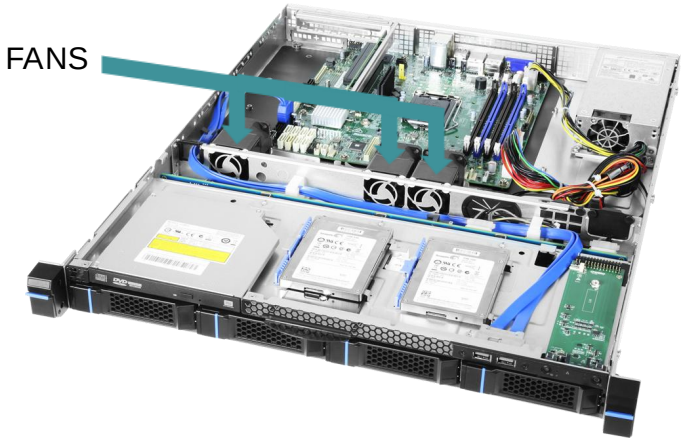


Figure 21.System Fans

- System fans are NOT hot-swap capable
- Each fan and is designed for tool-less insertion and extraction from the system.
- Each fan and incorporates vibration dampening features used to minimize fan vibration

affects within the chassis

- Fan speed for each fan is controlled by integrated platform management as controlled by the integrated BMC on the server board. As system thermals fluctuate high and low, the integrated BMC firmware will increase and decrease the speeds to specific fans to regulate system thermals.
- Each fan has a tachometer signal for each rotor that allows the Integrated BMC to monitor their status.
- Each fan has a 4-pin wire harness that connects to a matching connector on the server board.

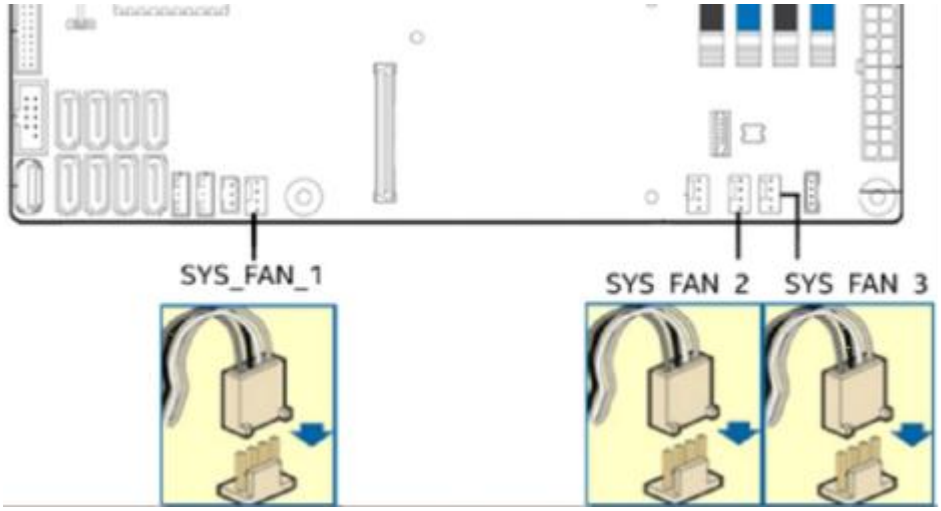


Figure 22.System Fan Connector Locations on Server Board

WARNING: HAZARDOUS MOVING PARTS KEEP FINGERS AND OTHER BODY PARTS AWAY

Table 25. System Fan Connector Pin-out

Pin	Signal Name	Type	Description
1	Ground	GND	Ground is the power supply ground
2	12V	Power	Power supply 12 V
3	Fan Tach Fan PWM	In Out	FAN_TACH signal is connected to the BMCto monitor the fan speed FAN_PWM signal to control fan speed
4	Fan PWM Fan Tach	Out In	FAN_PWM signal to control fan speed FAN_TACH signal is connected to the BMCto monitor the fan speed

5. System Storage and Peripheral Drive Bay Overview

RM1460X has support for a variety of different storage options, including:

- Up to 4 x 3.5” hot swap SAS or SATA hard disk drives or 2.5” SSDs
- Up to 8 x 2.5” hot swap SAS or SATA drives (hard disk or SSD)
- SATA Slim-line and 2 x 2.5’’ internal HDD Optical Drive support
- SATA DOM Support on SATA port 4
- Internally mounted Low Profile M.2 Solid State Device (M.2 SSD)

Support for different storage and peripheral options will vary depending on the system model and/or available accessory options installed. This section will provide an overview of each available option.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

5.1 Front Mount Drive Support

RM1460X supports either 4x3.5” or 8x2.5’’front mounted drives, Both system provide front panel I/O and front control panel support.

Figure 23. 4x3.5’’ Drive Bay Configuration

Figure 24. 8x2.5’’ Drive Bay Configuration

5.2 System Fan RVI and Hard Disk Drive Storage Performance

Hard disk drive storage technology, which utilizes the latest state-of-the-art track density architectures, are susceptible to the effects of system fan rotational vibration interference (RVI) within the server system. As system fan speeds increase to their upper limits (>80% PWM or > 19,320 RPM), hard disk drive performance can be impacted.

Chenbro publishes a list of supported hard drives on its Tested Hardware and OS List (THOL). In general, unless identified in the NOTES column in the THOL, all listed hard drives have been tested to meet Chenbro performance targets when the systems fans are operating above 80% PWM and/or the system is operating at or below the platform ambient thermal limit of 35°C (95°F).

The THOL may also list hard drives that are only recommended for use in non-extreme operating environments, where the ambient air is at or below 20°C (68°F) and /or the hard drives are installed in system configurations where the system fans regularly operate below 80% PWM. Hard drives that require these support criteria for a given system will include an “Environmental Limitation” tag and message in the THOL “NOTES” column for that device. Using these drives in the more extreme operating environments puts these devices at higher risk of performance degradation.

Chenbro recommends the following general support guidelines for server systems configured with hard drive storage technology:

- Avoid sustained server operation in extreme operating environments. Doing so will cause the system fans to operate at their upper speed limits and produce higher levels of RVI which could affect hard drive performance.

NOTE: Solid State Drive (SSD) performance is not impacted by the effects of system fan RVI.

5.3 External Hot Swap Drive Carriers

Each SAS/SATA hard disk drive or SSD that interfaces with a backplane is mounted to a hot swap drive carrier. Drive carriers include a latching mechanism used to assist with drive extraction and drive insertion.

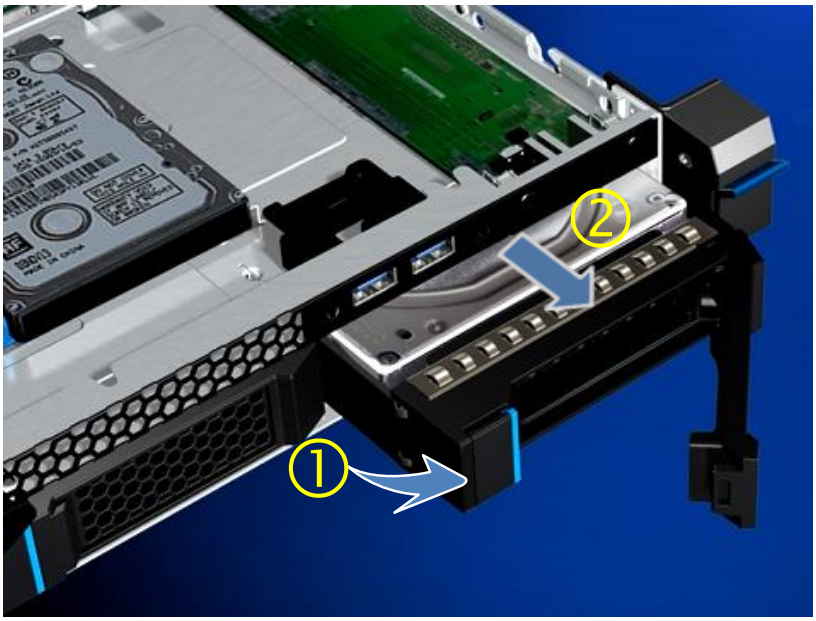


Figure 25. Hot Swap Storage Device Carrier Removal

NOTE: To ensure proper system air flow requirements, all front drive bays must be populated with a drive carrier. Drive carriers must be installed with either a drive or supplied drive blank.

There are drive carriers to support 2.5” devices and 3.5” devices. To maintain system thermals, all drive bays must be populated with a drive carrier mounted with a hard disk drive, SSD, or supplied drive blank. Drive blanks used with the 3.5” drive carrier can also be used to mount a 2.5” SSD into it as shown below.

Figure 26. 2.5” SSD mounted to 3.5” Drive Tray

Secure the 2.5'' HDD with four screws on the bottom of the HDD tray.

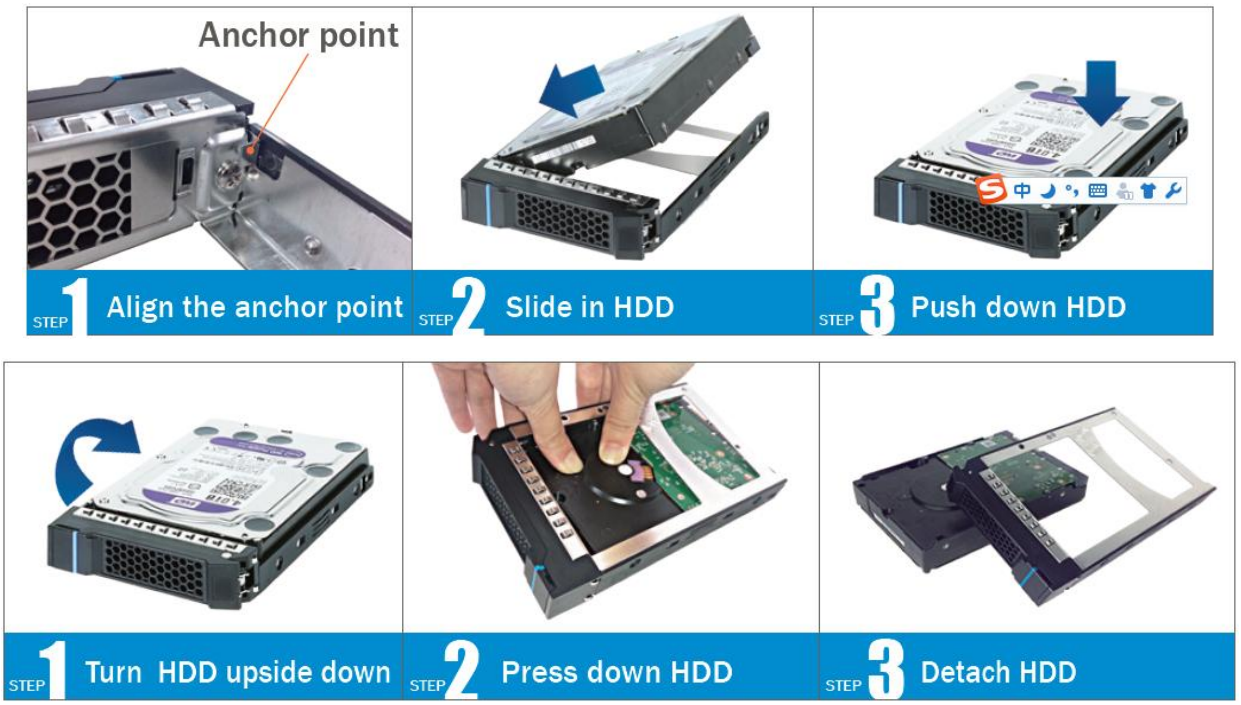


Figure 27.3.5''HDD Installation and Removal

NOTE: Due to degraded performance and reliability concerns, the use of the 3.5" drive blank as a 2.5" device bracket is intended to support SSD type storage devices only. Installing a 2.5" hard disk drive into the 3.5" drive blank cannot be supported.

Each drive carrier includes separate LED indicators for drive Activity and drive Status. Light pipes integrated into the drive carrier assembly direct light emitted from LEDs mounted next to each drive connector on the backplane to the drive carrier faceplate, making them visible from the front of the system.

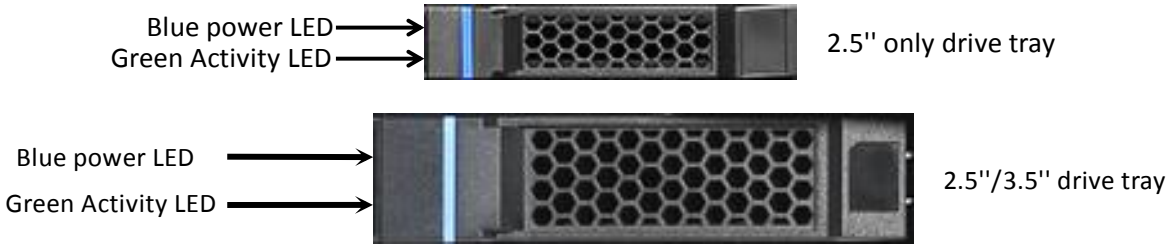


Figure 28. Drive Tray LED Identification

Table 26 Drive Power LED/Activity LED States

LED	Color	Behavior	Condition
Power LED	N/A	Stay off	Hard drive fault has occurred
	Blue	Solid on	When power on
Activity LED	Green	Stay on	When HDD is busy
	Red	Blink	Drive spinning up

NOTE: The drive activity LED is driven by signals coming from the drive itself. Drive vendors may

choose to operate the activity LED different from what is described in the table above. Should the activity LED on a given drive type behave differently than what is described, customers should reference the drive vendor specifications for the specific drive model to determine what the expected drive activity LED operation should be.

5.4 Internal 2.5” HDD Optional

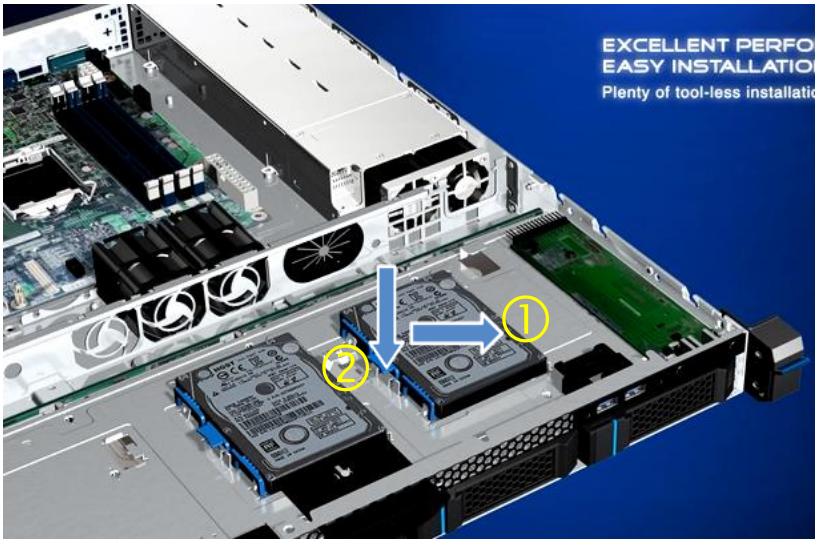


Figure 29.Internal 2.5" HDD Installation

①.Engage two embossed pin on HDD carrier into the side dimples on the 2.5’’ HDD.

②.Carefully push down the other side of 2.5’’ HDD until another two embossed pins in its position.

5.5 Storage Backplane Optional

RM14604 has support for two backplane options.

- 4 x 3.5” Mini SAS HD backplane
- 4 x 3.5” SAS/SATA backplane
- 8 x 2.5’’Mini SAS HD backplane

All available backplane options mount directly to the back of the drive bay as shown in the following illustration.

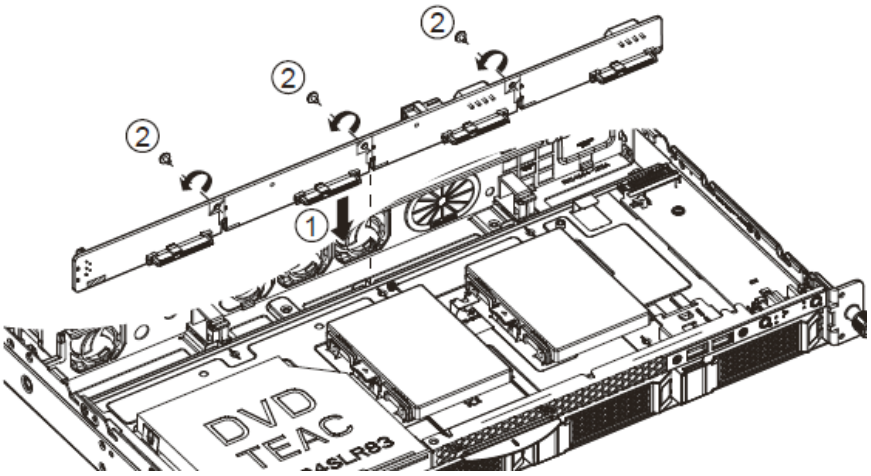


Figure 30. Backplane Installation-RM14604

①.Install backplane vertically into the chassis to align the screw holes with the hooks.

②.Secure the backplane with three screws as shown.

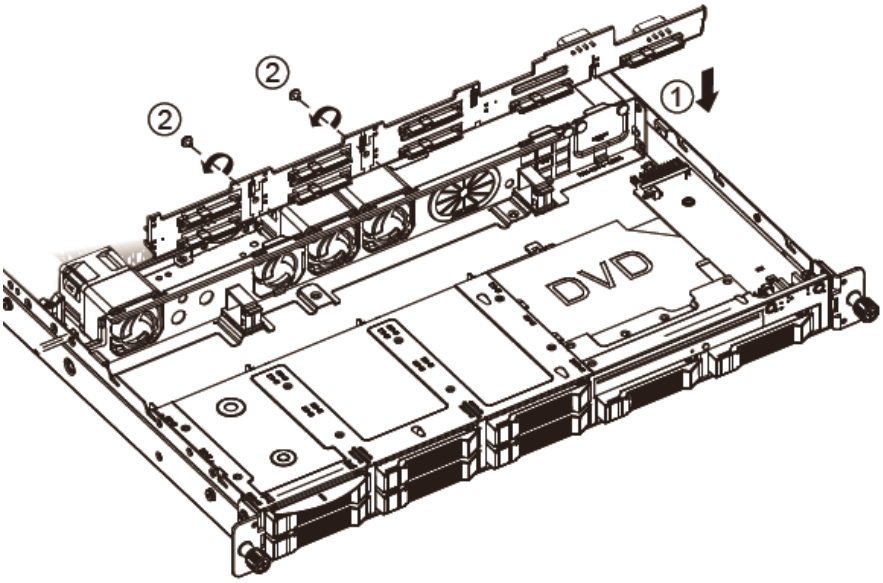


Figure 31. Backplane Installation-RM14608

①.Install backplane vertically into the chassis ,ensure that alianment screw holes and hooks match up.

②.Secure the backplane with two screws as shown.

All available SAS/SATA compatible backplanes include the following common features:

- 12 Gb SAS and 6Gb SAS/SATA
- 29-pin SFF-8680 12 Gb rated drive interface connectors, providing both power and I/O signals to attached devices
- Hot swap support for SAS/SATA devices
- I2C interface from a 3-pin connector for device status communication to the BMC over slave SMBus
- LEDs to indicate drive activity and status for each attached device

5.5.1 I2C Functionality

The microcontroller has a master/slave I2C connection to the server board BMC. The microcontroller is not an IPMB compliant device. The BMC will generate SEL events by monitoring registers on the HSBP microcontroller for DRIVE PRESENCE, FAULT, and RAID REBUILD in progress.

5.5.2 4 x 3.5" Drive Hot-Swap Backplane Overview

The 3.5" drive system SKUs within the product family will ship with a 4x drive backplane capable of supporting 12 Gb/sec SAS drives. Both hard disks and Solid State Drives (SSDs) can be supported within a common backplane. Each backplane can support SAS devices. However, SATA and mixing of SATA and SAS devices within a common hot swap backplane are not supported. Supported devices are dependent on the type of host bus controller driving the backplane.

The front side of the backplane includes 4 x 29-pin drive interface connectors, each capable of supporting 12 Gb SAS or 6 Gb SAS/SATA. The connectors are numbered 0 thru 3. Signals for all four drive connectors are routed to a single multi-port mini-SAS HD connector or four SATA host connector on the back side of the backplane.

5.5.2.1 12G Mini SAS HD 4 Port Backplane

Table 27.12G Mini SAS HD 4 Port Backplane

Specification	
Host Interface	Mini SAS HD RA
HDD Interface	SAS
Hot-Swap	Yes, allows user to on line replace Hard Disk Drive
Display	LED indicates Hard Disk Drive status Power LED – Blue (When HDD is present) Access LED – Green (When HDD is busy) Error LED – Red (When HDD is error)
Environment Monitor	Temperature senor detect(U2,U3)
Connectors	1.SAS29P *4 2.Mini-SAS HD RA*1 3.Standard 4P Power connector *2 for +5V, +12V from power supply 4. PIN Header 2mm (1x3) *2 5. I2C Connector *1
Dimension	426.62(L) x 26.8(W) x 2.4(H) mm
Material	FR4 4 layer

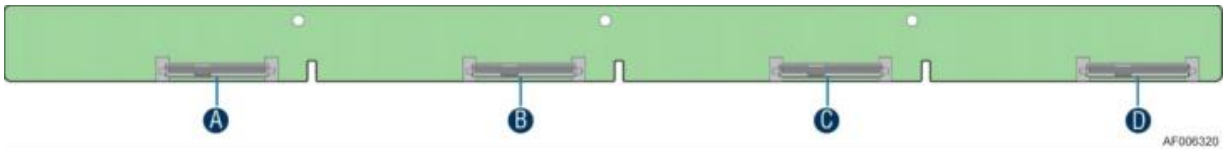


Figure 32. 12G Mini SAS HD 4 Port Backplane– front view

Label	Description
A	HDD_0
B	HDD_1
C	HDD_2
D	HDD_3

On the backside of the backplane are several connectors. The following illustration identifies each.

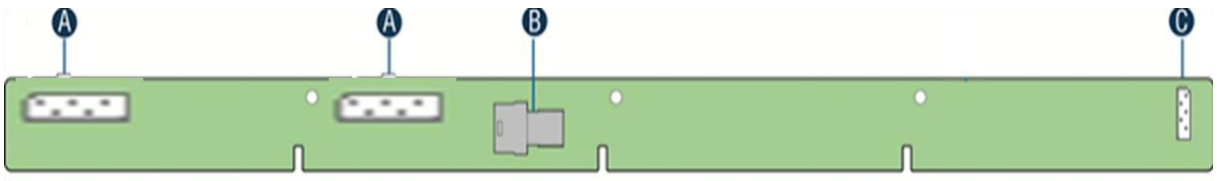


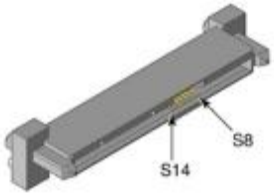
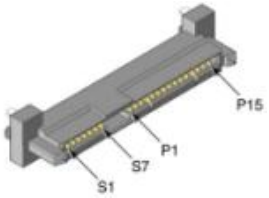
Figure 33. 12G Mini SAS HD 4 Port Backplane – rear view

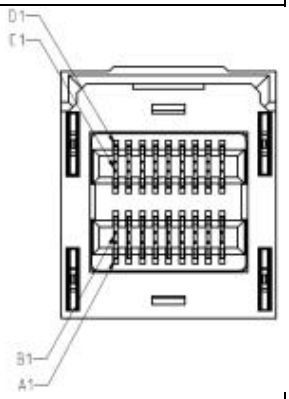
Label	Description
A	Power connector

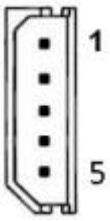
B	SAS/SATA Ports 0-3 Mini-SAS HD cable connector
C	I2C connector

A – Power Connector – The backplane includes a 2x2 connector supplying power to the backplane. Power is routed to the backplane via a power cable harness from the Power Supply Modules.
B – Multi-port Mini-SAS Cable Connector – The backplane includes one multi-port mini-SAS cable connector providing data signals for four SAS/SATA drives on the backplane. A cable can be routed from matching connectors on the server board or add-in SAS/SATA RAID cards.
C – I2C Cable Connector – The backplane includes a 1x3 cable connector used as a management interface to the server board.

Table 28.Connector Pin-out –4-port Mini SAS HD Backplane

Connector	Pin Number	Pin Definition	Input/output	Description	Drawing
Power Connector	1	12V	Input	Power +12V	
	2	GND	GND	Power GND	
	3	GND	GND	Power GND	
	4	5V	Input	Power +5V	
HDD Access select	1-2	HDD Mode	Input	HDD direct access decode	
	2-3	SGPIO Mode	Input	Through SGPIO signal decoder	
HDD IN Connector	S1	GND	GND	GND	 
	S2	TP	Input	Transmitter data (+)	
	S3	TN	Input	Transmitter data (-)	
	S4	GND	GND	GND	
	S5	RN	Output	Receiver data (-)	
	S6	RP	Output	Receiver data (+)	
	S7	GND	GND	GND	
	S8	NC	NC	NC	
	S9	NC	NC	NC	
	S10	NC	NC	NC	
	S11	NC	NC	NC	
	S12	NC	NC	NC	
	S13	NC	NC	NC	
	S14	NC	NC	NC	
	P1	NC	NC	NC	
	P2	NC	NC	NC	
	P3	NC	NC	NC	
	P4	GND	GND	GND	
	P5	Plug-in	Input	HDD Plug-in	

		detection		detection	
	P6	GND	GND	GND	
	P7	5V Pre-Charge	Input	Pre-Charge +5V	
	P8	5V	Power	Power +5V	
	P9	5V	Power	Power +5V	
	P10	GND	GND	GND	
	P11	NC	NC	NC	
	P12	GND	GND	GND	
	P13	12V Pre-Charge	Input	Pre-charge +12V	
	P14	12V	Power	Power +12V	
	P15	12V	Power	Power +12V	
Mini SAS HD Connector	A1	SGPIO SCKA	Input	SPGIO Clock	
	A2	GND	GND	GND	
	A3	GND	GND	GND	
	A4	RP1	Input	Receiver data 1 (+)	
	A5	RN1	Input	Receiver data 1 (-)	
	A6	GND	GND	GND	
	A7	RP3	Input	Receiver data 3 (+)	
	A8	RN3	Input	Receiver data 3 (-)	
	A9	GND	GND	GND	
	B1	SGPIO SLDA	Output	SPGIO SLoad	
	B2	GND	GND	GND	
	B3	GND	GND	GND	
	B4	RP0	Input	Receiver data 0 (+)	
	B5	RN0	Input	Receiver data 0 (-)	
	B6	GND	GND	GND	
	B7	RP2	Input	Receiver data 2 (+)	
	B8	RN2	Input	Receiver data 2 (-)	
	B9	GND	GND	GND	
	C1	GND	GND	GND	
	C2	SPGIO SDOA	Output	SPGIO data	
	C3	GND	GND	GND	
	C4	TP1	Output	Transmitter data 1(+)	
	C5	TN1	Output	Transmitter data 1(-)	
	C6	GND	GND	GND	
	C7	TP3	Output	Transmitter data 3(+)	
	C8	TN3	Output	Transmitter data 3(-)	
	C9	GND	GND	GND	
	D1	NC	NA	NA	

	D2	GND	GND	GND	
	D3	GND	GND	GND	
	D4	TP0	Output	Transmitter data 0 (+)	
	D5	TN0	Output	Transmitter data 0 (-)	
	D6	GND	GND	GND	
	D7	TP2	Output	Transmitter data 2 (+)	
	D8	TN2	Output	Transmitter data 2 (-)	
	D9	GND	GND	GND	
I2C Connector	1	SDA	I/O	I2C Data Signal (Internal pull high +5V)	
	2	GND	GND	GND	
	3	SCL	Input	I2C Clock Signal (Internal pull high +5V)	
	4	ADD0	Input	I2C address A0 Signal	
	5	ADD1	Input	I2C address A0 Signal	

5.5.2.2 12G SAS 4 Port Backplane

Table 29.12G SAS 4 Port Baackplane

Specification	
Host Interface	SATA/SAS
HDD Interface	SAS
Hot-Swap	Yes, allows user to on line replace Hard Disk Drive
Display	LED indicates Hard Disk Drive status Power LED – Blue (When HDD is present) Access LED – Green (When HDD is busy) Error LED – Red (When HDD is error)
Cooler	NA
Connectors	1.SAS29P *4 2.SATA Host Connector *4 3.Standard 4P Power connector *2 for +5V, +12V from power supply 4.SGPIO Pin header 2.54mm (2x5) *1 5. Pin header 2.00mm (1x3) *2
Dimension	426.62(L) x 26.8(W) x 2.4(H) mm
Material	FR4 2 layer

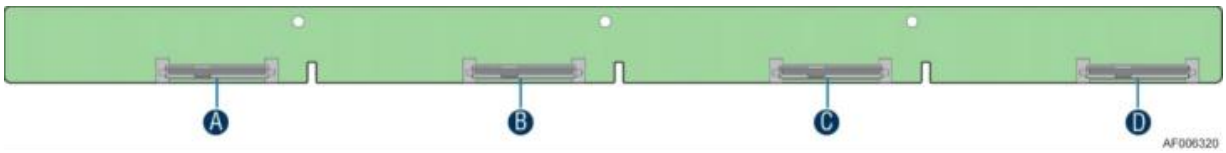


Figure 34. 12G SAS 4 Port Backplane – front view

Label	Description
A	HDD_0
B	HDD_1
C	HDD_2
D	HDD_3

On the backside of the backplane are several connectors. The following illustration identifies each.

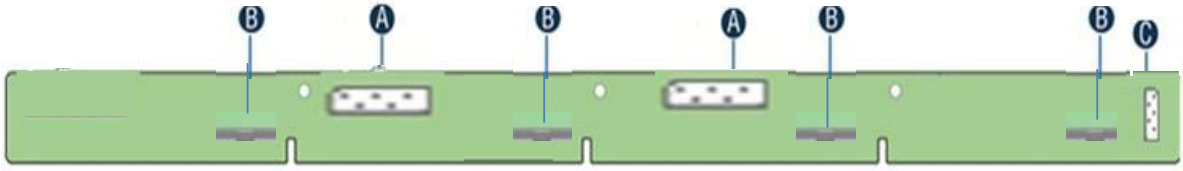


Figure 35. 12G SAS 4 Port Backplane – rear view

Label	Description
A	Power connector
B	SAS/SATA Host connector
C	I2C connector

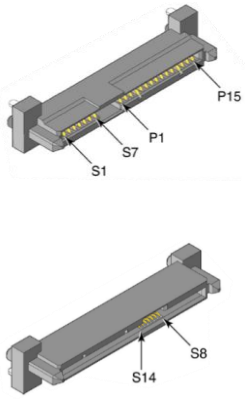
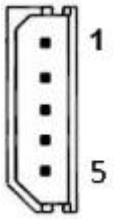
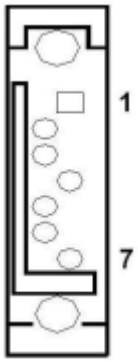
A – Power Connector – The backplane includes a 2x2 connector supplying power to the backplane. Power is routed to the backplane via a power cable harness from the Power Supply Modules.

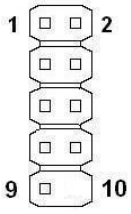
B – SAS/SATA Host Connector – The backplane includes four SAS/SATA Host Connector providing data signals for four SAS drives on the backplane. A cable can be routed from matching connectors on the server board or add-in SAS/SATA RAID cards.

C – I2C Cable Connector – The backplane includes a 1x3 cable connector used as a management interface to the server board.

Table 30.Connector Pin-out – SAS Backplane

Connector	Pin Number	Pin Definition	Input/output	Description	Drawing
Power Connector	The same as Table 28				
HDD Access select	The same as Table 28				

HDD IN Connector	The same as Table 28				
I2C Connector	The same as Table 28				
HOST IN Connector	1	GND	GND	GND	
	2	RP	Output	Receiver data (+)	
	3	RN	Output	Receiver data (-)	
	4	GND	GND	GND	
	5	TN	Input	Transmitter data (-)	
	6	TP	Input	Transmitter data (+)	
	7	GND	GND	GND	

	Pin NO.	**Descriptions**	**Pin NO.**	**Descriptions**	**Drawing**
SGPIO signal Connector	1	SGPIO DATA INPUT	2	NC	
	3	SGPIO DATA OUTPUT	4	GND	
	5	GND	6	SGPIO LOAD	
	7	CONTROL TYPE	8	SGPIO CLOCK	
	9	NC	10	KEY PIN	

5.5.2.3 12G Mini SAS HD 8 Port Backplane

Table 31.12G Mini SAS HD 8 Port Backplane

Specification	
Host Interface	Mini SAS HD
HDD Interface	SAS
Hot-Swap	Yes, allows user to on line replace Hard Disk Drive

Display	LED indicates Hard Disk Drive status Power LED – Blue (When HDD is present) Access LED – Green (When HDD is busy) Error LED – Red (When HDD is error)
Environment Monitor	Temperature senor detect(U03,U04)
Connectors	1.SAS29P *8 2.Mini-SAS HD Connector*2 3.Standard 4P Power connector *8 for +5V, +12V from power supply *2 4. PIN Header 2mm (1x3) *4 5. I2C Connector 2.5mm(1x5)*1
Dimension	426.4(L) x 25.5(W) x 2.4(H) mm
Material	FR4 6 layer

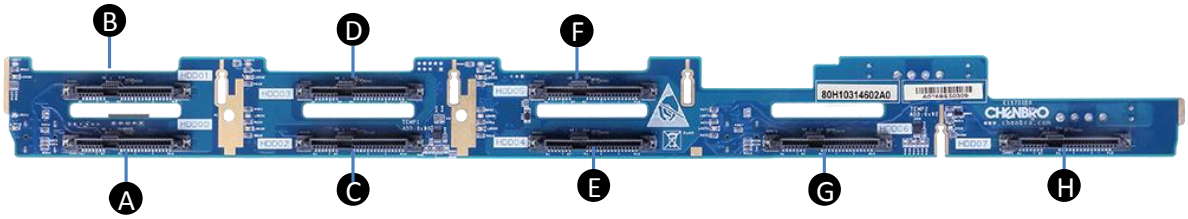


Figure 36. 12G Mini SAS HD 8 Port Backplane– front view

Label	Description
A	HDD_0
B	HDD_1
C	HDD_2
D	HDD_3
E	HDD_4
F	HDD_5
G	HDD_6
H	HDD_7

On the backside of the backplane are several connectors. The following illustration identifies each.

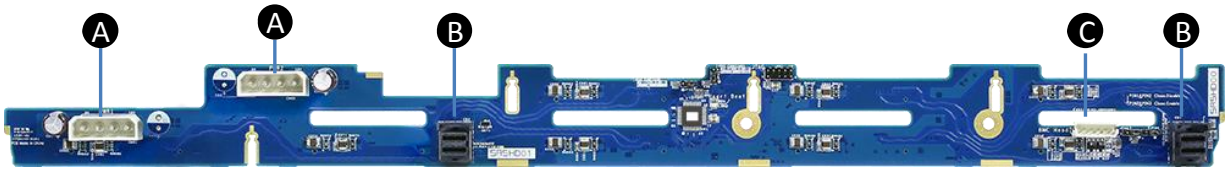


Figure 37. 12G Mini SAS HD 8 Port Backplane – rear view

Label	Description
A	Power connector
B	Mini-SAS HD cable connector
C	I2C connector

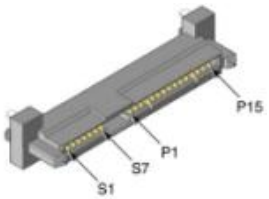
A – Power Connector – The backplane includes a 2x2 connector supplying power to the backplane.

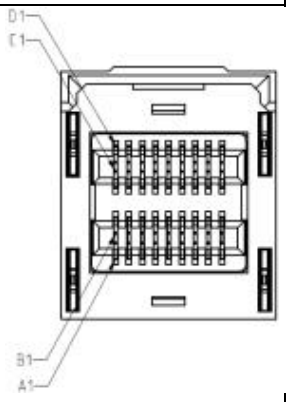
Power is routed to the backplane via a power cable harness from the Power Supply Modules.

B – Multi-port Mini-SAS Cable Connector – The backplane includes one multi-port mini-SAS cable connector providing data signals for four SAS/SATA drives on the backplane. A cable can be routed from matching connectors on the server board or add-in SAS/SATA RAID cards.

C – I2C Cable Connector – The backplane includes a 1x3 cable connector used as a management interface to the server board.

Table 32.Connector Pin-out –8-port Mini SAS HD Backplane

Connector	Pin Number	Pin Definition	Input/output	Description	Drawing
Power Connector	1	12V	Input	Power +12V	
	2	GND	GND	Power GND	
	3	GND	GND	Power GND	
	4	5V	Input	Power +5V	
HDD Access select	1-2	HDD Mode	Input	HDD direct access decode	
	2-3	SGPIO Mode	Input	Through SGPIO signal decoder	
HDD IN Connector	S1	GND	GND	GND	 
	S2	TP	Input	Transmitter data (+)	
	S3	TN	Input	Transmitter data (-)	
	S4	GND	GND	GND	
	S5	RN	Output	Receiver data (-)	
	S6	RP	Output	Receiver data (+)	
	S7	GND	GND	GND	
	S8	NC	NC	NC	
	S9	NC	NC	NC	
	S10	NC	NC	NC	
	S11	NC	NC	NC	
	S12	NC	NC	NC	
	S13	NC	NC	NC	
	S14	NC	NC	NC	
	P1	NC	NC	NC	
	P2	NC	NC	NC	
	P3	NC	NC	NC	
	P4	GND	GND	GND	
	P5	Plug-in detection	Input	HDD Plug-in detection	
	P6	GND	GND	GND	
	P7	5V Pre-Charge	Input	Pre-Charge +5V	
	P8	5V	Power	Power +5V	

	P9	5V	Power	Power +5V	
	P10	GND	GND	GND	
	P11	NC	NC	NC	
	P12	GND	GND	GND	
	P13	12V Pre-Charge	Input	Pre-charge +12V	
	P14	12V	Power	Power +12V	
	P15	12V	Power	Power +12V	
Mini SAS HD Connector	A1	SGPIO SCKA	Input	SPGIO Clock	
	A2	GND	GND	GND	
	A3	GND	GND	GND	
	A4	RP1	Input	Receiver data 1 (+)	
	A5	RN1	Input	Receiver data 1 (-)	
	A6	GND	GND	GND	
	A7	RP3	Input	Receiver data 3 (+)	
	A8	RN3	Input	Receiver data 3 (-)	
	A9	GND	GND	GND	
	B1	SGPIO SLDA	Output	SPGIO SLoad	
	B2	GND	GND	GND	
	B3	GND	GND	GND	
	B4	RP0	Input	Receiver data 0 (+)	
	B5	RN0	Input	Receiver data 0 (-)	
	B6	GND	GND	GND	
	B7	RP2	Input	Receiver data 2 (+)	
	B8	RN2	Input	Receiver data 2 (-)	
	B9	GND	GND	GND	
	C1	GND	GND	GND	
	C2	SPGIO SDOA	Output	SPGIO data	
	C3	GND	GND	GND	
	C4	TP1	Output	Transmitter data 1(+)	
	C5	TN1	Output	Transmitter data 1(-)	
	C6	GND	GND	GND	
	C7	TP3	Output	Transmitter data 3(+)	
	C8	TN3	Output	Transmitter data 3(-)	
	C9	GND	GND	GND	
	D1	NC	NA	NA	
	D2	GND	GND	GND	
	D3	GND	GND	GND	
	D4	TP0	Output	Transmitter data 0 (+)	
	D5	TN0	Output	Transmitter data 0 (-)	

	D6	GND	GND	GND	
	D7	TP2	Output	Transmitter data 2 (+)	
	D8	TN2	Output	Transmitter data 2 (-)	
	D9	GND	GND	GND	
I2C Connector (JC01)	1	SDA	I/O	I2C Data Signal (Internal pull high +5V)	
	2	GND	GND	GND	
	3	SCL	Input	I2C Clock Signal (Internal pull high +5V)	
	4	ADD0	Input	I2C address A0 Signal	
	5	ADD1	Input	I2C address A0 Signal	

5.6 SATA DOM Support

The SATA-4 connector on the server board is designed to be compatible with SATA DOM devices.

Table 33. SATA/SATADOM capable Connector Pin-out

Pin	IO	Signal Name
MH1	PWR	GND
1	GND	GND
2	I	SATA_TX_P
3	I	SATA_TX_N
4	GND	GND
5	O	SATA_RX_N
6	O	SATA_RX_P
7	PWR	GND
MH2	PWR	P5V(For Apacer* SATADOM) GND (For SATA)

6. Front Control Panel and I/O Panel Overview

RM14604/08 includes a Control Panel and I/O Panel on the front of the system.

6.1 I/O Panel Features

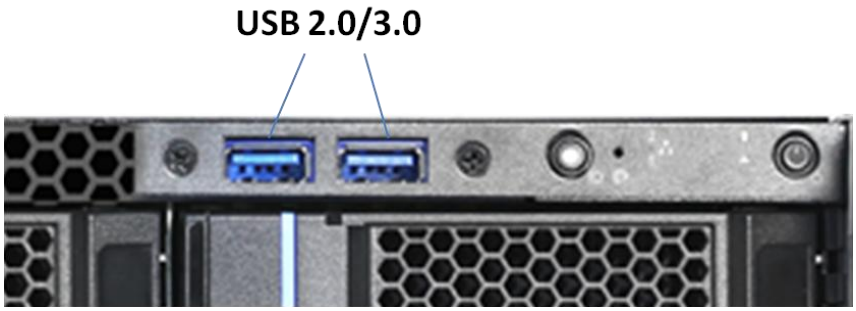


Figure 38. Front I/O Panel Features

USB 2.0/3.0 Ports –The front I/O panel includes two USB 2.0/3.0 ports. The USB ports are cabled to a Blue 2x5 connector on the server board labeled “Internal_USB3.0”.

** **NOTE:** Due to signal strength limits associated with USB 3.0 ports cabled to a front panel, some marginally compliant USB 3.0 devices may not be supported from these ports. In addition, server systems based on the Intel®Server Board S1200SP cannot be USB 3.0 certified with USB 3.0 ports cabled to a front panel.

6.2 Control Panel Features

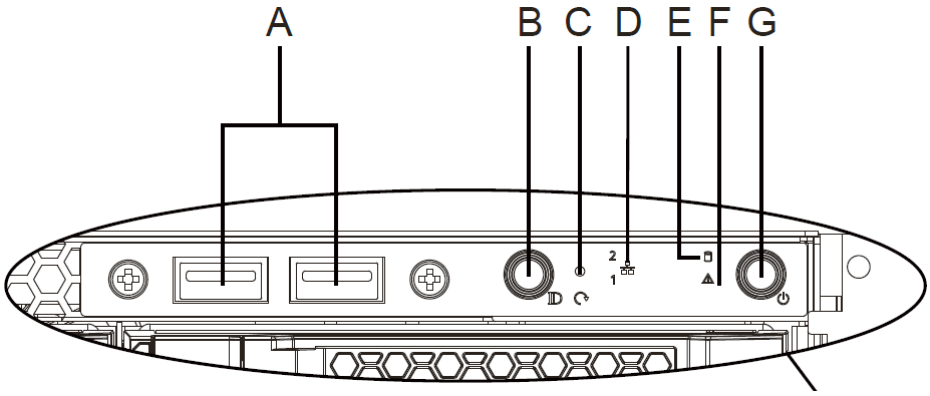


Figure 39. Front Panel Control and Buttons

The system includes a front panel that provides button system controls and LED indicators for several system features. This section will provide a description for each front control panel feature.

Table 34. Front Control Panel Buttons And Indicators

Label	Description
A	USB 2.0/3.0 port
B	ID Switch
C	System Reset Button
D	LAN1,LAN2 Activity LED

E	HDD Activity LED
F	System Status LED
G	Power on Button and LED

6.2.1 LED Board And System Status LED

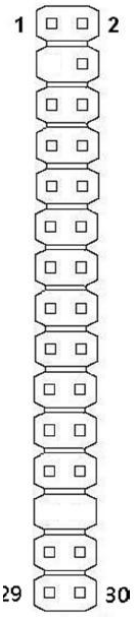
Figure 40.LED Board

Table 35.LED Board Specification

Specification	
Display	LED indicates status Power LED – Blue (When power on) UID LED – Blue (when locate this machine) Alarm LED – Red (when signal is error) HDD LED – Yellow (when HDD is busy) LAN1、LAN2 LED – Green (when internet is busy)
Connectors	Pin header 2.0mm (2x15) *1
Dimension	150(L)x46(W)x1.6(H)mm
Material	FR4 2 layer

Table 36.LED Board System Connector(J1A1)

Pin NO.	Descriptions	Pin NO.	Descriptions
1	POWER LED +	2	VCC (3.3V)
3	KEY PIN	4	UID LED +
5	POWER LED -	6	UID LED -
7	HDD LED +	8	NC
9	HDD LED -	10	ALARM_LED
11	POWER SW +	12	LAN1 LED +
13	GND	14	LAN1 LED -
15	RESET SW +	16	I2C_SDA
17	GND	18	I2C_SCL
19	UID SW +	20	CHAS_INTR
21	NC	22	LAN2 LED +
23	NC	24	LAN2 LED -
25	KEY PIN	26	KEY PIN
27	NC	28	NC
29	NC	30	NC



NOTE: The Status LED is controlled by the BMC but the BIOS informs the BMC of the state to which the Status LED should be set.

The BMC-detected states are included in the LED states. For fault states that are monitored by the BMC sensors, the contribution to the LED state follows the associated sensor state, with priority

given to the most critical asserted state.
When the server is powered down (transitions to the DC-off state), the BMC is still on standby power and retains the sensor and front panel status LED state established before the power-down event.

When AC power is first applied to the system, the status LED turns solid blue and then immediately changes to extinguish to indicate that the power is failure.

7. PCIe* Riser Card Support

The system includes a riser card slot on the server board. This section will provide an overview and description of the server board features and architecture supporting it.

NOTE: The riser card slot is specifically designed to support riser cards only. Attempting to install a PCIe* add-in card directly into a riser card slot on the server board may damage the server board, the add-in card, or both.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

The system supports a single slot PCIe* x16 (16 lanes, x16 slot) riser card. The riser card is mounted to a bracket assembly which is inserted into the riser card slot on the server board.

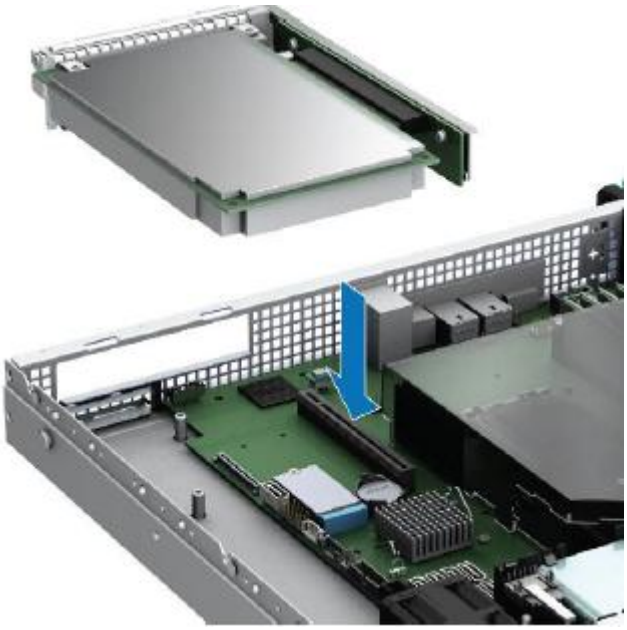


Figure 41. Add-in Card Support

The riser card assembly has support for a single full height, half-length PCIe* add-in card.

NOTE: Add-in cards that exceed the PCI specification for ½ length PCI add-in cards (167.65mm or 6.6in) may interfere with other installed devices on the server board.

Figure 42. Riser Card Assembly

8. Intel® I/O Module Support

To broaden the standard on-board feature set, the server board provides support for one of several available Intel® I/O Module options. The I/O module attaches to a high density 80-pin connector on the server board (labeled “IO_Module”) and is supported by x8 PCIe Gen3 signals from the IIO module of the CPU 1 processor.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

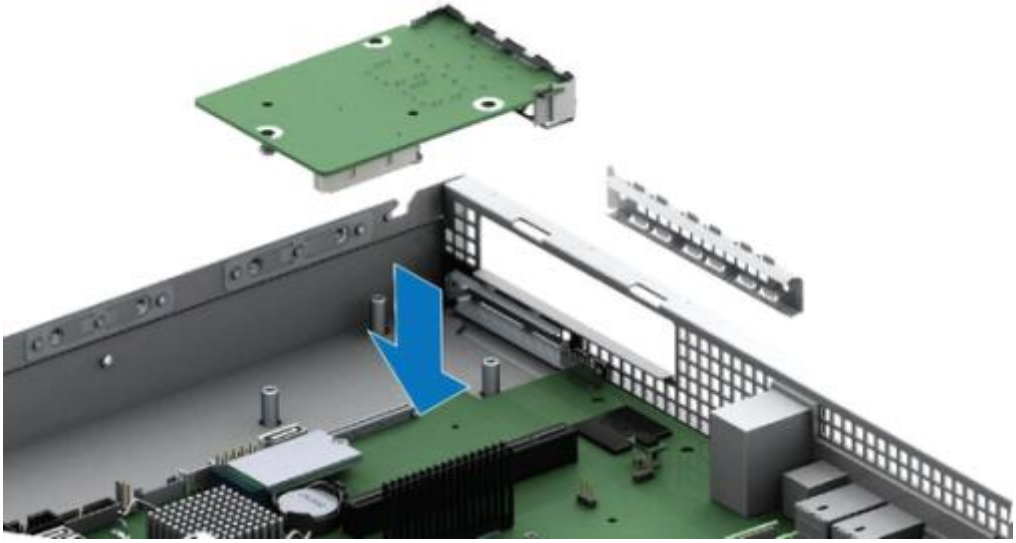


Figure 43. Intel ® I/O Module Placement

Supported I/O modules include:

Table 37. Supported Intel® I/O Modules

Intel Product Code	Description
Intel®I/O Module AXX10GBTWLIOM3	Dual RJ-45 port 10GBASE-T I/O expansion module, based on Intel®Ethernet Controller X540
Intel®I/O Module AXX10GBNIAIOM	Dual SFP+ port 10GbEIO module based on Intel®82599 10 Gigabit Ethernet Controller
Intel®I/O Module AXX4P1GBPWLIOM	Quad port 1GbE I/O expansion module based on Intel®Ethernet Controller I350

9. Basic and Advanced Server Management Features

The integrated BMC has support for basic and advanced server management features. Basic management features are available by default. Advanced management features are enabled with the addition of an optionally installed Remote Management Module 4 Lite (RMM4 Lite) key.

BEFORE YOU BEGIN

WARNING: Before working with your server product, observe the safety and ESD precautions found in the Warnings section at the beginning of this manual.

Table 38. Intel®Remote Management Module 4 (RMM4) Options

Intel Product Code	Description	Kit Contents	Benefits
AXXRMM4LITE	Intel®Remote Management Module 4 Lite	RMM4 Lite Activation Key	Enables KVM & media redirection

When the BMC FW initializes, it attempts to access the Intel®RMM4 lite. If the attempt to access Intel®RMM4 lite is successful, then the BMC activates the Advanced features.

The following table identifies both Basic and Advanced server management features.

Table 39. Basic and Advanced Server Management Features Overview

Feature	Basic	Advanced w/RMM4 Lite Key
IPMI 2.0 Feature Support	X	X
In-circuit BMCFirmware Update	X	X
FRB 2	X	X
Chassis Intrusion Detection	X	X
Fan Redundancy Monitoring	X	X
Hot-Swap Fan Support	X	X
Acoustic Management	X	X
Diagnostic Beep Code Support	X	X
Power State Retention	X	X
ARP/DHCP Support	X	X
PECI Thermal Management Support	X	X
E-mail Alerting	X	X
Embedded Web Server	X	X
SSH Support	X	X
Integrated KVM		X
Integrated Remote Media Redirection		X
Lightweight Directory Access Protocol (LDAP)	X	X
Intel®Intelligent Power Node Manager Support	X	X
SMASH CLP	X	X

9.1 IPMI 2.0 Features

- Baseboard management controller (BMC)
- IPMI Watchdog timer
- Messaging support, including command bridging and user/session support
- Chassis device functionality, including power/reset control and BIOS boot flags support
- Event receiver device: The BMC receives and processes events from other platform subsystems.
- Field Replaceable Unit (FRU) inventory device functionality: The BMC supports access to system FRU devices using IPMI FRU commands.
- System Event Log (SEL) device functionality: The BMC supports and provides access to a SEL.
- Sensor Data Record (SDR) repository device functionality: The BMC supports storage and access of system SDRs.
- Sensor device and sensor scanning/monitoring: The BMC provides IPMI management of sensors. It polls sensors to monitor and report system health.
- IPMI interfaces
  - Host interfaces including system management software (SMS) with receive message queue support, and server management mode (SMM)
  - IPMB interface
  - LAN interface that supports the IPMI-over-LAN protocol Remote Management Control Protocol(RMCP, RMCP+)
- Serial-over-LAN (SOL)
- ACPI state synchronization: The BMC tracks ACPI state changes that are provided by the BIOS.
- BMC self-test: The BMC performs initialization and run-time self-tests and makes results available to external entities.

Please refer to the *Intelligent Platform Management Interface Specification Second Generation v2.0* for more details.

9.2 Non-IPMI Features

The BMC supports the following non-IPMI features. This list does not preclude support for future enhancements or additions.

- In-circuit BMC firmware update
- Fault resilient booting (FRB): FRB2 is supported by the watchdog timer functionality.
- Chassis intrusion detection
- Basic fan speed control using Chenbro customized 2 SDRs
- Fan redundancy monitoring and support
- Power supply redundancy monitoring and support
- Hot-swap fan support
- Acoustic management: Support for multiple fan profiles
- Signal testing support:The BMCprovides test commands for setting and getting platform signal states.
- The BMCgenerates diagnostic beep codes for fault conditions.
- System GUID storage and retrieval

- Front panel management: The BMC controls the system status LED and chassis ID LED. It supports secure lockout of certain front panel functionality and monitors button presses.The chassis ID LED is turned on using a front panel button or a command.
- Power state retention
- Power fault analysis
- Intel® Light-Guided Diagnostics
- Power unit management: Support for power unit sensor. The BMC handles power-good dropout conditions.
- DIMM temperature monitoring: New sensors and improved acoustic management using closed-loop fan control algorithm taking into account DIMM temperature readings.
- Address Resolution Protocol (ARP): The BMC sends and responds to ARPs (supported on embedded NICs).
- Dynamic Host Configuration Protocol (DHCP): The BMC performs DHCP (supported on embedded NICs).
- Platform environment control interface (PECI) thermal management support
- E-mail alerting
- Embedded web server:
- Integrated KVM
- Integrated Remote Media Redirection
- Lightweight Directory Access Protocol (LDAP) support
- Intel® Intelligent Power Node Manager support

On the server board the Intel®RMM4 Lite key is installed at the following location.

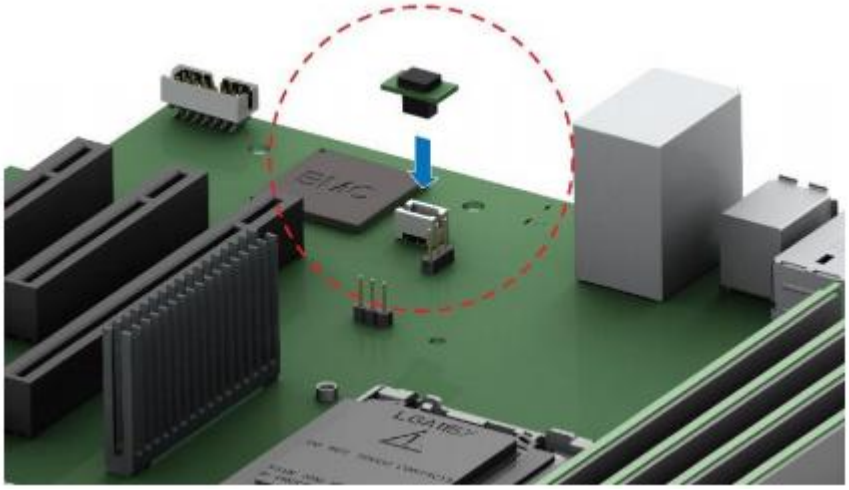


Figure 44. Intel® RMM4 Lite Activation Key Lnstallation

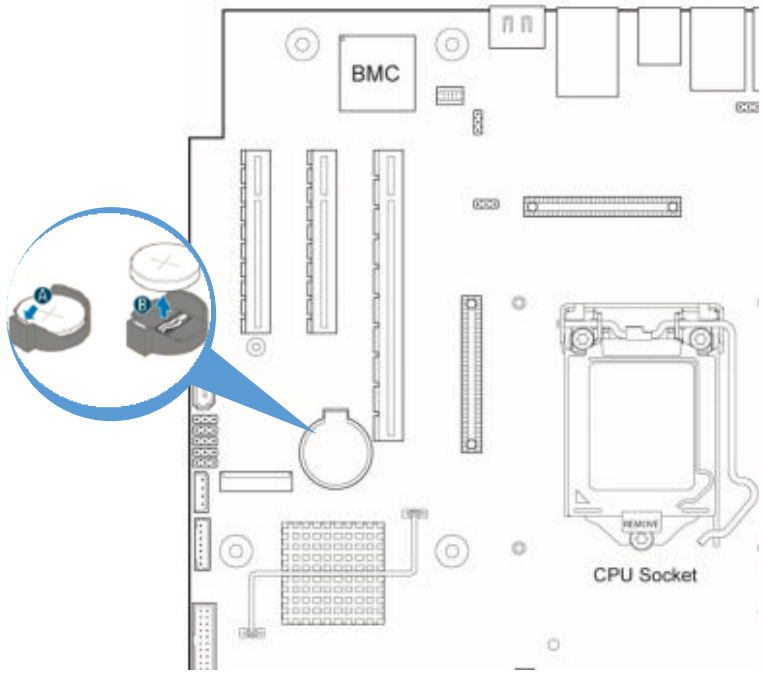


Figure 45. Replacing the Backup Battery

A:Gently press the metal clip as shown to release the battery

B:Remove the battery from the plastic socket

WARNING: RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

9.2.1 Dedicated Management Port

The server board includes a dedicated 1GbE RJ45 Management Port. The management port is active with or without the RMM4 Lite key installed.

9.2.2 Embedded Web Server

BMC Base manageability provides an embedded web server and an OEM-customizable web GUI which exposes the manageability features of the BMC base feature set. It is supported over all on-board NICs that have management connectivity to the BMC as well as an optional dedicated add-in management NIC. At least two concurrent web sessions from up to two different users is supported. The embedded web user interface shall support the following client web browsers:

- Microsoft Internet Explorer 9.0*
- Microsoft Internet Explorer 10.0*
- Mozilla Firefox 24*
- Mozilla Firefox 25*

The embedded web user interface supports strong security (authentication, encryption, and firewall support) since it enables remote server configuration and control. The user interface presented by the embedded web user interface, shall authenticate the user before allowing a web session to be initiated. Encryption using 128-bit SSL is supported. User authentication is based on user id and password.

The GUI presented by the embedded web server authenticates the user before allowing a web session to be initiated. It presents all functions to all users but grays-out those functions that the user does not have privilege to execute. For example, if a user does not have privilege to power

control, then the item shall be displayed in grey-out font in that user's UI display. The web GUI also provides a launch point for some of the advanced features, such as KVM and media redirection. These features are grayed out in the GUI unless the system has been updated to support these advanced features. The embedded web server only displays US English or Chinese language output.

Additional features supported by the web GUI includes:

- Presents all the Basic features to the users
- Power on/off/reset the server and view current power state
- Displays BIOS, BMC, MEand SDRversion information
- Display overall system health.
- Configuration of various IPMI over LAN parameters for both IPV4 and IPV6
- Configuration of alerting (SNMP and SMTP)
- Display system asset information for the product, board, and chassis.
- Display of BMC-owned sensors (name, status, current reading, enabled thresholds), including color-code status of sensors.
- Provides ability to filter sensors based on sensor type (Voltage, Temperature, Fan and Power supply related)
- Automatic refresh of sensor data with a configurable refresh rate
- On-line help
- Display/clear SEL (display is in easily understandable human readable format)
- Supports major industry-standard browsers (Microsoft Internet Explorer* and Mozilla Firefox*)
- The GUI session automatically times-out after a user-configurable inactivity period. By default, this inactivity period is 30 minutes.
- Embedded Platform Debug feature - Allow the user to initiate a "debug dump" to a file that can be sent to Intel for debug purposes.
- Virtual Front Panel. The Virtual Front Panel provides the same functionality as the local front panel.The displayed LEDs match the current state of the local panel LEDs. The displayed buttons (for example, power button) can be used in the same manner as the local buttons.
- Display of ME sensor data. Only sensors that have associated SDRs loaded will be displayed.
- Ability to save the SEL to a file
- Ability to force HTTPS connectivity for greater security. This is provided through a configuration option in the UI.
- Display of processor and memory information as is available over IPMI over LAN.
- Ability to get and set Node Manager (NM) power policies
- Display of power consumed by the server
- Ability to view and configure VLAN settings
- Warn user the reconfiguration of IP address will cause disconnect.
- Capability to block logins for a period of time after several consecutive failed login attempts. The lock-out period and the number of failed logins that initiates the lock-out period are configurable by the user.
- Server Power Control – Ability to force into Setup on a reset
- System POST results – The web server provides the system's Power-On Self-Test (POST)

sequence for the previous two boot cycles, including timestamps. The timestamps may be viewed in relative to the start of POST or the previous POST code.

- Customizable ports – The web server provides the ability to customize the port numbers used for SMASH, http, https, KVM, secure KVM, remote media, and secure remote media.

For additional information, reference the Intel®Remote Management Module 4 and Integrated BMC Web Console Users Guide.

9.2.3 Advanced Management Feature Support (RMM4 Lite)

The integrated baseboard management controller has support for advanced management features which are enabled when an optional Intel®Remote Management Module 4 Lite (RMM4 Lite) is installed. The Intel RMM4 add-on offers convenient, remote KVM access and control through LAN and internet. It captures, digitizes, and compresses video and transmits it with keyboard and mouse signals to and from a remote computer. Remote access and control software runs in the integrated baseboard management controller, utilizing expanded capabilities enabled by the Intel RMM4 hardware.

Key Features of the RMM4 add-on are:

- KVM redirection from either the dedicated management NIC or the server board NICs used for management traffic; up to two KVM sessions
- Media Redirection – The media redirection feature is intended to allow system administrators orusers to mount a remote IDE or USB CDROM, floppy drive, or a USB flash disk as a remote device to the server. Once mounted, the remote device appears just like a local device to the server allowing system administrators or users to install software (including operating systems), copy files, update BIOS, or boot the server from this device.
- KVM – Automatically senses video resolution for best possible screen capture, high performancemouse tracking and synchronization. It allows remote viewing and configuration in pre-boot POST and BIOS setup.

9.2.3.1 Keyboard, Video, Mouse (KVM) Redirection

The BMC firmware supports keyboard, video, and mouse redirection (KVM) over LAN. This feature is available remotely from the embedded web server as a Java applet. This feature is only enabled when the Intel®RMM4 lite is present. The client system must have a Java Runtime Environment (JRE) version 6.0 or later to run the KVM or media redirection applets.

The BMC supports an embedded KVM application (Remote Console) that can be launched from the embedded web server from a remote console. USB1.1 or USB 2.0 based mouse and keyboard redirection are supported. It is also possible to use the KVM-redirection (KVM-r) session concurrently with media-redirection (media-r). This feature allows a user to interactively use the keyboard, video, and mouse (KVM) functions of the remote server as if the user were physically at the managed server. KVM redirection console supports the following keyboard layouts: English, Dutch, French, German, Italian, Russian, and Spanish.

KVM redirection includes a “soft keyboard” function. The “soft keyboard” is used to simulate an entire keyboard that is connected to the remote system. The “soft keyboard” functionality supports the following layouts: English, Dutch, French, German, Italian, Russian, and Spanish.

The KVM-redirection feature automatically senses video resolution for best possible screen capture and provides high-performance mouse tracking and synchronization. It allows remote viewing and configuration in pre-boot POST and BIOS setup, once BIOS has initialized video.

Other attributes of this feature include:

- Encryption of the redirected screen, keyboard, and mouse
- Compression of the redirected screen.
- Ability to select a mouse configuration based on the OS type.
- Supports user definable keyboard macros.

KVM redirection feature supports the following resolutions and refresh rates:

- 640x480 at 60Hz, 72Hz, 75Hz, 85Hz, 100Hz
- 800x600 at 60Hz, 72Hz, 75Hz, 85Hz
- 1024x768 at 60Hx, 72Hz, 75Hz, 85Hz
- 1280x960 at 60Hz
- 1280x1024 at 60Hz
- 1600x1200 at 60Hz
- 1920x1080 (1080p),
- 1920x1200 (WUXGA)
- 1650x1080 (WSXGA+)

9.2.3.2 Remote Console

The Remote Console is the redirected screen, keyboard and mouse of the remote host system. To use the Remote Console window of your managed host system, the browser must include a Java* Runtime Environment plug-in. If the browser has no Java support, such as with a small handheld device, the user can maintain the remote host system using the administration forms displayed by the browser.

The Remote Console window is a Java Applet that establishes TCP connections to the BMC. The protocol that is run over these connections is a unique KVM protocol and not HTTP or HTTPS. This protocol uses ports #7578 for KVM, #5120 for CDROM media redirection, and #5123 for Floppy/USB media redirection. When encryption is enabled, the protocol uses ports #7582 for KVM, #5124 for CDROM media redirection, and #5127 for Floppy/USB media redirection. The local network environment must permit these connections to be made, that is, the firewall and, in case of a private internal network, the NAT (Network Address Translation) settings have to be configured accordingly.

9.2.3.3 Performance

The remote display accurately represents the local display. The feature adapts to changes to the video resolution of the local display and continues to work smoothly when the system transitions from graphics to text or vice-versa. The responsiveness may be slightly delayed depending on the bandwidth and latency of the network.

Enabling KVM and/or media encryption will degrade performance. Enabling video compression provides the fastest response while disabling compression provides better video quality.

For the best possible KVM performance, a 2Mb/sec link or higher is recommended.

The redirection of KVM over IP is performed in parallel with the local KVM without affecting the local KVM operation.

9.2.3.4 Security

The KVM redirection feature supports multiple encryption algorithms, including RC4 and AES. The actual algorithm that is used is negotiated with the client based on the client's capabilities.

9.2.3.5 Availability

The remote KVM session is available even when the server is powered-off (in stand-by mode). No re-start of the remote KVM session shall be required during a server reset or power on/off. A BMC reset (for example, due to a BMC Watchdog initiated reset or BMC reset after BMC FW update) will require the session to be re- established.

KVM sessions persist across system reset, but not across an AC power loss.

9.2.3.6 Usage

As the server is powered up, the remote KVM session displays the complete BIOS boot process. The user is able interact with BIOS setup, change and save settings as well as enter and interact with option ROM configuration screens.

At least two concurrent remote KVM sessions are supported. It is possible for at least two different users to connect to same server and start remote KVM sessions.

9.2.3.7 Force-enter BIOS Setup

KVM redirection can present an option to force-enter BIOS Setup. This enables the system to enter F2 setup while booting which is often missed by the time the remote console redirects the video.

9.2.3.8 Media Redirection

The embedded web server provides a Java applet to enable remote media redirection. This may be used in conjunction with the remote KVM feature, or as a standalone applet.

The media redirection feature is intended to allow system administrators or users to mount a remote IDE or USB CD-ROM, floppy drive, or a USB flash disk as a remote device to the server. Once mounted, the remote device appears just like a local device to the server, allowing system administrators or users to install software (including operating systems), copy files, update BIOS, and so on, or boot the server from this device.

TPS The following capabilities are supported:

- The operation of remotely mounted devices is independent of the local devices on the server. Both remote and local devices are useable in parallel.
- Either IDE (CD-ROM, floppy) or USB devices can be mounted as a remote device to the server.
- It is possible to boot all supported operating systems from the remotely mounted device and to boot from disk IMAGE (*.IMG) and CD-ROM or DVD-ROM ISO files. See the Tested/supported Operating System List (Table 3) for more information.
- Media redirection supports redirection for both a virtual CD device and a virtual Floppy/USB device concurrently. The CD device may be either a local CD drive or else an ISO image file; the Floppy/USB device may be a local Floppy drive, a local USB device, or a disk image file.
- The media redirection feature supports multiple encryption algorithms, including RC4 and AES. The actual algorithm that is used is negotiated with the client based on the client's capabilities.
- A remote media session is maintained even when the server is powered-off (in standby mode). No restart of the remote media session is required during a server reset or power on/off. An BMC reset (for example, due to an BMC reset after BMC FW update) will require the session to be re-established
- The mounted device is visible to (and useable by) managed system's OS and BIOS in both pre-boot and post-boot states.
- The mounted device shows up in the BIOS boot order and it is possible to change the

BIOS boot order to boot from this remote device.

- It is possible to install an operating system on a bare metal server (no OS present) using the remotely mounted device. This may also require the use of KVM-r to configure the OS during install.

USB storage devices will appear as floppy disks over media redirection. This allows for the installation of device drivers during OS installation.

If either a virtual IDE or virtual floppy device is remotely attached during system boot, both the virtual IDE and virtual floppy are presented as bootable devices. It is not possible to present only a single-mounted device type to the system BIOS.

Availability

The default inactivity timeout is 30 minutes and is not user-configurable. Media redirection sessions persist across system reset but not across an AC power loss or BMC reset.

Network Port Usage

The KVM and media redirection features use the following ports:

- 5120 – CD Redirection
- 5123 – FD Redirection
- 5124 – CD Redirection (Secure)
- 5127 – FD Redirection (Secure)
- 7578 – Video Redirection
- 7582 – Video Redirection (Secure)

For additional information, reference the Intel®Remote Management Module 4 and Integrated BMC Web Console Users Guide.

Appendix A: Integration and Usage Tips

This section provides a list of useful information that is unique to the Chenbro RM14604/08 and should be kept in mind while configuring your server system.

- When adding or removing components or peripherals from the server board,you must remove the AC power cord. With ACpower plugged into the server board,5-V standby is still present even though the server board is powered off.

- This server board supports the Intel® Xeon® Processor E3-1200 V5 product family with a Thermal Design Power (TDP) of up to and including 80 Watts. Previous generation Intel®Xeon® processors are not supported.

- On the back edge of the server board are EIGHT (2 rows of 4) diagnostic LEDs that display a sequence of POST codes during the boot process. If the server board hangs during POST, the LEDs display the last POST event run before the hang.

- Only ECC Unbuffered DDR4 DIMMs (UDIMMs) are supported on this Product Family.

- Clear CMOS with the AC power cord plugged in. Removing AC power before performing the CMOS Clear operation causes the system to automatically power up and immediately power down after the CMOS Clear procedure is followed and AC power is re-applied. If this happens, remove the AC power cord, wait 30 seconds, and then re-connect the AC power cord. Power up the system and proceed to the <F2> BIOS Setup Utility to reset the desired settings.

- Normal BMCfunctionality is disabled with the Force BMCUpdate jumper set to the “enabled” position (pins 2-3). You should never run the server with the Force BMCUpdate jumper set in this position and should only use the jumper in this position when the standard firmware update process fails. This jumper must remain in the default (disabled) position (pins 1-2) when the server is running normally.

- Make sure the recovery jumper is placed on pins 1-2, before a normal BIOS update procedure.

Appendix B: POST Code Diagnostic LED Decoder

As an aid to assist in trouble shooting a system hang that occurs during a system's Power-On Self-est (POST) process, the server board includes a bank of eight (2 rows of 4) POST Code Diagnostic LEDs on the back edge of the server board.

During the system boot process, Memory Reference Code (MRC) and System BIOS execute a number of memory initialization and platform configuration processes, each of which is assigned a specific hex POST code number. As each routine is started, the given POST code number is displayed to the POST Code Diagnostic LEDs on the back edge of the server board.

During a POST system hang, the displayed post code can be used to identify the last POST routine that was run prior to the error occurring, helping to isolate the possible cause of the hang condition.

Each POST code is represented by eight LEDs; four Green and four Amber. The POST codes are divided into two groups, an upper nibble and a lower nibble. The upper nibble bits are represented by Amber Diagnostic LEDs #4, #5, #6, #7. The lower nibble bits are represented by Green Diagnostics LEDs #0, #1, #2 and #3. If the bit is set in the upper and lower nibbles, the corresponding LED is lit. If the bit is clear, the corresponding LED is off.

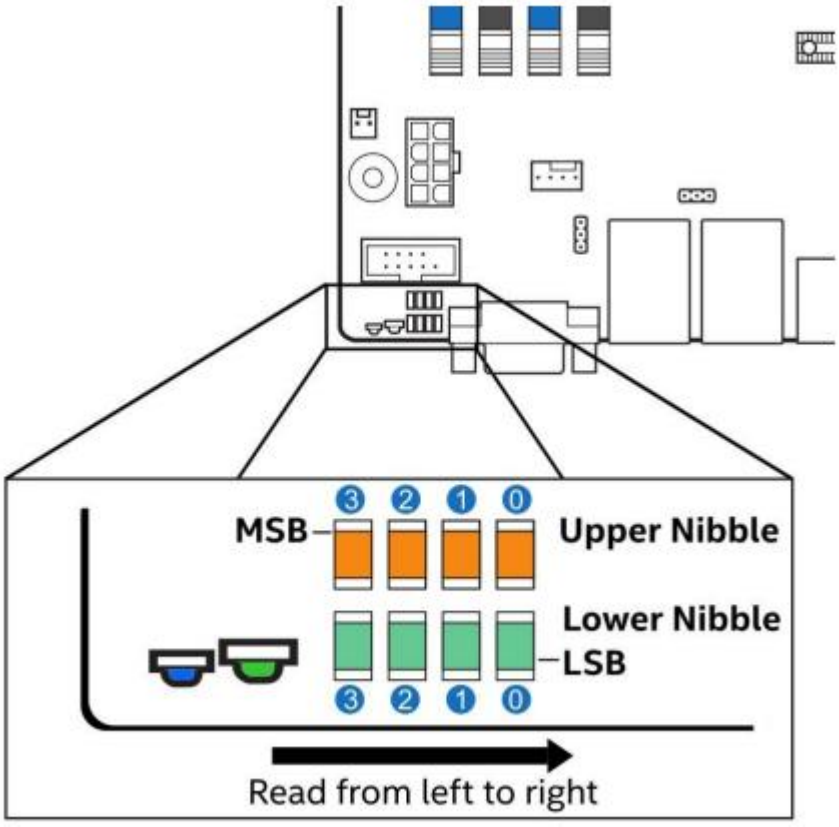


Figure 46. POST Diagnostic LED Location

In the following example, the BIOS sends a value of ACh to the diagnostic LED decoder. The LEDs are decoded as follows:

Table 40.POST Progress Code LED Example

	LED #3 8h (MSB)	LED #2 4h	LED #1 2h	LED #0 1h (LSB)	
LED Status	ON	off	ON	off	Upper Nibble: Ah
	ON	ON	off	off	Lower Nibble: Ch
	8h (MSB) LED #3	4h LED #2	2h LED #1	1h (LSB) LED #0	POST CODE: ACh

Note: Upper nibble bits = 1010b = Ah; Lower nibble bits = 1100b = Ch; the two are concatenated as ACh

The following table provides a list of all POST progress codes.

Table 41.POST Progress Codes

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
SEC Phase						
01h	Upper Nibble	off	off	off	off	First POST code after CPU reset
	Lower Nibble	off	off	off	ON	
02h	Upper Nibble	off	off	off	off	Microcode load begin
	Lower Nibble	off	off	ON	off	
03h	Upper Nibble	off	off	off	off	CRAM initialization begin
	Lower Nibble	off	off	ON	ON	
04h	Upper Nibble	off	off	off	off	Pei Cache When Disabled
	Lower Nibble	off	ON	off	off	
05h	Upper Nibble	off	off	off	off	SEC Core At Power On Begin.
	Lower Nibble	off	ON	off	ON	
06h	Upper Nibble	off	off	off	off	Early CPU initialization during Sec Phase.
	Lower Nibble	off	ON	ON	off	
07h	Upper Nibble	off	off	off	off	Early SB initialization during Sec Phase.
	Lower Nibble	off	ON	ON	ON	
08h	Upper Nibble	off	off	off	off	Early NB initialization during Sec Phase.
	Lower Nibble	ON	off	off	off	

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
09h	Upper Nibble	off	off	off	off	End Of Sec Phase.
	Lower Nibble	ON	off	off	ON	
0Eh	Upper Nibble	off	off	off	off	Microcode Not Found.
	Lower Nibble	ON	ON	ON	off	
0Fh	Upper Nibble	off	off	off	off	Microcode Not Loaded.
	Lower Nibble	ON	ON	ON	ON	
PEI Phase						
10h	Upper Nibble	off	off	off	ON	PEI Core
	Lower Nibble	off	off	off	off	
11h	Upper Nibble	off	off	off	ON	CPU PEIM
	Lower Nibble	off	off	off	ON	
15h	Upper Nibble	off	off	off	ON	NB PEIM
	Lower Nibble	off	ON	off	ON	
19h	Upper Nibble	off	off	off	ON	SB PEIM
	Lower Nibble	ON	off	off	ON	
MRC Process Codes – MRC Progress Code Sequence is executed						
PEI Phase continued...						
31h	Upper Nibble	off	off	ON	ON	Memory Installed
	Lower Nibble	off	off	off	ON	
32h	Upper Nibble	off	off	ON	ON	CPU PEIM (Cpu Init)
	Lower Nibble	off	off	ON	off	
33h	Upper Nibble	off	off	ON	ON	CPU PEIM (Cache Init)
	Lower Nibble	off	off	ON	ON	
4Fh	Upper Nibble	off	ON	off	off	Dxe IPL started
	Lower Nibble	ON	ON	ON	ON	
DXE Phase						
60h	Upper Nibble	off	ON	ON	off	DXE Core started
	Lower Nibble	off	off	off	off	
61h	Upper Nibble	off	ON	ON	off	DXE NVRAM Init
	Lower Nibble	off	off	off	ON	
62h	Upper Nibble	off	ON	ON	off	SB RUN Init
	Lower Nibble	off	off	ON	off	

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
63h	Upper Nibble	off	ON	ON	off	DXE CPU Init
	Lower Nibble	off	off	ON	ON	
65h	Upper Nibble	off	ON	ON	off	DXE CPU BSP Select
	Lower Nibble	off	ON	off	ON	
66h	Upper Nibble	off	ON	ON	off	DXE CPU AP Init
	Lower Nibble	off	ON	ON	off	
68h	Upper Nibble	off	ON	ON	off	DXE PCI Host Bridge Init
	Lower Nibble	ON	off	off	off	
69h	Upper Nibble	off	ON	ON	off	DXE NB Init
	Lower Nibble	ON	off	off	ON	
6Ah	Upper Nibble	off	ON	ON	off	DXE NB SMM Init
	Lower Nibble	ON	off	ON	off	
70h	Upper Nibble	off	ON	ON	ON	DXE SB Init
	Lower Nibble	off	off	off	off	
71h	Upper Nibble	off	ON	ON	ON	DXE SB SMM Init
	Lower Nibble	off	off	off	ON	
72h	Upper Nibble	off	ON	ON	ON	DXE SB devices Init
	Lower Nibble	off	off	ON	off	
78h	Upper Nibble	off	ON	ON	ON	DXE ACPI Init
	Lower Nibble	ON	off	off	off	
79h	Upper Nibble	off	ON	ON	ON	DXE CSM Init
	Lower Nibble	ON	off	off	ON	
80h	Upper Nibble	ON	off	off	off	DXE BDS Started
	Lower Nibble	off	off	off	off	
81h	Upper Nibble	ON	off	off	off	DXE BDS connect drivers
	Lower Nibble	off	off	off	ON	
82h	Upper Nibble	ON	off	off	off	DXE PCI Bus begin
	Lower Nibble	off	off	ON	off	
83h	Upper Nibble	ON	off	off	off	DXE PCI Bus HPC Init
	Lower Nibble	off	off	ON	ON	
84h	Upper Nibble	ON	off	off	off	DXE PCI Bus enumeration
	Lower Nibble	off	ON	off	off	

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
85h	Upper Nibble	ON	off	off	off	DXE PCI Bus resource requested
	Lower Nibble	off	ON	off	ON	
86h	Upper Nibble	ON	off	off	off	DXE PCI Bus assign resource
	Lower Nibble	off	ON	ON	off	
87h	Upper Nibble	ON	off	off	off	DXE CON_OUT connect
	Lower Nibble	off	ON	ON	ON	
88h	Upper Nibble	ON	off	off	off	DXE CON_IN connect
	Lower Nibble	ON	off	off	off	
89h	Upper Nibble	ON	off	off	off	DXE SIO Init
	Lower Nibble	ON	off	off	ON	
8A	Upper Nibble	ON	off	off	off	DXE USB start
	Lower Nibble	ON	off	ON	off	
8B	Upper Nibble	ON	off	off	off	DXE USB reset
	Lower Nibble	ON	off	ON	ON	
8C	Upper Nibble	ON	off	off	off	DXE USB detect
	Lower Nibble	ON	ON	off	off	
8D	Upper Nibble	ON	off	off	off	DXE USB enable
	Lower Nibble	ON	ON	off	ON	
90h	Upper Nibble	ON	off	off	ON	DXE IDE begin
	Lower Nibble	off	off	off	off	
91h	Upper Nibble	ON	off	off	ON	DXE IDE reset
	Lower Nibble	off	off	off	ON	
92h	Upper Nibble	ON	off	off	ON	DXE IDE detect
	Lower Nibble	off	off	ON	off	
93h	Upper Nibble	ON	off	off	ON	DXE IDE enable
	Lower Nibble	off	off	ON	ON	
94h	Upper Nibble	ON	off	off	ON	DXE SCSI begin
	Lower Nibble	off	ON	off	off	
95h	Upper Nibble	ON	off	off	ON	DXE SCSI reset
	Lower Nibble	off	ON	off	ON	
96h	Upper Nibble	ON	off	off	ON	DXE SCSI detect
	Lower Nibble	off	ON	ON	off	

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	Description
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
MRC Progress Codes						
B0h	Upper Nibble	ON	off	ON	ON	Detect DIMM population
	Lower Nibble	off	off	off	off	
B1h	Upper Nibble	ON	off	ON	ON	Set DDR4 frequency
	Lower Nibble	off	off	off	ON	
B2h	Upper Nibble	ON	off	ON	ON	Gather remaining SPD data
	Lower Nibble	off	off	ON	off	
B3h	Upper Nibble	ON	off	ON	ON	Program registers on the memory controller level
	Lower Nibble	off	off	ON	ON	
B4h	Upper Nibble	ON	off	ON	ON	Evaluate RAS modes and save rank information
	Lower Nibble	off	ON	off	off	
B5h	Upper Nibble	ON	off	ON	ON	Program registers on the channel level
	Lower Nibble	off	ON	off	ON	
B6h	Upper Nibble	ON	off	ON	ON	Perform the JEDEC defined initialization sequence
	Lower Nibble	off	ON	ON	off	
B7h	Upper Nibble	ON	off	ON	ON	Train DDR4 ranks
	Lower Nibble	off	ON	ON	ON	
B8h	Upper Nibble	ON	off	ON	ON	Initialize CLTT/OLTT
	Lower Nibble	ON	off	off	off	
B9h	Upper Nibble	ON	off	ON	ON	Hardware memory test and init
	Lower Nibble	ON	off	off	ON	
BAh	Upper Nibble	ON	off	ON	ON	Execute software memory init
	Lower Nibble	ON	off	ON	off	
BBh	Upper Nibble	ON	off	ON	ON	Program memory map and interleaving
	Lower Nibble	ON	off	ON	ON	
BCh	Upper Nibble	ON	off	ON	ON	Program RAS configuration
	Lower Nibble	ON	ON	off	off	
BFh	Upper Nibble	ON	off	ON	ON	MRC is done
	Lower Nibble	ON	ON	ON	ON	

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	Description
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
MRC Fatal Error Codes						
E8h	Upper Nibble	ON	ON	ON	off	No usable memory error 01h = No memory was detected from the SPD read, or invalid config that causes no operable memory.
	Lower Nibble	ON	off	off	off	02h = Memory DIMMs on all channels of all sockets are disabled due to hardware mem-test error. 3h = No memory installed. All channels are disabled.
E9h	Upper Nibble	ON	ON	ON	off	Memory is locked by Intel® Trusted Execution Technology and is inaccessible
	Lower Nibble	ON	off	off	ON	
EAh	Upper Nibble	ON	ON	ON	off	DDR4 channel training error 01h = Error on read DQ/DQS (Data/Data Strobe) init 02h = Error on Receive Enable
	Lower Nibble	ON	off	ON	off	3h = Error on Write Leveling 04h = Error on write DQ/DQS (Data/Data Strobe
EBh	Upper Nibble	ON	ON	ON	off	Memory test failure 01h = Software mem-test failure. 02h = Hardware mem-test failed.
	Lower Nibble	ON	off	ON	ON	03h = Hardware Mem-test failure in Lockstep Channel mode requiring a channel to be disabled. This is a fatal error which requires a reset and calling MRC with a different RAS mode to retry.

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
S3 Resume						
40h	Upper Nibble	off	ON	off	off	S3 Resume PEIM (S3 started)
	Lower Nibble	off	off	off	off	
41h	Upper Nibble	off	ON	off	off	S3 Resume PEIM (S3 boot script)
	Lower Nibble	off	off	off	ON	
42h	Upper Nibble	off	ON	off	off	S3 Resume PEIM (S3 Video Repost)
	Lower Nibble	off	off	ON	off	
43h	Upper Nibble	off	ON	off	off	S3 Resume PEIM (S3 OS wake)
	Lower Nibble	off	off	ON	ON	
BIOS Recovery						
46h	Upper Nibble	off	ON	off	off	PEIM which detected forced Recovery condition
	Lower Nibble	off	ON	ON	off	
47h	Upper Nibble	off	ON	off	off	PEIM which detected User Recovery condition
	Lower Nibble	off	ON	ON	ON	
48h	Upper Nibble	off	ON	off	off	Recovery PEIM (Recovery started)
	Lower Nibble	ON	off	off	off	
49h	Upper Nibble	off	ON	off	off	Recovery PEIM (Capsule found)
	Lower Nibble	ON	off	off	ON	
4Ah	Upper Nibble	off	ON	off	off	Recovery PEIM (Capsule loaded)
	Lower Nibble	ON	off	ON	off	

POST Memory Initialization MRC Diagnostic Codes

There are two types of POST Diagnostic Codes displayed by the MRC during memory initialization; Progress Codes and Fatal Error Codes.

The MRC Progress Codes are displays to the Diagnostic LEDs that show the execution point in the MRC operational path at each step.

Table 42.MRC Progress Codes

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	Description
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
MRC Progress Codes						
B0h	Upper Nibble	ON	off	ON	ON	Detect DIMM population
	Lower Nibble	off	off	off	off	
B1h	Upper Nibble	ON	off	ON	ON	Set DDR4 frequency
	Lower Nibble	off	off	off	ON	
B2h	Upper Nibble	ON	off	ON	ON	Gather remaining SPD data
	Lower Nibble	off	off	ON	off	
B3h	Upper Nibble	ON	off	ON	ON	Program registers on the memory controller level
	Lower Nibble	off	off	ON	ON	
B4h	Upper Nibble	ON	off	ON	ON	Evaluate RAS modes and save rank information
	Lower Nibble	off	ON	off	off	
B5h	Upper Nibble	ON	off	ON	ON	Program registers on the channel level
	Lower Nibble	off	ON	off	ON	
B6h	Upper Nibble	ON	off	ON	ON	Perform the JEDEC defined initialization sequence
	Lower Nibble	off	ON	ON	off	
B7h	Upper Nibble	ON	off	ON	ON	Train DDR4 ranks
	Lower Nibble	off	ON	ON	ON	
B8h	Upper Nibble	ON	off	ON	ON	Initialize CLTT/OLTT
	Lower Nibble	ON	off	off	off	
B9h	Upper Nibble	ON	off	ON	ON	Hardware memory test and init
	Lower Nibble	ON	off	off	ON	
BAh	Upper Nibble	ON	off	ON	ON	Execute software memory init
	Lower Nibble	ON	off	ON	off	
BBh	Upper Nibble	ON	off	ON	ON	Program memory map and interleaving
	Lower Nibble	ON	off	ON	ON	
BCh	Upper Nibble	ON	off	ON	ON	Program RAS configuration
	Lower Nibble	ON	ON	off	off	
BFh	Upper Nibble	ON	off	ON	ON	MRC is done
	Lower Nibble	ON	ON	ON	ON	

Memory Initialization at the beginning of POST includes multiple functions, including: discovery, channel training, validation that the DIMM population is acceptable and functional, initialization of the IMC and other hardware settings, and initialization of applicable RAS configurations.

When a major memory initialization error occurs and prevents the system from booting with data

integrity, a beep code is generated, the MRC will display a fatal error code on the diagnostic LEDs, and a system halt command is executed. Fatal MRC error halts do NOT change the state of the System Status LED, and they do NOT get logged as SEL events. The following table lists all MRC fatal errors that are displayed to the Diagnostic LEDs.

Table 43.POST Progress LED Codes

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	Description
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
MRC Fatal Error Codes						
E8h	Upper Nibble	ON	ON	ON	off	No usable memory error 01h = No memory was detected from the SPD read, or invalid config that causes no operable memory.
	Lower Nibble	ON	off	off	off	02h = Memory DIMMs on all channels of all sockets are disabled due to hardware mem-test error. 3h = No memory installed. All channels are disabled.
E9h	Upper Nibble	ON	ON	ON	off	Memory is locked by Intel® Trusted Execution Technology and is inaccessible
	Lower Nibble	ON	off	off	ON	
EAh	Upper Nibble	ON	ON	ON	off	DDR4 channel training error 01h = Error on read DQ/DQS (Data/Data Strobe) init 02h = Error on Receive Enable
	Lower Nibble	ON	off	ON	off	3h = Error on Write Leveling 04h = Error on write DQ/DQS (Data/Data Strobe
EBh	Upper Nibble	ON	ON	ON	off	Memory test failure 01h = Software mem-test failure. 02h = Hardware mem-test failed.
	Lower Nibble	ON	off	ON	ON	03h = Hardware Mem-test failure in Lockstep Channel mode requiring a channel to be disabled. This is a fatal error which requires a reset and calling MRC with a different RAS mode to retry.

Diagnostic LED Decoder						
	LED #	LED 3	LED 2	LED 1	LED 0	Description
Checkpoint	Upper Nibble	8h (MSB)	4h	2h	1h (LSB)	
	Lower Nibble	8h (MSB)	4h	2h	1h (LSB)	
EDh	Upper Nibble	ON	ON	ON	off	DIMM configuration population error
						01h = Different DIMM types (UDIMM, RDIMM, LRDIMM) are detected installed in the system.
						02h = Violation of DIMM population rules.
	Lower Nibble	ON	ON	off	ON	03h = The 3rd DIMM slot cannot be populated when QR DIMMs are installed.
						04h = UDIMMs are not supported in the 3rd DIMM slot.
						05h = Unsupported DIMM Voltage.
EFh	Upper Nibble	ON	ON	ON	off	Indicates a CLTT table structure error
	Lower Nibble	ON	ON	ON	ON	

Appendix C: POST Code Errors

Most error conditions encountered during POST are reported using POST Error Codes. These codes represent specific failures, warnings, or are informational. POST Error Codes may be displayed in the Error Manager Display screen, and are always logged to the System Event Log (SEL). Logged events are available to System Management applications, including Remote and Out of Band (OOB) management.

There are exception cases in early initialization where system resources are not adequately initialized for handling POST Error Code reporting. These cases are primarily Fatal Error conditions resulting from initialization of processors and memory, and they are handed by a Diagnostic LED display with a system halt.

The following table lists the supported POST Error Codes. Each error code is assigned an error type which determines the action the BIOS will take when the error is encountered. Error types include Minor, Major, and Fatal. The BIOS action for each is defined as follows:

- **Minor:** The error message is displayed on the screen or on the Error Manager screen, and an error is logged to the SEL. The system continues booting in a degraded state. The user may want to replace the erroneous unit. The POST Error Pause option setting in the BIOS setup does not have any effect on this error.
- **Major:** The error message is displayed on the Error Manager screen, and an error is logged to the SEL. The POST Error Pause option setting in the BIOS setup determines whether the system pauses to the Error Manager for this type of error so the user can take immediate corrective action or the system continues booting.

  Note that for 0048 “Password check failed”, the system halts, and then after the next reset/reboot will displays the error code on the Error Manager screen.
- **Fatal:** The system halts during post at a blank screen with the text **“Unrecoverable fatal error found.System will not boot until the error is resolved” and “Press <F2> to enter setup”** The POST Error Pause option setting in the BIOS setup does not have any effect with this class of error.

  When the operator presses the F2 key on the keyboard, the error message is displayed on the Error Manager screen, and an error is logged to the SEL with the error code. The system cannot boot unless the error is resolved. The user needs to replace the faulty part and restart the system.

NOTE: The POST error codes in the following table are common to all current generation Intel server platforms. Features present on a given server board/system will determine which of the listed error codes are supported

Table 44.POST Error Codes and Messages

Error Code	Error Message	Response
0012	System RTC date/time not set	Major
0048	Password check failed	Major
0140	PCI component encountered a PERR error	Major
0141	PCI resource conflict	Major
0146	PCI out of resources error	Major
0191	Processor core/thread count mismatch detected	Fatal
0192	Processor cache size mismatch detected	Fatal
0194	Processor family mismatch detected	Fatal

Error Code	Error Message	Response
0195	Processor Intel(R) QPI link frequencies unable to synchronize	Fatal
0196	Processor model mismatch detected	Fatal
0197	Processor frequencies unable to synchronize	Fatal
5220	BIOS Settings reset to default settings	Major
5221	Passwords cleared by jumper	Major
5224	Password clear jumper is Set	Major
8130	Processor 01 disabled	Major
8131	Processor 02 disabled	Major
8160	Processor 01 unable to apply microcode update	Major
8161	Processor 02 unable to apply microcode update	Major
8170	Processor 01 failed Self Test (BIST)	Major
8171	Processor 02 failed Self Test (BIST)	Major
8180	Processor 01 microcode update not found	Minor
8181	Processor 02 microcode update not found	Minor
8190	Watchdog timer failed on last boot	Major
8198	OS boot watchdog timer failure	Major
8300	Baseboard management controller failed self test	Major
8305	Hot Swap Controller failure	Major
83A0	Management Engine (ME) failed self test	Major
83A1	Management Engine (ME) Failed to respond.	Major
84F2	Baseboard management controller failed to respond	Major
84F3	Baseboard management controller in update mode	Major
84F4	Sensor data record empty	Major
84FF	System event log full	Minor
8500	Memory component could not be configured in the selected RAS mode	Major
8501	DIMM Population Error	Major
8520	DIMM_A1 failed test/initialization	Major
8521	DIMM_A2 failed test/initialization	Major
8523	DIMM_B1 failed test/initialization	Major
8524	DIMM_B2 failed test/initialization	Major
8540	DIMM_A1 disabled	Major

8541	DIMM_A2 disabled	Major
8543	DIMM_B1 disabled	Major
8544	DIMM_B2 disabled	Major
8560	DIMM_A1 encountered a Serial Presence Detection (SPD) failure	Major
8561	DIMM_A2 encountered a Serial Presence Detection (SPD) failure	Major
8563	DIMM_B1 encountered a Serial Presence Detection (SPD) failure	Major
8564	DIMM_B2 encountered a Serial Presence Detection (SPD) failure	Major
8604	POST Reclaim of non-critical NVRAM variables	Minor
8605	BIOS Settings are corrupted	Major
8606	NVRAM variable space was corrupted and has been reinitialized	Major
8607	Recovery boot has been initiated. **NOTE:** The Primary BIOS image may be corrupted or the system may hang during POST. A BIOS update is required.	Fatal

Error Code	Error Message	Response
92A3	Serial port component was not detected	Major
92A9	Serial port component encountered a resource conflict error	Major
A000	TPM device not detected.	Minor
A001	TPM device missing or not responding.	Minor
A002	TPM device failure.	Minor
A003	TPM device failed self-test.	Minor
A100	BIOS ACM Error	Major
A421	PCI component encountered a SERR error	Fatal
A5A0	PCI Express component encountered a PERR error	Minor
A5A1	PCI Express component encountered an SERR error	Fatal
A6A0	DXE Boot Services driver: Not enough memory available to shadow a Legacy Option ROM.	Minor

POST Error Beep Codes

The following table lists the POST error beep codes. Prior to system video initialization, the BIOS uses these beep codes to inform users on error conditions. The beep code is followed by a user-visible code on the POST Progress LEDs.

Table 45.POST Error Beep Codes

Beeps	Error Message	POST Progress Code	Description
1	USB device action	N/A	Short beep sounded whenever USB device is discovered in POST, or inserted or removed during runtime.
1 long	Intel® TXT security violation	0xAE, 0xAF	System halted because Intel® Trusted Execution Technology detected a potential violation of system security.
3	Memory error	Multiple	System halted because a fatal error related to the memory was detected.
3 long and 1	CPU mismatch error	0xE5, 0xE6	System halted because a fatal error related to the CPU family/core/cache mismatch was detected.
The following Beep Codes are sounded during BIOS Recovery.			
2	BIOS Recovery started	N/A	Recovery boot has been initiated.
4	BIOS Recovery failure	N/A	BIOS recovery has failed. This typically happens so quickly after recovery us initiated that it sounds like a 2-4 beep code.

The Integrated BMC may generate beep codes upon detection of failure conditions. Beep codes are sounded each time the problem is discovered, such as on each power-up attempt, but are not sounded continuously. Codes that are common across all Intel server boards and systems that use same generation chipset are listed in the following table. Each digit in the code is represented by a sequence of beeps whose count is equal to the digit.

Table 46.Integrated BMC Beep Codes

Code	Associated Sensors	Reason for Beep
1-5-2-1	No CPUs installed or first CPU socket is empty.	CPU1 socket is empty, or sockets are populated incorrectly CPU1 must be populated before CPU2.
1-5-2-4	MSID Mismatch	MSID mismatch occurs if a processor is installed into a system board that has incompatible power capabilities.
1-5-4-2	Power fault	DC power unexpectedly lost (power good dropout) – Power unit sensors report power unit failure offset
1-5-4-4	Power control fault (power good assertion timeout).	Power good assertion timeout – Power unit sensors report soft power control failure offset
1-5-1-2	VR Watchdog Timer sensor assertion	VR controller DC power on sequence was not completed in time.
1-5-1-4	Power Supply Status	The system does not power on or unexpectedly powers off and a Power Supply Unit (PSU) is present that is an incompatible model with one or more other PSUs in the system.

Appendix D: High Temperature Ambient Info

The system can operate in an environment that complies with ASHARE Class A3 specification with no hardware configuration limitation. However, there are limitations regarding the time that the system can operate in such situation.

The ASHARE Class A3 specification includes operation of the system in an environment with a temperature of 40°C for up to 900 hours per year. The use beyond this limits may impact system reliability.

The following notes communicate support criteria associated with specific configurations identified in the following table. Each relevant note to a configuration is identified by reference number in the table.

1. The 27°C configuration alone is limited to elevations of 900m or less. Altitudes higher than 900m need to be de-rated to ASHRAEClass 2 levels.
2. To support system fan redundancy, the system must be configured with two power supplies to maintain sufficient cooling. Concurrent system and power supply fan failures is not supported.
3. Processor and memory throttling may occur which may impact system performance. CPU reliability is not impacted.
4. In fan fail mode, Intel®I/O Modules AXX10GBTWLIOM and AXX2FDRIBIOM are only supported in the specified base system model configured with 120W processors and DRx4 memory.
5. Use of the designated PCIe* slot is limited to add-in cards that have a limit of 55°C local ambient temperature and air flow requirements of 200 LFM or less. Please refer to the add-in card specs for air flow requirements.
6. For ASHRAE Class 3 and Class 4 support, the following power supply margining is required to meet thermal specifications:
   a) For dual power supply configurations, the power budget must fit within a single power supply rated load and be installed in a dual configuration, or
   b) For single power supply configurations, the power budget must be sized with 30% margin to single power supply rated load.
7. The system only supports PCIe* SSD Add-in Card FF devices which have operational temperature limits of 55°C local ambient temperature and 300LFM.
8. The Intel® RAID Maintenance Free Backup Unit (AXXRMFBUx) can support a case temperature of up to 45°C with the system operating in normal mode and up to 55°C with the system operating in a fan fail mode. Excursions over these specs may result in a reliability impact.
9. M.2 drives may see performance impact under heavy work load
10. Light workload is assuming 70% write, 30% read, 100% Random, 100% access, 8kb transfer rate, I/O "delay" of 8ms
11. M.2 drives may see a slight performance impact under light workloads.