Intel® Server Chassis SC5400 5U Kit

Technical Product Specification

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Enterprise Platforms and Services Division - Marketing

Revision History

Date	Revision Number	Modifications
May 13, 2006	1.0	Initial Draft

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1. Introduction

This specification details the feature set of the Intel® Server Chassis SC5400, a server chassis designed for Intel® server board products. The Intel® Server Chassis SC5400 series of products are low cost, quick to integrate, and allow utilization of multiple platforms and configurations. The Intel® Server Chassis SC5400 series comes in three configurations:

- Intel® Server Chassis SC5400 670W SC54000BASE
- Intel® Server Chassis SC5400 830W SC5400BRP
- Intel® Server Chassis SC5400 830W SC5400LX

The configurations are distinguishable from one another based primarily on power supply and cooling features.

1.1 Intel® Server Chassis SC5400 Design Features

The Intel® Server Chassis SC5400 series makes extensive use of tool-less hardware features and, dependent upon configuration and upgrade features, provides redundant cooling and redundant power supply capability. The following table lists the features for the Intel® Server Chassis SC5400BASE, Intel® Server Chassis SC5400BRP, and Intel® Server Chassis SC5400LX configurations.

Table 1. Intel® Server Chassis SC5400BASE, SC5400BRP, and SC5400LX Features

	Intel® Server Chassis SC5400BASE	Intel® Server Chassis SC5400BRP	Intel® Server Chassis SC5400LX
Power Delivery	Includes one (1) fixed 670W power factor corrected (PFC) Intel validated power supply unit (PSU) with an integrated cooling fan.	Includes (1 of 2) redundant 830W PFC module Intel validated PSU. Each power module includes an integrated cooling fan. Each redundant power module includes one (1) AC line input.	Includes (1 of 2) redundant 830W PFC module Intel validated PSU. Each power module includes an integrated cooling fan. Each redundant power module includes one (1) AC line input.
System Cooling	Two fixed, non-redundant chassis fans: one (1) 120mm and one (1) 92mm.	Two fixed, non-redundant chassis fans: one (1) 120mm and one (1) 92mm.	Four tool-less, hot swappable and redundant chassis fans with handle-mounted diagnostic failure LEDs: two (2) 120mm and two (2) 92mm.
Peripheral Bays	Three tool-less, multi-mount 5.25 inch peripheral bays	Three tool-less, multi-mount 5.25 inch peripheral bays	Three tool-less, multi-mount 5.25 inch peripheral bays
Drive Bays (6+4) Bay Layout	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5400BASE configuration supports up to 6 drives.	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5400BRP configuration supports up to 10 drives	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5400LX configuration supports up to 10 drives

	Intel® Server Chassis SC5400BASE	Intel® Server Chassis SC5400BRP	Intel® Server Chassis SC5400LX
PCI Slots	Seven full-length PCI slots	Seven full-length PCI slots	Seven full-length PCI slots.
Form Factor	5U Tower, convertible to rack mount	5U Tower, convertible to rack mount	5U Tower, convertible to rack mount
Front Panel	LEDs for NIC1, NIC2, System ID, HDD activity and system status. Power switch, ID switch, Reset switch, NMI Optical side cover intrusion switch and connection for bezel intrusion switch Integrated temperature sensor for fan speed management	LEDs for NIC1, NIC2, System ID, HDD activity and system status. Power switch, ID switch, Reset switch, NMI Optical side cover intrusion switch and connection for bezel intrusion switch Integrated temperature sensor for fan speed management	LEDs for NIC1, NIC2, System ID, HDD activity and system status. Power switch, ID switch, Reset switch, NMI Optical side cover intrusion switch and connection for bezel intrusion switch Integrated temperature sensor for fan speed management
External	Two (2) front USB and one (1) optional front or rear mounted serial port	Two (2) front USB and one (1) optional front or rear mounted serial port	Two (2) front USB and one (1) optional front or rear mounted serial port
Color	Black	Black	Black
Construction	1.0 mm, zinc plated sheet metal, meets Intel Cosmetic Spec # C25432	1.0 mm, zinc plated sheet metal, meets Intel Cosmetic Spec # C25432	1.0 mm, zinc plated sheet metal, meets Intel Cosmetic Spec # C25432
Chassis ABS	Fire retardant, non-brominated PC-ABS	Fire retardant, non-brominated PC-ABS	Fire retardant, non-brominated PC-ABS
Dimensions (Rack)	8.6-inch x 16.6-inch x 27.4-inch	8.6-inch x 16.6-inch x 27.4-inch	8.6-inch x 16.6-inch x 27.4-inch
Dimensions (Pedestal)	17.0-inch x 8.6-inch x 28.4-inch	17.0-inch x 8.6-inch x 28.4-inch	17.0-inch x 8.6-inch x 28.4-inch
Weight	34.6 kg	36.2 kg	36.2 kg
Optional Accessories	Rack Conversion Kit Rack Cable Management Arm Intel® Management Module Four (4) Drive Fixed Bay Six (6) Drive Hot Swap SAS/SATA Backplane Six (6) Drive Hot Swap SAS/SATA Expander Backplane Four (4) Drive Hot Swap SAS/SATA Backplane Four (4) Drive Hot Swap SAS/SATA Expander Backplane Redundant Cooling Upgrade Kit 10-pack Branding /	Rack Conversion Kit Rack Cable Management Arm Intel® Management Module Redundant Power Supply Four (4) Drive Fixed Bay Six (6) Drive Hot Swap SAS/SATA Backplane Six (6) Drive Hot Swap SAS/SATA Expander Backplane Four (4) Drive Hot Swap SAS/SATA Backplane Four (4) Drive Hot Swap SAS/SATA Expander Backplane Redundant Cooling Upgrade Kit	Rack Conversion Kit Rack Cable Management Arm Intel® Management Module Redundant Power Supply Four (4) Drive Fixed Bay Six (6) Drive Hot Swap SAS/SATA Backplane Six (6) Drive Hot Swap SAS/SATA Expander Backplane Four (4) Drive Hot Swap SAS/SATA Backplane Four (4) Drive Hot Swap SAS/SATA Expander Backplane 10-pack Branding / Customization Panels

	Intel® Server Chassis SC5400BASE	Intel® Server Chassis SC5400BRP	Intel® Server Chassis SC5400LX
	Customization Panels Unpainted Rack Top Cover Slim Line CDROM/USB Floppy Kit	10-pack Branding / Customization Panels Unpainted Rack Top Cover Slim Line CDROM/USB Floppy Kit	Unpainted Rack Top Cover Slim Line CDROM/USB Floppy Kit

1.2 Intel® Server Chassis SC5400BASE Summary

The Intel® Server Chassis SC5400BASE is designed to address the entry-level market. It includes a fixed single 670W Power Factor Correction (PFC) non-redundant power supply, which supports up to six hard drives. Two tachometer output fans are mounted in front of the server board. The optional 4-drive and 6-drive SAS (Serial Attach-SCSI)/SATA (Serial ATA) hot swap drive bay kits provide upgrades to allow support for 6 hot swap SAS/SATA drives. Three 5.25-inch half-height peripheral bays are available for installation of a floppy[1], CD-ROM drive and/or other accessories. The standard chassis configuration is pedestal. A rack mount conversion kit is available.

Note:

1 The Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN support the optional accessory Slim Line CDROM/USB Floppy Kit - AXXCDUSBFDBRK.

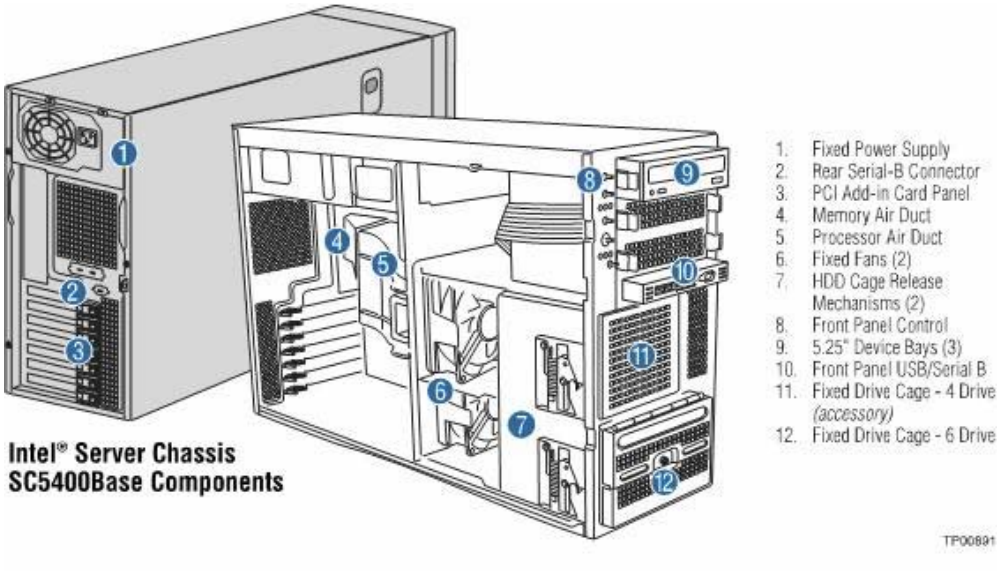


Figure 1. Intel® Server Chassis SC5400BASE Components

1.3 Intel® Server Chassis SC5400BRP Summary

The Intel® Server Chassis SC5400BRP supports the redundant power capability of the Intel® Server Chassis SC5400LX configuration and the fixed fan features of the Intel® Server Chassis SC5400BASE configuration. The Intel® Server Chassis SC5400BRP configuration includes a single 830W PFC power supply module. Two tachometer output fans are mounted in front of the server board. A second 830W module may be added to provide redundancy. Optional 4 and 6 drive SAS/SATA hot swap drive bay kits provide upgrades to allow support for up to 10 hot swap SAS/SATA drives. Three 5.25-inch half-height peripheral bays are available for installations of a floppy[1], CD-ROM drive and/or other accessories. The standard chassis configuration is pedestal. A rack mount conversion kit is available.

Note:

[1] The Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN support the optional accessory Slim Line CDROM/USB Floppy Kit - AXXCDUSBFDBRK.

1.4 Intel® Server Chassis SC5400LX Summary

The Intel® Server Chassis SC5400LX supports redundant power and includes redundant fan features. The Intel® Server Chassis SC5400LX configuration includes a single 830W PFC power supply module. A second 830W module may be added to provide redundancy. Four LED hot swap tachometer output fans provide redundant cooling. Optional 4 and 6 drive SAS/SATA hot swap drive bay kits provide upgrades to allow support for up to ten hot swap SAS/SATA drives. Three 5.25-inch half-height peripheral bays are available for installation of a floppy[1], CD-ROM drive and/or other accessories. The standard chassis configuration is pedestal. A rack mount conversion kit is available.

Note:

[1] The Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN support the optional accessory Slim Line CDROM/USB Floppy Kit - AXXCDUSBFDBRK.

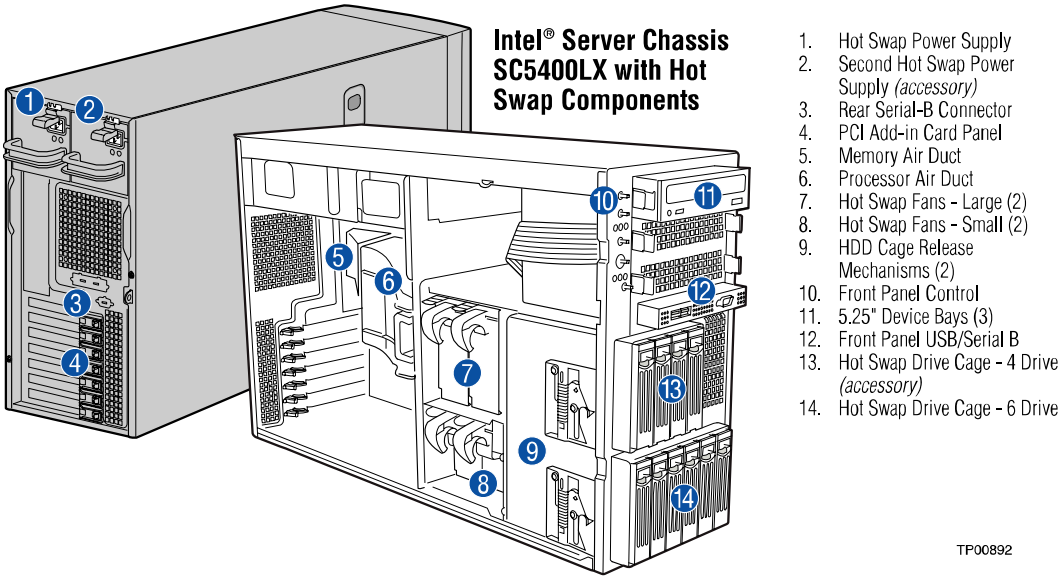


Figure 2. Intel® Server Chassis SC5400LX Components

1.5 Product Matrix

The supported upgrades and optional accessories for the Intel® Server Chassis SC5400 are shown in the product matrix in Table 2.

Table 2. Product Matrix

Product Code	Supported Intel® Server Boards	Standard Fixed Hard Drive Bays	Optional Hot Swap SAS/SATA Drives	Power Supply and Required Power Cord Configuration	Hot Swap Fans	Pedestal/ Rack
Intel® Server Chassis SC5400BASE Fixed 670W	Intel® Server Board S5000PSL Intel® Server Board S5000XSL Intel® Server Board S5000XVN	6-drive bay 4-drive bay optional accessory is available	6-SAS/SATA 6-SAS/SATA Expander 4-SAS/SATA 4-SAS/SATA Expander	Fixed 670WPFC Requires one power cord	Available as an optional accessory	Pedestal is Standard. Rack Conversion Kit is an accessory.
Intel® Server Chassis SC5400BRP Hot Swap Redundant 830W	Intel® Server Board S5000PSL Intel® Server Board S5000XSL	6-drive bay 4-drive bay optional accessory is available	6-SAS/SATA 6-SAS/SATA Expander 4-SAS/SATA 4-SAS/SATA Expander	One 830W PFC module installed. Second power module is optional. Requires one power cord per module.	Available as an optional accessory	Pedestal is Standard. Rack Conversion Kit is an accessory.
Intel® Server Chassis SC5400LX Hot Swap Redundant 830W	Intel® Server Board S5000PSL Intel® Server Board S5000XSL	6-drive bay 4-drive bay optional accessory is available	6-SAS/SATA 6-SAS/SATA Expander 4-SAS/SATA 4-SAS/SATA Expander	One 830W PFC module installed. Second power module is optional. Requires one power cord per module.	Yes	Pedestal is Standard. Rack Conversion Kit is an accessory.

2. Chassis Features

2.1 Chassis Dimensions and Weight

Shipping weights include packaging.

Complete systems configured with server board, accessories and hard disk drives will have varying weights.

Table 3. Chassis Dimensions and Weights

Configuration		Pedestal	Rack
Height		17 inches (43.2 cm)	8.6 inches (21.8 cm)
Width		8.6 inches (21.8 cm)	16.6 inches (42.2 cm)
Depth		28.4 inches (70.9 cm)	27.4 inches (69.6 cm)
Clearance front		Ten inches (25.4 cm)	N/A
Clearance rear		Five inches (12.7 cm)	N/A
Clearance side		3 inches (7.6 cm)	N/A
Weight	LX	36.2 kg	36.2 kg
	Base	34.6 kg	34.6 kg

2.2 System Colors

The Intel® Server Chassis SC5400 is offered in one color configuration, black.

Table 4. System Color Code

Manufacturer	Color Code
GE	Black GE701

2.3 Pedestal Front Bezel

The standard pedestal front bezel is a molded plastic door covering all drive bays. A key lock is provided to prevent unauthorized access to the peripheral bays. A molded plastic sub-bezel is located on the face of the chassis under the front bezel. The sub-bezel houses the front panel buttons and light pipes for the front panel indicators. Each peripheral bay is covered with a removable electromagnetic interference (EMI) shield.

Opening the exterior plastic door on the pedestal chassis accesses the hot swap hard drives. An EMI shield is incorporated into the drive carrier design, eliminating the need for a separate shield or door. This adds flexibility to the bezel design by making EMI performance independent of the cosmetic plastic parts.

Customized bezels for OEM customers can be designed from the standard bezel design. OEM snap-in branding panels are also available.

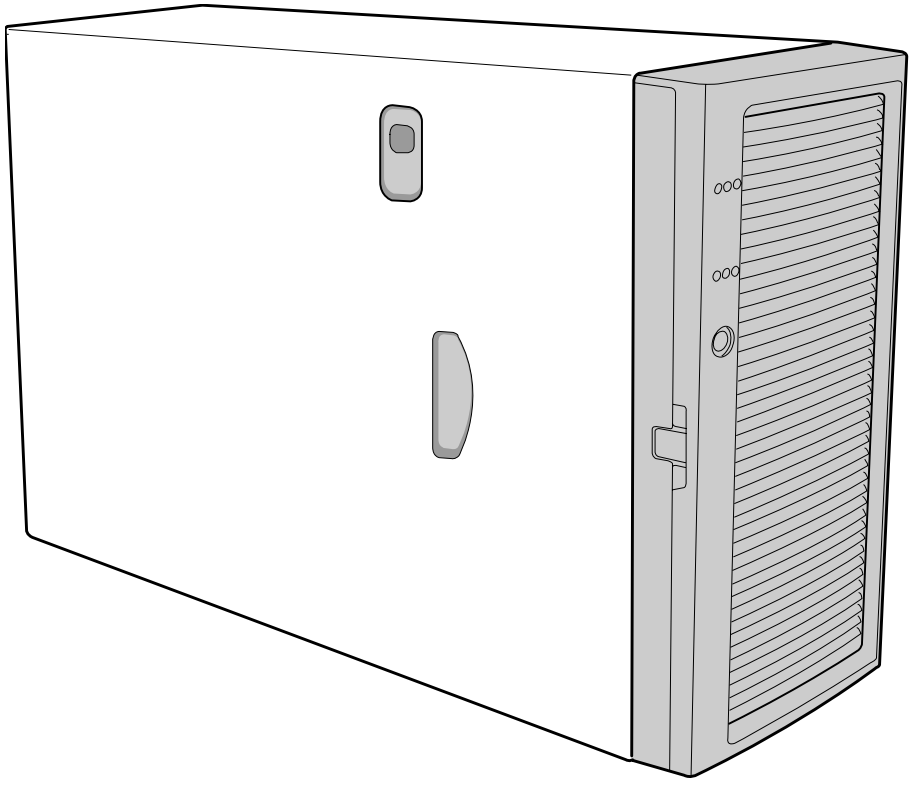


Figure 3. Bezel Assembly

2.4 Rack Mount Configuration

In the rack mount configuration, the front door is removed and the sub-bezel becomes the front panel for the rack mount system. The drive bays and bezel icons are rotated 90° to have the correct orientation. The rack mount kit includes the chassis slides, rack handles, front door hinge cover plate and icon label.

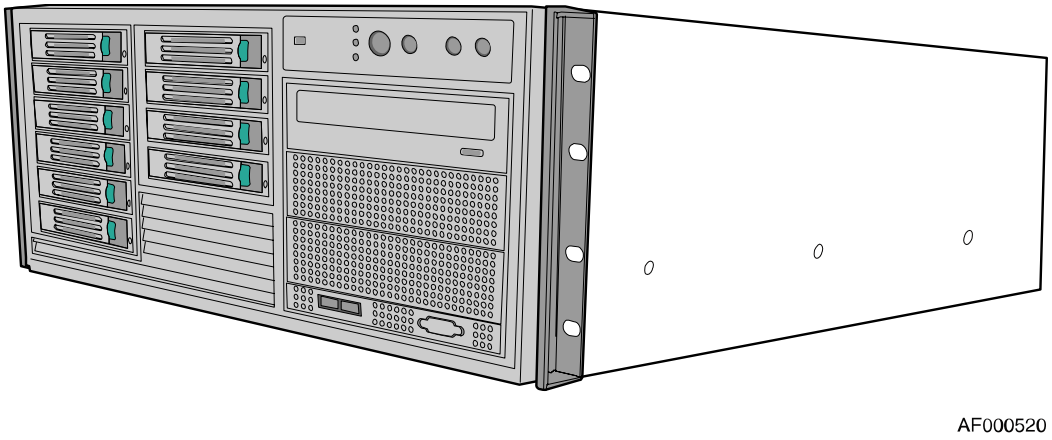


Figure 4. Rack Configuration

2.5 Security

A variety of chassis security options are provided at the system level:

- A two-position key lock/switch will unlock the front bezel and side cover in the pedestal configuration only. Rack mount configuration does not have a key lock.
- For rack-mounted systems, a removable padlock loop on the rear of the system access cover can be used to prevent access to the microprocessors, memory, and add-in cards. A variety of lock sizes can be accommodated by the 0.270-inch diameter loop.
- A Kensington* cable lock mounting hole is provided on the rear chassis I/O panel.
- An intrusion switch for the side panel and front bezel door are standard. In the rack mount configuration, only the system cover has an active intrusion switch.

Note:

See the appropriate Server Board Technical Product Specification on the support.intel.com website for a description of BIOS and Intel® Server Management security features. Intrusion switches are provided allowing server management software, such as Intel® Server Management (ISM) to detect unauthorized access to the system cover and pedestal bezel door.

2.6 I/O Panel

All input/output (I/O) connectors are accessible on the rear of the chassis. The SSI E-bay 3.5-compliant chassis provides an ATX* 2.03-compatible cutout for I/O shield installation. Boxed server boards provide the required I/O shield for installation in the cutout. The I/O cutout dimensions are shown in the figure below.

The rear I/O panel conforms to the Advanced Technology Extended (ATX) Specification, Revision 2.1, and supports seven full-length expansion PCI adaptor cards.

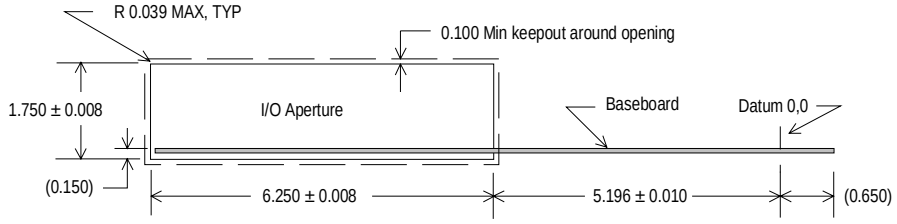


Figure 5. ATX* 2.03 I/O Aperture

2.7 Standard and Optional Hot Swap Drive Bays

One fixed bay, supporting six cabled drives, ships with the standard chassis. A 4-drive bay for cabled (fixed) drives is also available. Optional 4-drive and 6-drive hot swap bays are also available and may be installed to replace either the 4-drive or 6-drive fixed bays. No tools are required to replace the fixed drive bays.

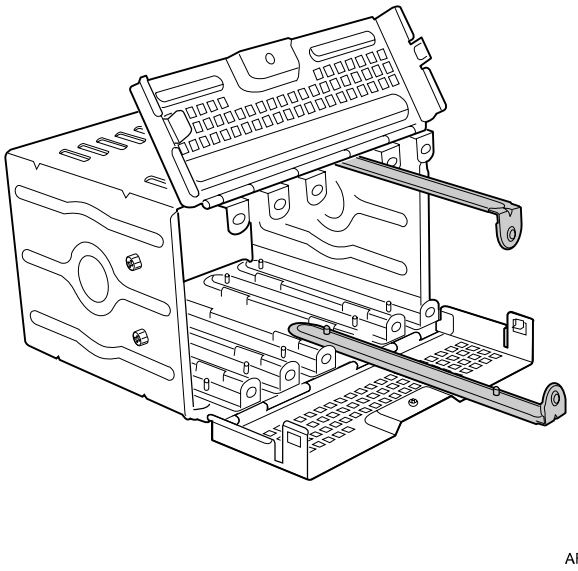
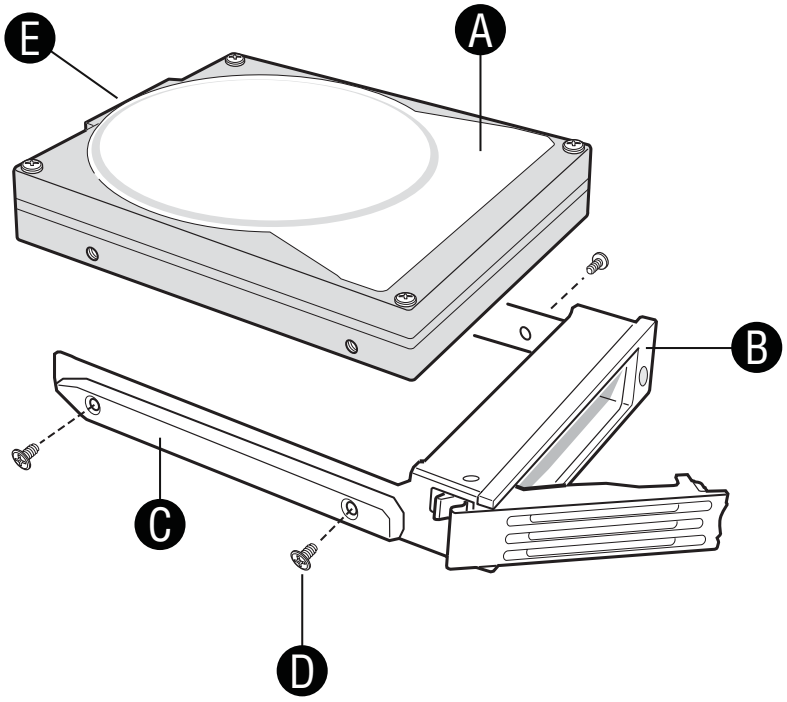


Figure 6. Fixed Drive Cage

2.7.1 Hot Swap Drive Bays

Each hard drive must be mounted to a hot-swap drive tray, making insertion and extraction of the drive from the chassis very simple. Each drive tray has its own dual-purpose latching mechanism that is used to both insert and extract drives from the chassis and lock the tray in place. Each drive tray supports a light pipe providing a drive status indicator, located on the backplane, to be viewable from the front of the chassis.



A. Hard Drive
B. Drive Carrier
C. Side Rail
D. Mounting Screw
E. Hard Drive Connector

Figure 7. Hot Swap Drive Bay

2.7.2 Drive Blanks

Drive blanks must be used when no drive is used in a hard drive bay. Drive blanks simulate the spatial volume of a hard disk that is required to maintain proper air pressure limits necessary to cool the system.

Figure 8. Drive Bay with Drive Blank

2.8 5.25-inch Half-height Peripheral Bays

Three 5.25 inch, half-height drive bays are available for installation of a floppy[1] drive, CD-ROM drive or tape drive. The chassis ships with a 3.5 inch fixed drive adapter bracket, installed in the top 5.25-inch drive bay, and two empty 5.25 inch drive bays. Tool-less mounting rails are included for all three-drive bays and attach without screws.

Note:

[1] The Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN support the optional accessory Slim Line CDROM/USB Floppy Kit - AXXCDUSBFDBRK.

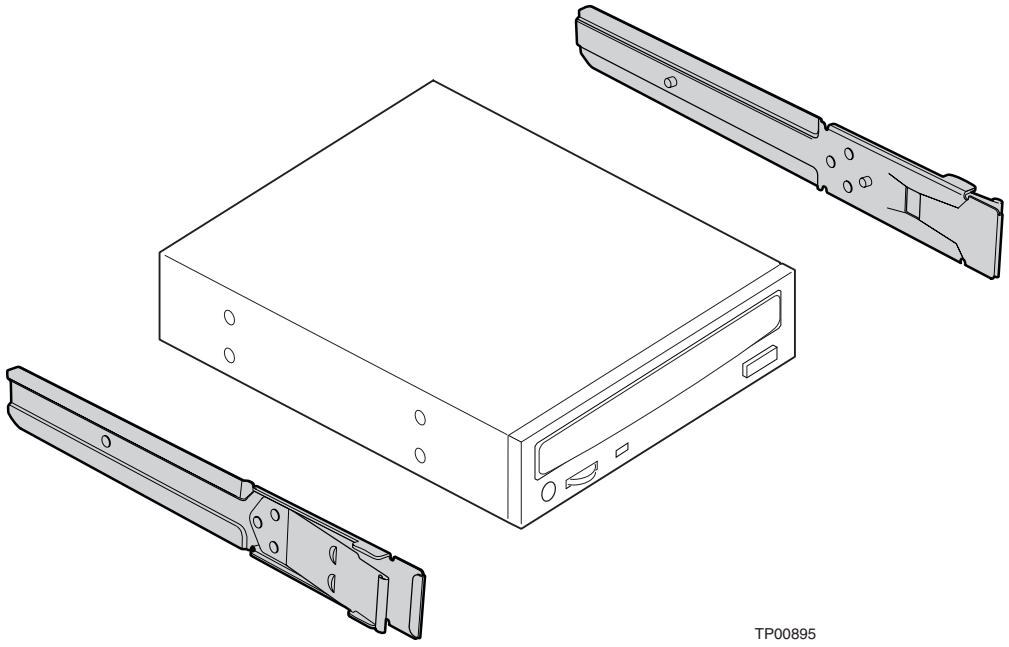


Figure 9. Tool-less Rails Mounting 5.25 inch CD-ROM Drive

3. Front Panel

The Intel® Server Chassis SC5400 provides a 24-pin cable option with the chassis kit. A 24-pin Entry Ebay SSI (rev 3.61) front panel header for Intel® server boards is located on the back of the front panel. This allows for connection of a 24-pin ribbon cable for use with SSI rev 3.61-compliant server boards. The front panel features control buttons and LED indicators. The LEDs are visible with the pedestal exterior access door closed. The blue ID LED and ID toggle switch featured in the rack mount Intel® Server Chassis SC5400 are used to indicate which particular chassis among several in a rack configuration is being serviced.

3.1 Front Panel Board Layout

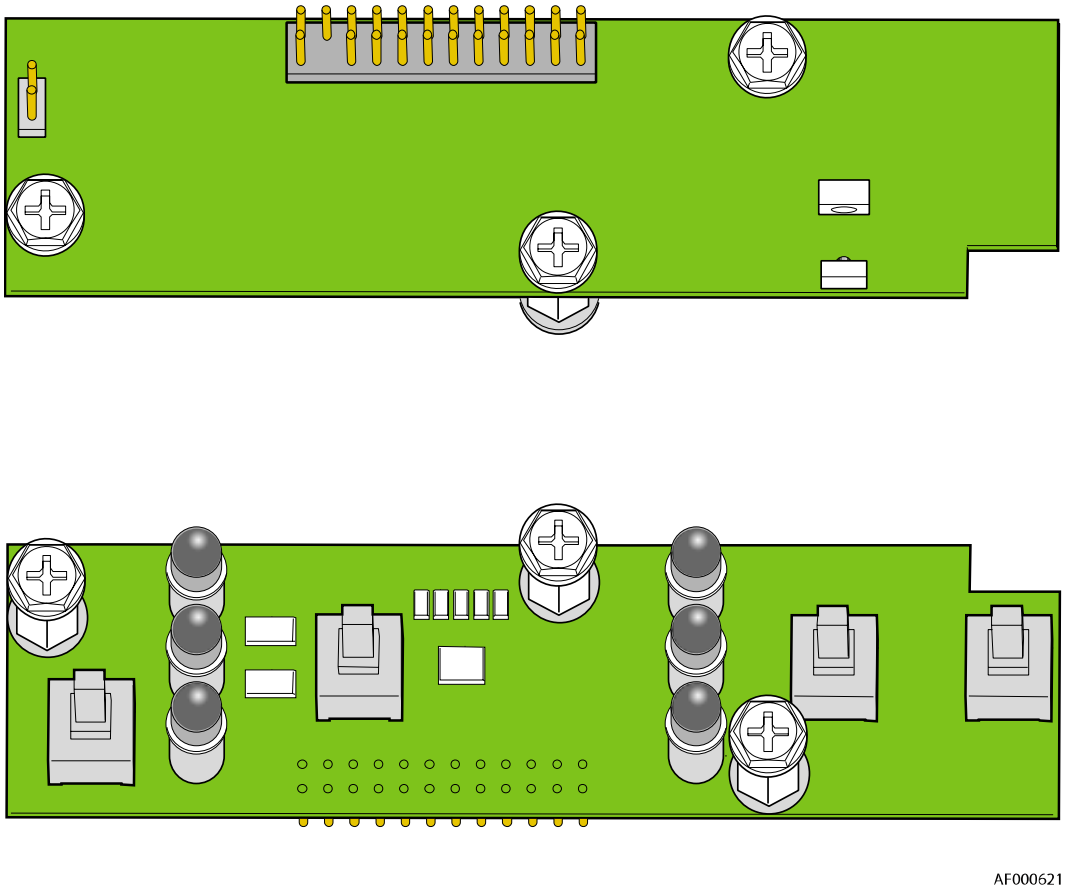


Figure 10. Front Panel Primary Side and Secondary Side

3.2 Front Panel Connectors

Front panel connectors are listed in the following table.

Table 5. Front Panel Connector Designations

Designator	Header Size	Description
JP2	17x2	Front panel SSI Connector
JP3	2x1	Intrusion or front panel key switch

3.2.1 24-pin EEB SSI Compliance Connector Pin-out

A 24-pin Entry Ebay SSI (rev 3.61) front panel header is located on the back of the front panel. This allows for a 24-pin ribbon cable connection for use with SSI rev 3.61-compliant server boards.

Table 6. 24-pin EEB SSI Compliance Connector Pin-out

Pin	Signal
1	FP_PWR_LED_ANODE
2	P3V3_STBY
3	KEY
4	FP_ID_LED_BUF_ANODE
5	FP_PWR_LED_N
6	FP_ID_LED_BUF_N
7	LED_HDD_ACTIVITY_ANODE
8	FP_LED_STATUS_GREEN_N
9	LED_HDD_ACTIVITY_N
10	FP_LED_STATUS_AMBER_N
11	FP_PWR_BTN_N
12	NIC1_ACT_LED_N
13	GND
14	NIC1_LINK_LED_N
15	BMC_RST_BTN_N
16	SMB_SENSOR_3V3STB_DATA
17	GND
18	SMB_SENSOR_3V3STB_CLK
19	FP_ID_BTN_N
20	FP_CHASSIS_INTRU
21	FM_SIO_TEMP_SENSOR

Pin	Signal
22	NIC2_ACT_LED_N
23	FP_NMI_BTN_N
24	NIC2_LINK_LED_N

3.3 Front Panel Controls and Indicators

The front panel control buttons and LED indicators are displayed in the following figure. The tool-activated non-maskable Interrupt (NMI) switch is located below the Status Fault LED. When the hot swap drive bay is installed, a bi-color hard drive LED is located on each drive carrier (six total) to indicate specific drive failure or activity. For pedestal systems, these LEDs are visible upon opening the front bezel door.

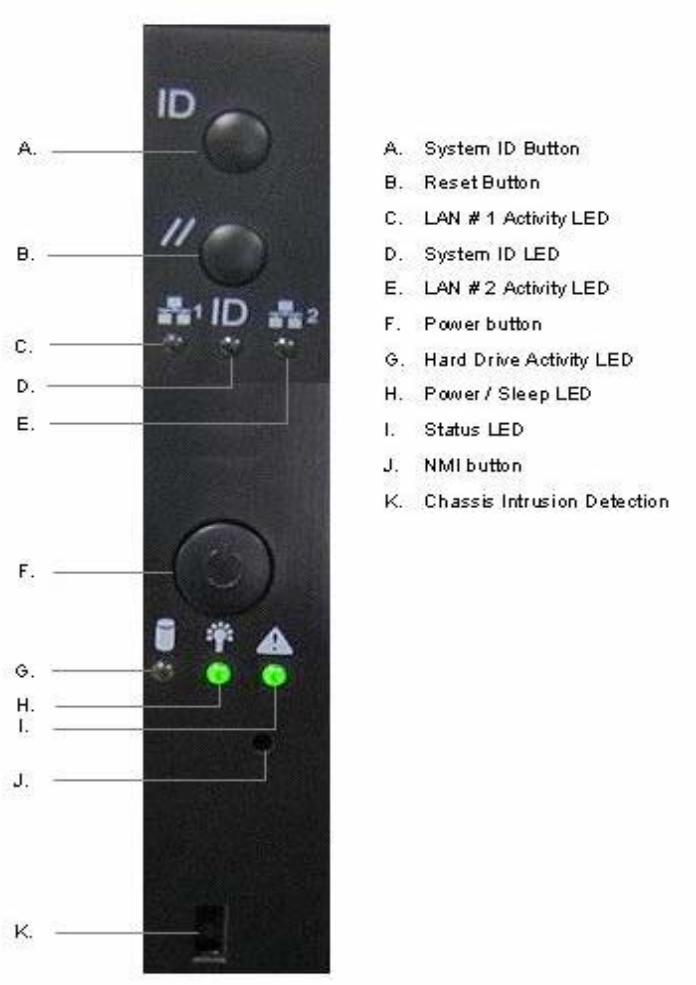


Figure 11. Front Panel Controls and Indicators

Front panel buttons and indicator LED's function are shown in the following table.

Table 7. Front Panel LED Functions

LED	Color	Condition[1]	What It Means
Power / Sleep	Green	On	Power On
		Blink	Sleep S1/S3
		Off	Off (also Sleep S4/S5)
System Status	Off	N/A	AC power off
	Green / Amber	Alternating Blink	Pre DC Power On – 15-20 second BMC Initialization when AC is applied to the server. Control Panel buttons are disabled until BMC initialization is complete.
	Green	Solid on	System booted / Normal operation
		Blink	System degraded (See Section 3.3.2.3)
	Amber	Blink	Non-critical condition (See Section 3.3.2.3)
		Solid on	Critical condition (See Section 3.3.2.1)
HDD	Green	Blink	Drive Activity
		Off	No Drive Activity
NIC 1 / NIC 2 Activity	Green	On	NIC Link
	Green	Blink	NIC Activity
		Off	No Connection
	Green	Blink	NIC Activity
Identification	Blue	On	Unit selected for identification
		Off	No identification

Note:

LED functionality is dependent on server board support. Not all server boards support all features. For additional details about control panel functions supported for a specific board, refer to the individual server board technical product specification.

3.3.1 Power / Sleep LED

The green power LED is active when system DC power is on. The power LED is controlled by the BIOS. The power LED reflects a combination of the state of system (DC) power and the system ACPI state. Table 8 shows the states that can be assumed

Table 8. Power LED Operation.

State	Power Mode	LED	Description
Power Off	Non-ACPI	Off	System power is off, and the BIOS has not initialized the chipset.
Power On	Non-ACPI	On	System power is on, but the BIOS has not yet initialized the chipset.
S5	ACPI	Off	Mechanical is off, and the operating system has not saved any context to the hard disk.
S4	ACPI	Off	Mechanical is off. The operating system has saved context to the hard disk.
S3-S1	ACPI	Slow blink	DC power is still on. The operating system has saved context and entered into a level of low-power state.
S0	ACPI	Steady on	System and the operating system are up and running.

3.3.2 System Status LED

The system status LED is a bi-color LED. Green (status) is used to show a normal operation state or a degraded operation. Amber (fault) shows the platform hardware state and overrides the green status.

When the server is powered down (transitions to the DC-off state or S5), the BMC is still on standby power and retains the sensor and front panel status LED state established prior to the power-down event.

When AC power is first applied to the system and 5V-STBY is present, the BMC controller on the server board requires 15-20 seconds to initialize. During this time, the System Status LED will blink, alternating between Amber and Green. In addition, the Power Button functionality of the Control Panel is disabled, preventing the server from powering up. Once BMC initialization has completed, the Status LED will stop blinking and the Power Button functionality is restored and can be used to turn on the server.

3.3.2.1 Critical Conditions

A critical condition is defined as any critical or non-recoverable threshold crossing associated with the following events:

- DIMM failure when there is one DIMM present, no good memory present
- Run-time memory uncorrectable error in non-redundant mode
- Processor 1 missing
- Temperature (CPU, memory, critical threshold crossed)
- No power good – power fault
- Processor configuration error

3.3.2.2 Non-Critical Conditions

A non-critical condition is a threshold crossing associated with the following events:

- Chassis intrusion
- Critical voltage threshold crossed
- Minimum number of fans to cool the system not present or failed
- In non-sparing and non-mirroring mode if the threshold of ten correctable errors is crossed within the window

3.3.2.3 Degraded Conditions

A degraded condition could be associated with the following events:

- Unable to use all of the installed memory (more than one DIMM installed).
- Correctable errors over a threshold of ten and migrating to a spare DIMM (memory sparing). This indicates the user no longer has spared DIMMs indicating a redundancy lost condition. Corresponding DIMM LED should light up.
- In mirrored configuration, when memory-mirroring takes place and system loses memory redundancy. This is not covered by two.
- Redundancy loss such as power-supply or fan. This does not apply to non-redundant sub-systems.
- PCI-e* link errors
- CPU failure / disabled – if there are two processors and one of them fails
- Fan alarm – Fan failure. Number of operational fans should be more than a minimum number needed to cool the system
- Non-critical threshold crossed – Temperature and voltage

3.3.3 Drive Activity LED

The drive activity LED on the front panel indicates drive activity from the onboard hard disk controllers.

3.3.4 System Identification LED

The blue system identification LED is used to help identify a system for servicing. This is especially useful when the system is installed when in a high-density rack or cabinet that is populated with several similar systems. The system ID LED will light when the System ID button on the control panel is pressed or it can be illuminated remotely through server management software.

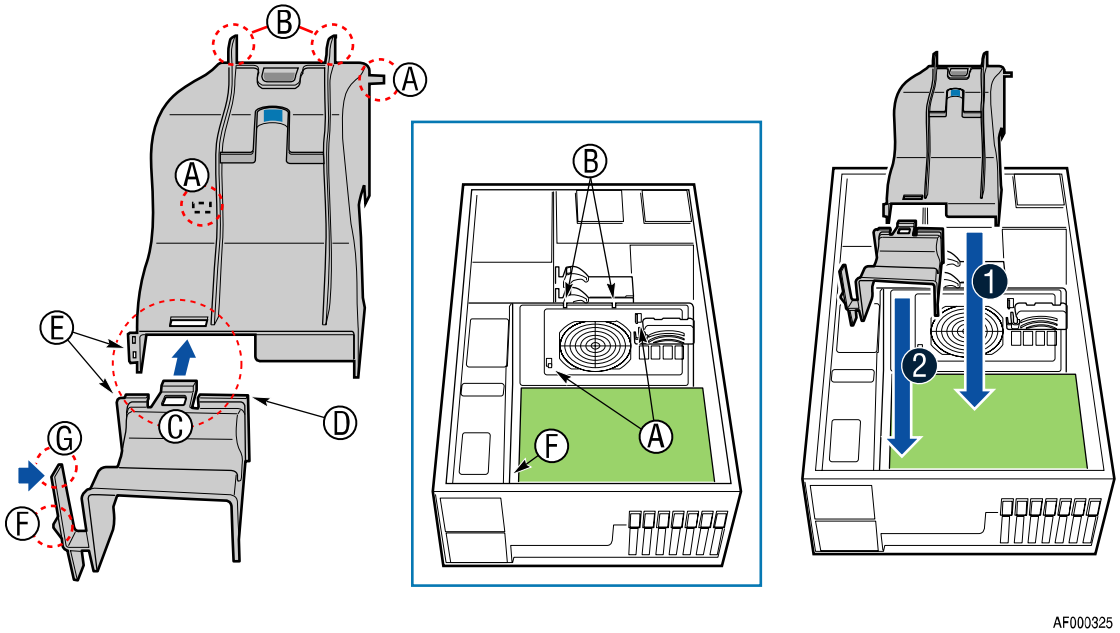
4. System Cooling

Two cooling solutions are employed in the Intel® Server Chassis SC5400. The base solution consists of two fixed fans (92mm and 120mm) to provide sufficient system cooling. The second redundant solution is designed for maximum up time by providing four replaceable hot-swap fans (92mm and 120mm). The fans can maintain proper system cooling, even with a single failed fan. Air ducts are used in both configurations and an active memory heat sink solution for the server board memory may be required for several of the system configurations.

4.1 Processor Passive Heat Sink Cooling

Processors with passive heat sinks should be used unless otherwise indicated in the server board manuals. The ducting shown (see the figure below) is designed to work with the passive heat sink.

Air flows through the system from front to back. The heat sink solution used for the Intel® Server Chassis SC5400 is provided with the Intel® Xeon® processors.



A. CPU Duct Hooks
B. CPU Duct Alignment Slots
C. Memory Duct Hook
D. Memory Duct Connection
E. Memory Duct Side Hooks
F. Memory Duct Latch
G. Memory Duct Latch Touch Point

Figure 12. CPU and Memory Air Ducts

4.2 Base Cooling Solution

One 120 x 38mm fan and one 92 x 38mm fan provide cooling for the processors, hard drives, and add-in cards. These two fans draw air through the rear of each hard drive bay to provide drive cooling. In addition, the power supply fan provides cooling for the power supply.

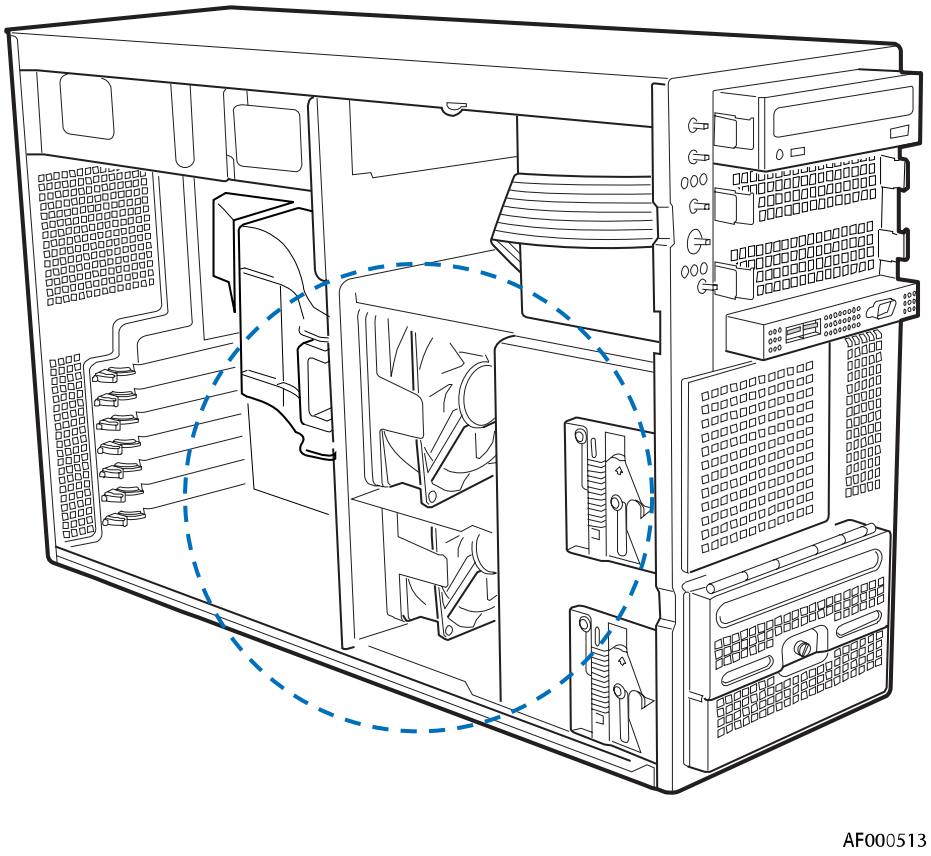


Figure 13. Fixed Fan Mounting

4.3 Redundant Cooling Solution

Two hot swap 120x38mm fans and two hot swap 92x38mm fans provide cooling for the processors, hard drives and add-in cards. The two 120x38mm fans ensure proper cooling of the core area (processors and memory) and the hot swap drive bay. The two 92x38mm fans provide cooling for the PCI card area. When any single fan fails, the remaining fans will increase in speed and maintain cooling until the failed unit is replaced. All system fans provide a signal for RPM detection that the server board can make available for server management functions.

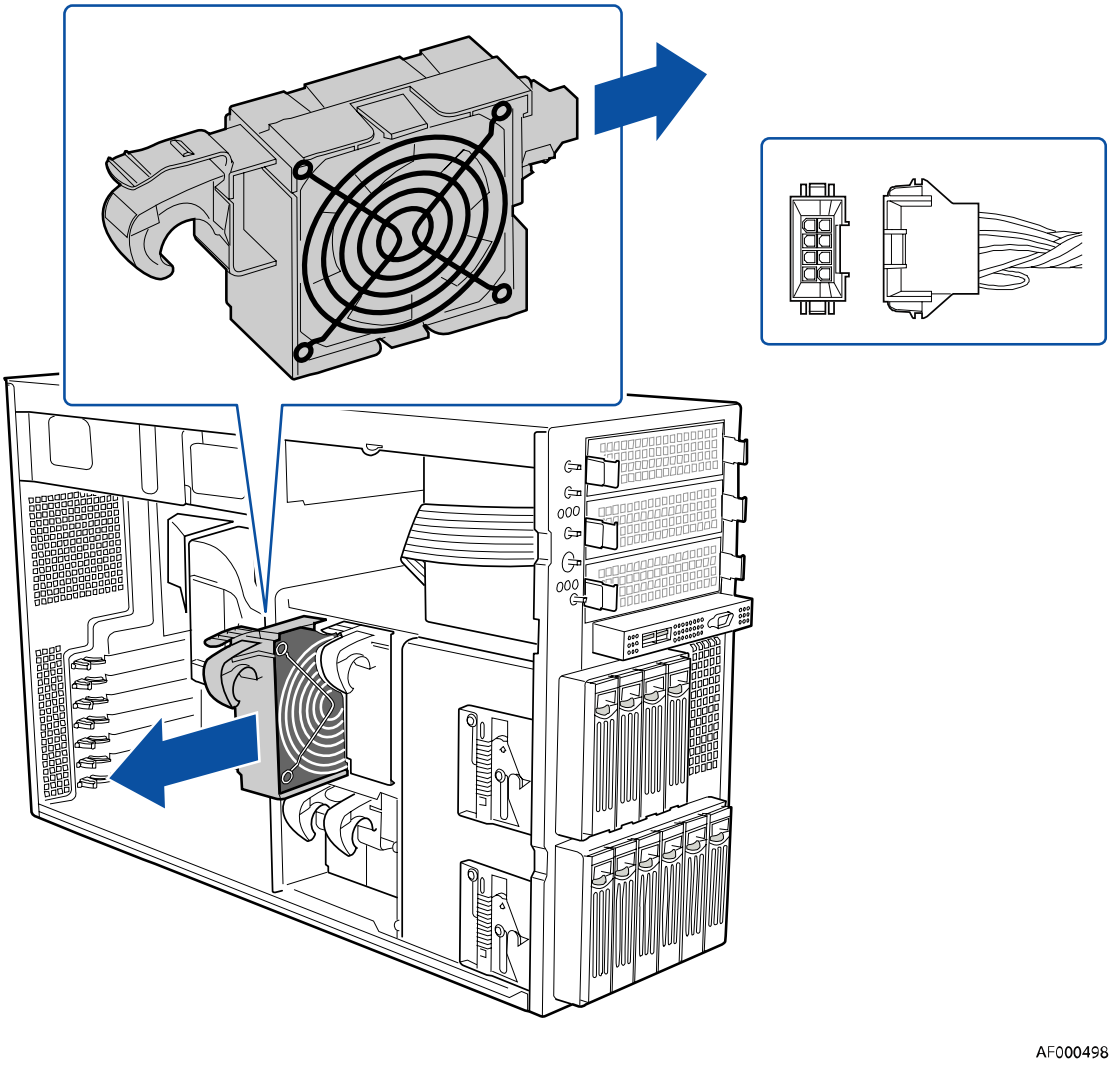


Figure 14. Hot Swap Fans and Connectors

The figure below shows the airflow characteristics through the Intel® Server Chassis SC5400.

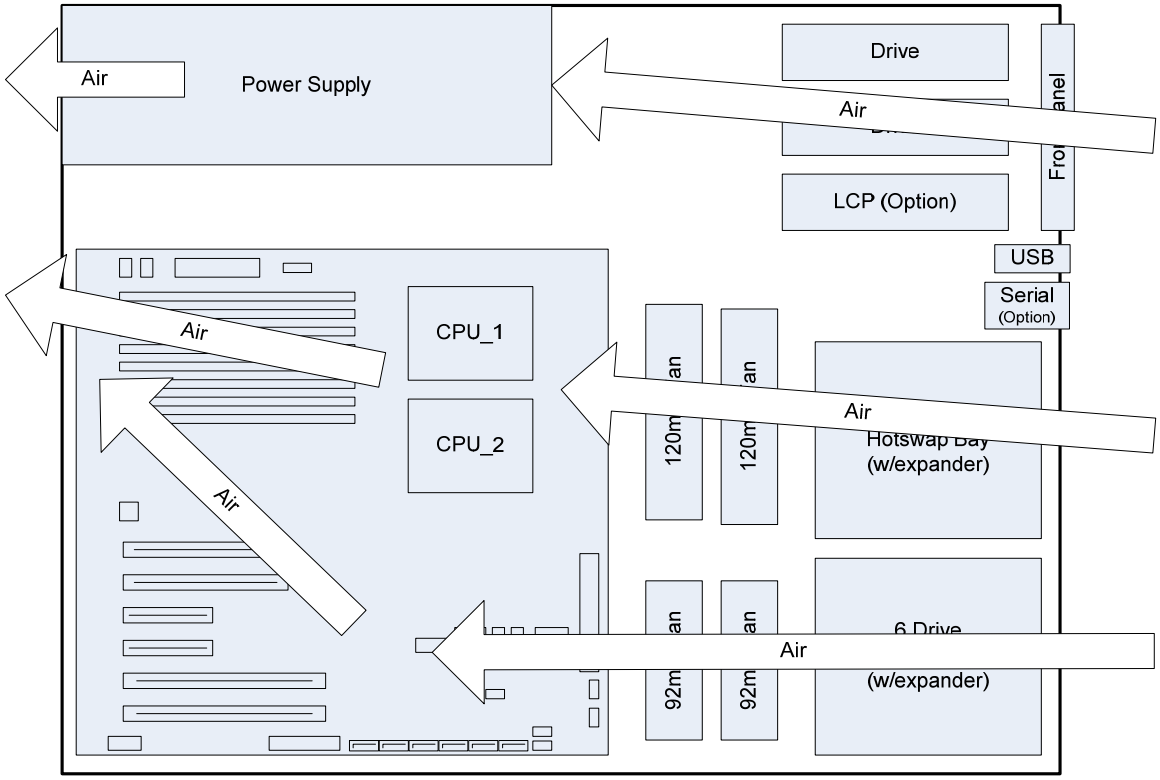


Figure 15. Redundant Chassis Airflow Characteristics

4.4 Fan Control

The fans in the Intel® Server Chassis SC5400 are designed for server boards that support fan control via a PWM control signal.

4.4.1 Basic Fan Control (All fans)

The front panel of the chassis has an active temperature sensor (i.e., Texas Instruments* TMP141) connected to the front panel's bus. Based on this front panel inlet temperature and processor temperatures, the server board's firmware will adjust the fan speed.

4.4.2 Additional Fan Control (120mm fans)

Fan control will monitor the temperature of the processors and further reduce the speed of the 120mm fans. This allows the system to provide minimal airflow for when processors and sitting idle, then ramp fans speeds faster when they are under a heavy load. This will maintain proper system cooling of all components and peripherals, while minimizing the acoustic noise level.

Refer to the baseboard documentation for additional details on how fan control is implemented.

4.5 Fan Header Connector Descriptions

All system fan headers use pulse width modulated (PWM) fans for cooling the processors in the chassis. PWM fans have an improved RPM range (20% to 100% rated fan speed) when compared to voltage controlled fans.

Base Chassis Fans are a 4-wire/4-pin style designed to plug into 4-pin or 6-pin SSI Fan headers. When plugged into a 6-pin header, only the first four signals are used (Pwr, Gnd, Tach, PWM)

LX Chassis fans are a 6-wire/6-pin style designed to plug into 6-pin headers. The extra signals provide for fan redundancy and failure indications (Pwr, Gnd, Tach, PWM, Presence, Failure).

Server Boards installed in this chassis may feature an additional two 4-pin CPU fan headers and two 4-pin System fan headers. These connections are not required for use with the Intel® Server Chassis SC5400.

To assist with fan connections in the system, the system fans are numbered one through four and color-coded. These correspond to fan header numbers on the server board. Fan 1 and fan 2 connectors are white in color and the fan 3 and fan 4 connectors are blue in color. These colors should also match between server board and fans.

5. Chassis Power Subsystem

The Intel® Server Chassis SC5400 power supplies are Server System Infrastructure (SSI) compliant. The SSI specifications may be found at the following website: www.ssifourm.org. Both the 670W power supply and the 830W power distribution board have identical power supply wire harness cable lengths to reach peripheral bays and server board.

5.1 670W Power Supply

The 670W power supply has eight outputs: 3.3V, 5V, 12V1, 12V2, 12V3, 12V4, -12V, and 5Vsb (standby). The 670W power supply contains a single 80-mm fan for cooling the power supply, which also provides part of the system cooling. The 12V six-pin power connector is for the 150W PCIe* (video) cards, which require an external 75W power connector.

5.1.1 670W Mechanical Outline

The power supply size is 150mm x 180mm x 86mm and has a wire harness for the DC outputs. The AC power cord plugs directly into the external face of the power supply.

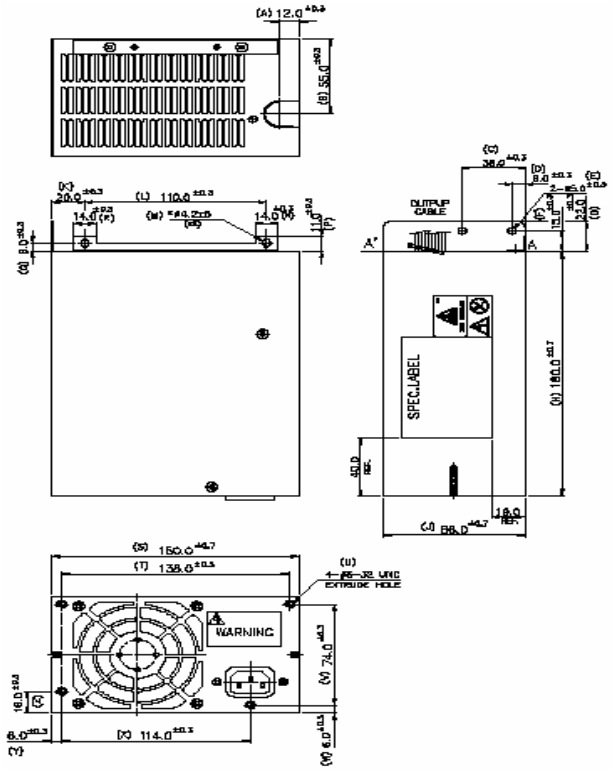


Figure 16. Mechanical Outline

Note:

All dimensions are in millimeters.

5.1.2 670W Output Wire Harness

Listed or recognized component appliance wiring material (AVLV2), CN, rated minimum 105 C, 300VDC shall be used for all output wiring.

Table 9. 670W Power Supply Cable Lengths

From	Length (mm)	To Connector Number	Number of Pins	Description
Power supply cover exit hole	425	P1	24	Server Board Power Connector
Power supply cover exit hole	680	P2	8	Processor Power Connector
Power supply cover exit hole	375	P14	5	Power Signal Connector
Power supply cover exit hole	375	P15	6	PCI Express* Connector
Power supply cover exit hole	680	P16	4	12V4 Power Connector
Power supply cover exit hole	450	P3	4	Peripheral Power Connector
Extension	100	P4	4	Peripheral Power Connector
Extension from P4	100	P5	4	Floppy[1] Power Connector
Power supply cover exit hole	575	P6	4	Peripheral Power Connector
Extension	75 (cover with sleeve)	P7	4	Right-angle Peripheral Power Connector
Power supply cover exit hole	740	P8	4	Peripheral Power Connector
Extension	75	P9	4	Peripheral Power Connector
Power supply cover exit hole	740	P10	4	Peripheral Power Connector
Extension	75	P11	4	Peripheral Power Connector
Power supply cover exit hole	740	P12	5	Right-angle SATA Power Connector
Extension	75	P13	5	SATA Power Connector

Note:

[1]Not supported by the Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN

5.1.2.1 Server Board Power Connector (P1)

- Connector housing: 24-Pin Molex* Mini-Fit Jr. 39-01-2245 or equivalent
- Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 10. Baseboard Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1[1]	+3.3VDC	Orange	13	+3.3VDC	Orange
	3.3V RS	Orange (24AWG)	14	-12VDC	Blue
2	+3.3VDC	Orange	15	COM	Black
3[1]	COM	Black	16	PSON#	Green (24AWG)
	COM RS	Black (24AWG)	17	COM	Black
4[1]	+5VDC	Red	18	COM	Black
	5V RS	Red (24AWG)	19	COM	Black
5	COM	Black	20	Reserved	N.C.
6	+5VDC	Red	21	+5VDC	Red
7	COM	Black	22	+5VDC	Red
8	PWR OK	Gray (24AWG)	23	+5VDC	Red
9	5 VSB	Purple	24	COM	Black
10	+12V3	Yellow			
11	+12V3	Yellow			
12	+3.3VDC	Orange			

Note:

[1] Remote Sense wire double crimped.

5.1.2.2 Processor Power Connector (P2)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 11. Processor Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V1	White
2	COM	Black		12V1 RS	Yellow (24AWG)
3	COM	Black	6	+12V1	White
4	COM	Black	7	+12V2	Brown
			8	+12V2	Brown

5.1.2.3 Power Signal Connector (P14)

- Connector housing: 5-pin Molex 50-57-9405 or equivalent
- Contacts: Molex 16-02-0087 or equivalent

Table 12. Power Signal Connector

Pin	Signal	24 AWG Color
1	I^2C Clock	White
2	I^2C data	Yellow
3	Reserved	N.C.
4	COM	Black
5	3.3RS	Orange

5.1.2.4 12V4 Power Connector (P16)

- Connector housing: 4-pin Molex 39-01-2040 or equivalent
- Contact: Molex Mini-Fit, HCS, 44476-1111 or equivalent

Table 13. 12V4 Power Connector

PIN	Signal	18 AWG Colors	PIN	Signal	18 AWG Colors
1	COM	Black	4	+12V4	Green
2	COM	Black	5	+12V4	Green

5.1.2.5 PCI Express* Connector (P15)

- Connector housing: 6-pin Molex 455590002 or equivalent
- Contact: Molex Mini-Fit, HCS, Female, Crimp 44476

Table 14. PCI Express* Connector

PIN	Signal	18 AWG Colors	PIN	Signal	18 AWG Colors
1	+12V4	Green	4	COM	Black
2	+12V4	Green	5	COM	Black
3	+12V4	Green	6	COM	Black

5.1.2.6 Peripheral Power Consumption (P3, P4, and P6, P8 – P11)

- Connector housing: Amp 1-480424-0 or equivalent
- Contacts: Amp 61314-1 contact or equivalent

Table 15. Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.1.2.7 Right-angle Peripheral Power Connectors (P7)

- Connector housing: JWT F6001HS2-4P or equivalent

Table 16. Right-Angle Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.1.2.8 Floppy Power Connector (P5)

- Connector housing: Amp 171822-4 or equivalent
- Contact: Amp 170204-1 contact or equivalent

Table 17. Floppy Power Connector

Pin	Signal	22 AWG Color
1	+5VDC	Red
2	COM	Black
3	COM	Black
4	+12V4	Green

Note:

Floppy drive not supported by the Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN

5.1.2.9 Right-angle SATA Power Connector (P12)

- Connector housing: JWT F6002HS0-5P-18 or equivalent

Table 18. Right-angle SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3V	Orange
2	COM	Black
3	+5VDC	Red
4	COM	Black
5	+12V4	Green

5.1.2.10 SATA Power Connector (P13)

- Connector housing: JWT A3811H00-5P or equivalent
- Contact: JWT A3811TOP-0D or equivalent

Table 19. SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3V	Orange
2	COM	Black
3	+5VDC	Red
4	COM	Black
5	+12V4	Green

5.1.3 670W Power Supply Airflow and Temperature Rise

The power supply incorporates one 80mm fan for self-cooling and system cooling. The fan provides 14 cubic feet per minute (CFM) airflow through the power supply when installed in the system. The cooling air enters the power module from the non-AC side.

The power supply meets Underwriters Laboratories (UL) enclosure requirements for temperature rise limits. All sides of the power supply, with exception to the air exhaust side, are classified as “Handle, knobs, grips, etcetera, held for short periods of time only.”

5.1.4 670W AC Specifications

The power supply incorporates universal power input with active power factor correction, which reduces line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards.

5.1.4.1 AC Inlet Connector

The AC input connector is an IEC* 320 C14 power inlet. This inlet is rated for 15A / 250VAC.

5.1.4.2 AC Input Voltage Specification

The power supply operates within all specified limits over the following input voltage range (see the following table). The power supply shall power off if the AC input is less than 75±5VAC ranges. The power supply operates properly starting at 80-85VAC input voltages.

Table 20. AC Input Ratings

Parameter	Minum	Rated	VMAX	IMAX	Start up VAC	Power Off VAC
Voltage (110)	90 V_{rms}	100-127 V_{rms}	140 V_{rms}	12 A[1, 3]	85VAC +/-4VAC	75VAC +/-5VAC
Voltage (220)	180 V_{rms}	200-240 V_{rms}	264 V_{rms}	7 A[2, 3]		
Frequency	47 Hz	50/60	63 Hz			

Notes:

[1] Maximum input current at low input voltage range shall be measured at 90VAC, at maximum load.

[2] Maximum input current at high input voltage range shall be measured at 180VAC, at maximum load.

[3] This requirement is not to be used for determining agency input current markings.

5.1.4.3 Efficiency

The 670W power supply has an efficiency of 68% at maximum load and over the specified AC voltage.

5.1.4.4 AC Line Dropout / Holdup

An AC line dropout occurs when the AC input drops to 0VAC at any phase of the AC line for any length of time. During an AC dropout of one cycle or less, the power supply meets dynamic voltage regulation requirements over the rated load. An AC line dropout of 1 cycle or less (20 ms minimum) shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than one cycle, the power supply should recover and meet all turn-on requirements. The power supply meets the AC dropout requirement over rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line does not cause damage to the power supply.

5.1.4.5 AC Line Fuse

The power supply has one line fused in the single line fuse on the line (Hot) wire of the AC input. The input fuse is a slow blow type. AC inrush current does not cause the AC line fuse to blow under any conditions. Not all protection circuits shall cause the AC fuse to blow unless a component in the power supply has failed. This includes DC output load short conditions.

5.1.5 670W DC Output Specifications

5.1.5.1 Grounding

The output ground of the pins of the power supply provides the return path. The output connector ground pins is to the safety ground (power supply enclosure).

5.1.5.2 Output Voltage and Currents

The following tables define two power and current ratings for the 670W power supply. The combined output power of all outputs shall not exceed the rated output power.

Table 21. Load Ratings

Voltage	Minimum Continuous	Maximum Continuous	Peak
+3.3 V	1.0 A	24 A	
+5 V	2.0 A	30 A	
+12 V1	0.5 A	16 A	18 A
+12 V2	1.0 A	16 A	18 A
+12 V3	0.5 A	16 A	18 A
+12 V4	1.0 A	16 A	18 A
-12 V	0 A	0.5 A	
+5 VSB	0.1 A	3.0 A	5A

Notes:

Maximum continuous total output power should not exceed 670W.

Maximum continuous load on the combined 12 V output shall not exceed 48A.

Peak load on the combined 12 V output shall not exceed 52A.

Peak total DC output power should not exceed 730W.

For 12V, peak power and current loading shall be supported for a minimum of 12 seconds.

For 5Vsb, 5Vsb must withstand 5A for 500mS long under first turn on condition.

Combined 3.3V and 5V power shall not exceed 170W.

5.1.5.3 Voltage Regulation

The output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. These limits include the peak-peak ripple/noise. All outputs are measured with reference to the return remote sense signal (Returns). The +12V3, +12V4, –12V and 5VSB outputs are measured at the power supply connectors referenced to Returns. The +3.3V, +5V, +12V1, and +12V2 are measured at the remote sense signal located at the signal connector.

Table 22. Voltage Regulation Limits

Parameter	Tolarance	Minimum	Nominal	Maximum	Units
+3.3V	- 5% / +5%	+3.14	+3.30	+3.46	V_{rms}
+5V	- 5% / +5%	+4.75	+5.00	+5.25	V_{rms}
+12V1	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V2	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V3	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V4	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
- 12V	- 5% / +9%	- 11.40	-12.00	-13.08	V_{rms}
+5VSB	- 5% / +5%	+4.75	+5.00	+5.25	V_{rms}

5.1.5.4 Standby Operation

The 5V standby output is present when an AC input greater than the power supply turn on voltage is applied.

The power supply fan is off (fan-less operation) when the power supply is in the stand-by mode of operation. The power supply will work indefinitely in stand-by mode with the input AC power on, power supply off, and the 5V stand-by output at full load (= 3A).

5.1.6 670W Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds and a PSON# cycle HIGH for one second shall be able to reset the power supply.

5.1.6.1 Over Voltage Protection

The power supply shall shutdown and latch off after an over voltage condition occurs. The voltage shall never exceed the maximum levels when measured at the power pins of the power supply connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power supply connector. 5Vsb (stand-by) will be auto-recovered after removing the Over Voltage Protection limit.

5.1.6.2 Over Temperature Protection

In an Over Temperature condition, the power supply will shutdown. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the 5VSB remains always on. The over temperature protection circuit has built-in hysterisis such that the power supply will not oscillate on and off due to a temperature recovering condition. The over temperature protection trip level shall have a minimum of 4 C of ambient temperature hysterisis.

5.1.7 670W Power Supply Control and Indicator Functions

The following sections define the input and output signals from the power supply.
Signals that can be defined as low true use the following convention:
Signal# = low true

5.1.7.1 PSON# Input Signal

The PSON# signal is required for remotely turning on or off the power supply. PSON# is an active low signal that turns on the +3.3V, +5V, +12V, and -12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

5.1.7.2 PWOK (Power OK) Output Signal

PWOK is a power OK signal and is pulled HIGH by the power supply to indicate that all the outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK will be de-asserted to a LOW state. The start of the PWOK delay time shall be inhibited as long as any power supply output is in current limit.

5.1.8 670W Mean Time Between Failures (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours at 75% load at 40 C, as calculated by Bellcore RPP, or 250,000 hours demonstrated at 75% load at 40 C.

5.2 830W Power Supply

The 830W power supply replaceable module has two outputs: 12V and 5VSB. The input is power factor corrected. An IEC connector on the external face provides for AC input to the power supply. The power supply contains a cooling fan.

5.2.1 830W Mechanical Outline

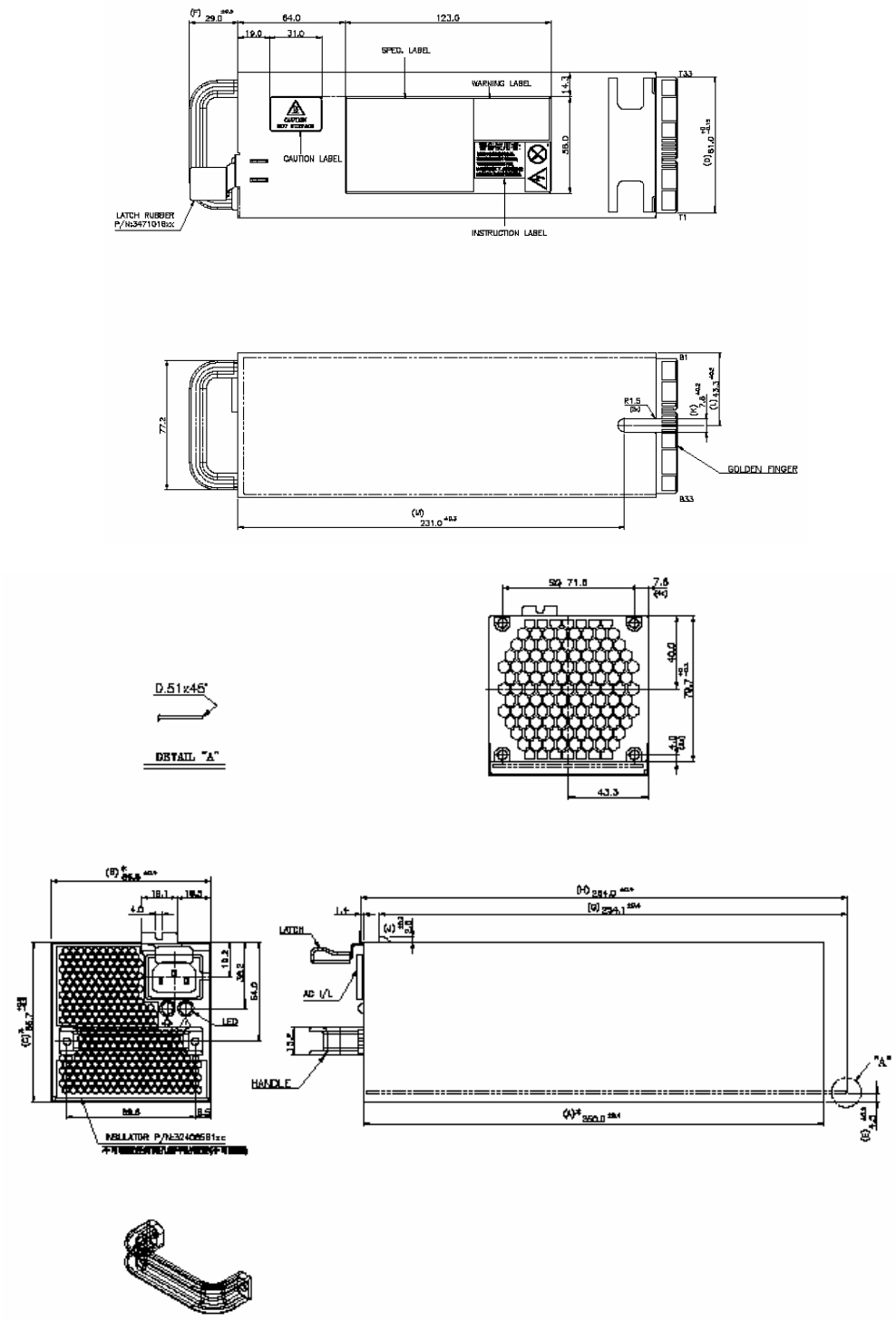


Figure 17. 830W Power Supply Mechanical Drawings

5.2.2 830W Output Wire Harness

The output wiring harness is part of the power distribution board (backplane) and is described in that section. The 830W power distribution board wiring harness is identical to the 670W power supply described in Section 5.1.2 above.

5.2.3 830W Airflow Requirements and Temperature Rise

The power module supply incorporates one 60mm fan. The fan will provide no less than 14 CFM airflow through the power supply when installed in the system

The power supply meets UL enclosure requirements for temperature rise limits. All sides of the power supply, with exception to the air exhaust side, are classified as “Handle, knobs, grips, etcetera, held for short periods of time only.”

5.2.4 830W AC Specifications

The power supply incorporates universal power input with active power factor correction, which reduces line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards. The AC input connector shall be an IEC 320 C-14 power inlet. This inlet is rated for 15A / 250VAC.

5.2.4.1 AC Input Voltage Specification

The power supply operates within all specified limits over the following input voltage range (see the following table). The power supply shall power off if the AC input is less than the 75-80VAC range. The power supply operates properly starting at 80-85VAC input voltages.

Table 23. AC Input Rating

Parameter	Minimum	Rated	Maximum	Maximum Input Current	Start up VAC	Power Off VAC
Voltage (110)	90 V_{rms}	100-127 V_{rms}	140 V_{rms}	14A_{rms}	85Vac +/- 4Vac	75Vac +/-5Vac
Voltage (220)	180 V_{rms}	200-240 V_{rms}	264 V_{rms}	8A_{rms}		
Frequency	47 Hz		63 Hz			

5.2.4.2 Efficiency

The power supply has a recommended minimum efficiency of 75% at maximum load and over the specified 90VAC voltage.

5.2.4.3 AC Line Fuse

The power supply shall have a single line fuse, on the line (Hot) wire of the AC input. The input fuse shall be a slow blow type. AC inrush current shall not cause the AC line fuse to blow under any conditions. No protection circuits in the power supply shall cause the AC fuse to blow unless a component in the power supply has failed. This includes DC output load short conditions.

5.2.5 830W DC Specifications

5.2.5.1 Output Connector

The power supply provides card edge fingers, which mate to a female connector located on the backplane (power distribution board). This blind mating type connector connects the power supply's output voltages and signals.

Table 24. Edge Finger Pin-out

Pin	Component Side	Pin	Bottom
31	GND	31	GND
30	GND	30	GND
29	GND	29	GND
28	GND	28	GND
27	GND	27	GND
26	GND	26	GND
25	+12V	25	+12V
24	+12V	24	+12V
23	+12V	23	+12V
22	+12V	22	+12V
21	+12V	21	+12V
20	+12V	20	+12V
19	+12V	19	+12V
18	+12V	18	+12V
17	+12V	17	+12V
16	+12V	16	+12V
15	+12V	15	+12V
14	+12V	14	+12V
13	GND	13	GND
12	GND	12	GND
11	GND	11	GND
10	GND	10	GND
9	GND	9	GND
8	GND	8	GND
7	Reserved	7	5VSB
6	PS_Kill	6	5VSB

Pin	Component Side	Pin	Bottom
5	PSON	5	Returns
4	PWOK	4	I^2C SCL
3	SMBAlert	3	I^2C SDA
2	+12LS	2	A0
1	Vbias	1	+12VRS

The ground of the pins of the output connector provides the power return path. The ground pin is connected to safety ground (power supply enclosure).

5.2.5.2 Output Power / Currents

The following table defines the current ratings for the 830W power supply.

Table 25. 830W Load Ratings

Voltage	Minimum Continuous Load	Maximum Continuous Load	Peak Load	Maximum Continuous Power	Maximum Peak Power
+12V	1.0A	68A	72A peak (see note 2)	816W	864W
+5VSB	0.1A	3.0 A	3.5A	15W	17.5W
Total continuous power =				830W	
Total Peak power (note 2) =					882W

Notes:

Maximum continuous total DC output power should not exceed 830 Watts.

Peak power and peak current loading shall be supported for a minimum of 12 seconds.

5.2.5.3 Standby Outputs

The 5VSB output shall be present when an AC input greater than the power supply turn on voltage is applied.

5.2.5.4 Stand By Operation

Fan-less operation requirement is the power supply's ability to work indefinitely in stand-by mode: with power on, power supply off and the 5VSB at full load (=2A) under environmental conditions (temperature, humidity, altitude).

5.2.5.5 Voltage Regulation

The output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense signal (Returns). The 12V and 5VSB outputs are measured at the power distribution output connectors referenced to return source.

Table 26. Voltage Regulation Limits

Parameter	Tolerance	Minimum	Nominal	Maximum	Units
+ 12V	-5%/+5%	+11.40	+12.00	+12.60	V_{rms}
+ 5VSB	-5%/+5%	+4.75	+5.00	+5.25	V_{rms}

5.2.6 830W Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main output to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds and a PSON# cycle HIGH for one second shall be able to reset the power supply.

5.2.6.1 Over Current Protection

The power supply shall have over current limit to prevent the +12V output. If the current limits are exceeded, the power supply shall shutdown and latch off. The latch is cleared by toggling the PSON# signal or by an AC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. The 5VSB shall also be protected during over current or shorted conditions so that no damage can occur to the power supply.

5.2.6.2 Over Voltage Protection and Over Temperature

The power supply shall shutdown and latch off after an over voltage condition occurs. This latch is cleared by toggling the PSON# signal or by an AC power interruption.

The power supply is protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In an Over Temperature Protection (OTP) condition, the power supply will shutdown. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the 5VSB remains always on.

5.2.7 830W Power Supply Control and Indicator Functions

5.2.7.1 PSON# Input Signal

The PSON# signal is required to turn on/off the power supply. PSON# is an active low signal that turns on the +12V power rail. When this signal is not pulled low by the system, or left open, the output (except the +5VSB) turns off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

5.2.7.2 PWOK Output Signal

PWOK is a power OK signal and is pulled HIGH by the power supply to indicate all the outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK is de-asserted to a LOW state.

5.2.7.3 PSKILL Signal Requirements

The purpose of the PSKill pin is to allow for hot swapping of the power supply. The PSKill pin on the power supply is shorter than the other signal pins. When a power supply is operating in parallel with other power supplies and then extracted from the system, the PSKill pin will quickly turn off the power supply and prevent arching of the DC output contacts.

5.2.8 830W Mean Time Between Failure (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours at 75% load and 30 C, as calculated by Bellcore RPP, or 250,000 hours demonstrated at 75% load and 30 C.

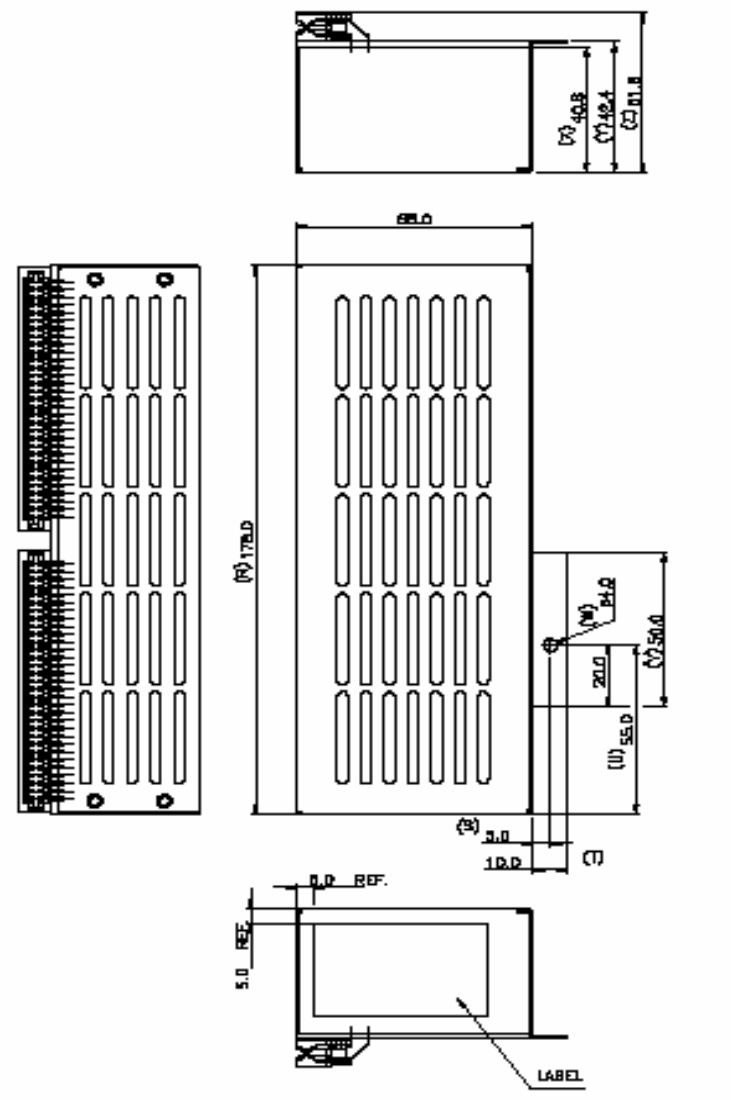
5.2.9 830W Redundant (1+1) Hot Swap Mode

In the redundant (1+1) parallel configuration (two power supply modules installed) the +12V output shared output current is enough current to meet voltage regulation limits during hot swapping and power supply failures. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating power system while the AC cord is unplugged. During this process, the output voltages shall remain within the limits specified. In general, a failed supply may be removed and replaced with a good power supply. Hot swap works with operational as well as failed power supplies. There is a mechanical latch on the power supply to prevent the removal or insertion of a power supply while the AC power cord is plugged into the power supply.

5.3 830W Power Distribution Board

The power distribution board (PDB) is designed to plug directly to the output connector of the power supplies and contains the DC/DC power converters required to produce the output voltages: +3.3 VDC, +5 VDC and –12 VDC along with additional protection circuitry and a FRU EEPROM.

5.3.1 Power Distribution Mechanical Overview



Note:

All dimensions are in millimeters.

Figure 18. Power Supply Module

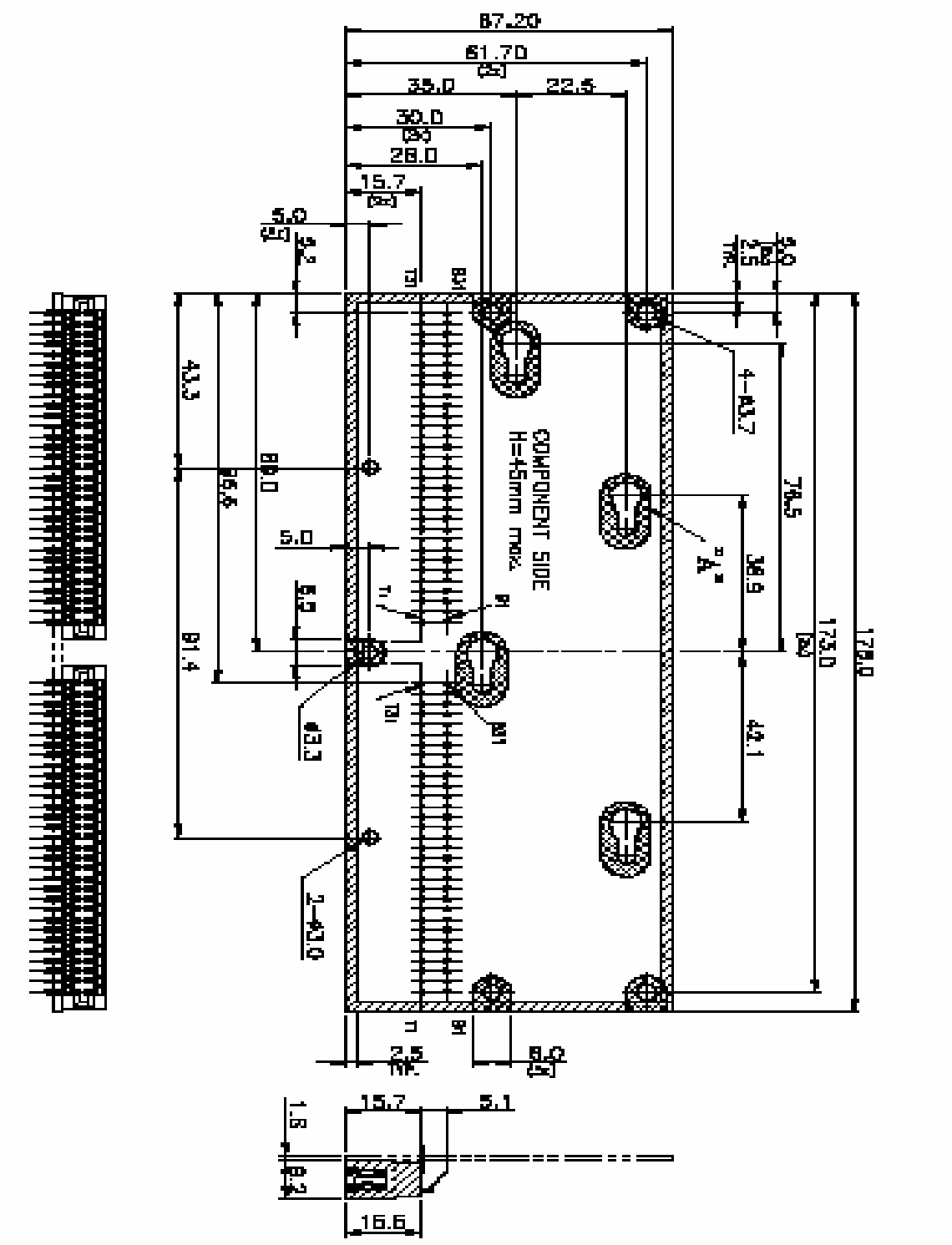


Figure 19. Mechanical Dimensions Power Distribution Board

Note:

All dimensions in the drawing are in mm.

5.3.2 Temperature Operational Limits

The power supply modules provide airflow to cool the power distribution board. The power distribution board operates over the specified limits listed in the following table:

Table 27. Thermal Requirements

Item	Description	Minimum	Maximum	Units
T_{op}	Operating temperature range.	10	45	C
T_{non-op}	Non-operating temperature range.	-40	70	C

5.3.3 Electrical Specification

5.3.3.1 Input Connectors

Each connector provides card edge fingers, which mate with the female input connector on the power distribution board. The female type connector on the power distribution board is a right angle 2x31 pin type Singatron* (p/n: 2806-62-R-30T-P-K1) or equivalent.

Signals that are defined as low true or high true use the following convention:

signal# = low true

Reserved pins are reserved for future use.

Table 28. Cable Lengths

From	Length For Revision S0 Only (mm)	Connector #	Number of Pins	Description
Power supply cover exit hole	450	P1	24	Server Board Power Connector
Power supply cover exit hole	755	P2	8	Processor Power Connector
Power supply cover exit hole	230	P3	4	Peripheral Power Connector
Extension	100	P4	4	Peripheral Power Connector
Extension	100	P5	4	Floppy[1] Power Connector
Power supply cover exit hole	540	P6	4	Peripheral Power Connector
Extension	75 (cover with sleeve)	P7	4	Right-angle Peripheral Power Connector
Power supply cover exit hole	565	P8	4	Peripheral Power Connector
Extension	75	P9	4	Peripheral Power Connector

From	Length For Revision S0 Only (mm)	Connector #	Number of Pins	Description
Power supply cover exit hole	565	P10	4	Peripheral Power Connector
Extension	75	P11	4	Peripheral Power Connector
Power supply cover exit hole	565	P12	5	Right-angle SATA Power Connector
Extension	75	P13	5	SATA Power Connector
Power supply cover exit hole	755	P14	2x2	12V4 Power Connector
Power supply cover exit hole	450	P15	1x5	Signal Connector

Note:

Floppy drive not supported by the Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN.

5.3.3.2 Server Board Power Connector (P1)

- Connector housing: 24-Pin Molex Mini-Fit Jr. 39-01-2245 or equivalent
- Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 29. Server Board Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	+3.3VDC[12]	Orange	13	+3.3VDC	Orange
2	+3.3VDC	Orange	14	-12VDC	Blue
3	COM	Black	15	COM	Black
4	+5VDC[1]	Red	16	PSON[#]	Green
5	COM	Black	17	COM	Black
6	+5VDC	Red	18	COM	Black
7	COM	Black	19	COM	Black
8	PWR OK	Gray	20	Reserved	N.C.
9	5 VSB	Purple	21	+5VDC	Red
10	+12V3	Yellow	22	+5VDC	Red
11	+12V3	Yellow	23	+5VDC	Red
12	+3.3VDC	Orange	24	COM	Black

Notes:

Remote Sense wire double crimped

If the signal connector is not present, the 3.3V remote sense wire will be double crimped into pin 1 in the baseboard power connector (P1)

5.3.3.3 Processor Power Connector (P2)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 30. Processor Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V1	White
2	COM	Black	6	+12V1	White
3	COM	Black	7	+12V2	Brown
4	COM	Black	8	+12V2	Brown

5.3.3.4 Peripheral Power Connectors (P3 - P4, P6, P8 - P11)

- Connector housing: Amp 1-480424-0 or equivalent;
- Contact: Amp 61314-1 contact or equivalent

Table 31. Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.3.3.5 Floppy Power Connector (P5)

- Connector housing: Amp 171822-4 or equivalent
- Contact: Amp 170204-1 contact or equivalent

Table 32. Floppy Power Connector

Pin	Signal	22 AWG Color
1	+5VDC	Red
2	COM	Black
3	COM	Black
4	+12V4	Green

Note:

Floppy drive not supported by the Intel® Server Board S5000PSL, Intel® Server Board S5000XSL and Intel® Server Board S5000XVN.

5.3.3.6 Power Signal Connector (P15)

- Connector housing: 5-pin Molex 50-57-9405 or equivalent
- Contacts: Molex 16-02-0087 or equivalent

Table 33. Power Signal Connector

Pin	Signal	24 AWG Color
1	I^2C Clock	Brown
2	I^2C data	Blue
3	SMBAlert#	White
4	Return Sense	Black
5	3.3RS	Orange

5.3.3.7 12V4 Power Connector (P14)

- Connector housing: 4-Pin Molex 39-01-2040 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 34. 12V4 Power Connector

Pin	Signal	18 AWG color	Pin	Signal	18 AWG Color
1	COM	Black	3	+12V4	Green
2	COM	Black	4	+12V4	Green

5.3.3.8 Right-angle Peripheral Power Connectors (P7)

- Connector housing: JWT F6001HS2-4P or equivalent

Table 35. Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.3.3.9 Right-angle SATA Power Connector (P12)

- Connector housing: JWT F6002HS0-5P-18 or equivalent
- Contact: JWT A3811TOP-0D or equivalent

Table 36. SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3V	Orange
2	COM	Black
3	+5VDC	Red
4	COM	Black
5	+12V4	Green

5.3.3.10 SATA Power Connector (P13)

- Connector housing: JWT A3811H00-5P or equivalent
- Contact: JWT A3811TOP-0D or equivalent

Table 37. SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3V	Orange
2	COM	Black
3	+5VDC	Red
4	COM	Black
5	+12V4	Green

5.3.3.11 DC/DC Converters Loading

The following table defines the power and current ratings of the three DC/DC converters located on the power distribution board, each powered from the +12V rail. The three converters must meet both static and dynamic voltage regulation requirements for the minimum and maximum loading conditions.

3.3V / 5V combined power limit is 170W maximum.

Table 38. DC/DC Converters Load Ratings

	+12VDC Input DC/DC Converters		
	+3.3V Converter	**+5V Converter**	**-12V Converter**
Maximum Load	25.0A	30.0A	0.5A
Minimum Static / Dynamic Load	0.0A	0.0A	0.0A
Maximum Output Power, see table note below	3.3x25=82.5W	5x30=150W	0.5x12=6W

Note:

The straight sum of the three maximum powers = 238.5W, but considering the 3.3/5V power limit, it may be 170W +6W = 176W maximum combined power.

5.3.3.12 Voltage Regulation

The DC/DC converters' output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. These limits include the peak-peak ripple/noise specified. All outputs are measured with reference to the return remote sense signal (Returns). The 3.3V output is measured at the 3.3 RS point; all other voltages are measured at the output harness connectors.

Table 39. Voltage Regulation Limits

Converter Output	Tolarance	Minimum	Nominal	Maximum	Units
+ 3.3VDC	- 5% / +5%	+3.14	+3.30	+3.46	VDC
+ 5VDC	- 5% / +5%	+4.75	+5.00	+5.25	VDC
+12VDC (12V1/2/3/4)	-5%/ +5%	+11.40	+12.00	+12.60	VDC
- 12VDC	- 5% / +9%	-11.40	-12.00	-13.08	VDC
5VSB	-5% / +5%	+4.75	+5.00	+5.25	VDC

5.3.3.13 Fan-less Operation in Stand-by Mode

The power supply will work indefinitely in standby mode with power on, power supply plus power distribution board off, and the 5VSB at full load under environmental conditions (temperature, humidity, altitude) as specified.

5.3.4 Protection Circuits

Protection circuits inside the power distribution board (and the power supply) cause the following:

- The power supply's main +12V output to shutdown, which in turn shuts down the other three outputs on the power distribution board or
- Shut down any of the three outputs on the power distribution board, which in turn also shuts down the entire power supply combo.

If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 second minimum and a PSON# cycle HIGH for 1sec shall be able to reset the power supply and the power distribution board.

5.3.4.1 Over Current Protection (OCP) / 240VA Current Limit

Each DC/DC converter output on the power distribution board has individual OCP protection circuits. The power supply will shutdown and latch off after an over current condition occurs. This latch is cleared by toggling the PSON# signal or by an AC power interruption. Also, the +12V output from the power supply is divided on the power distribution board into four channels and each is limited to 240 VA of power. Current sensors and limit circuits shut down the entire power supply if the limit is exceeded.

5.3.4.2 Over Voltage Protection (OVP)

Each DC/DC converter output on the power distribution board has individual OVP protection circuits built in and locally sensed. The power supply shall shutdown and latch off after an over voltage condition occurs. This latch shall be cleared by toggling the PSON# signal or by an AC power interruption. The values are measured at the power distribution board harness connectors. The voltage shall never exceed the maximum levels when measured at the power pins of the output harness connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power distribution board connector.

5.3.5 Control and Indicator Functions

The following sections define the input and output signals from the power distribution board.

Signals that can be defined as low true use the following convention:

signal# = low true

5.3.5.1 PSON# Input and Output Signals

The PSON# signal is required to remotely turn on/off the power supply.

5.3.5.2 PSKILL

The purpose of the PSKill pin is to allow for hot swapping of the power supply. The mating pin of this signal on the power distribution board input connector should be tied to ground, and its resistance shall be less than five ohms.

5.3.5.3 PWOK (Power OK) Input and Output Signals

PWOK is a Power Good, 5V TTL compatible, coming from the power supply, active HI logic signal, which will be pulled HIGH by the power supply to indicate that its +12V output is within its regulation limits. When its +12V output voltage falls below regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK will be de-asserted to a LOW state.

5.3.5.4 PSALERT# Output Signal

This signal indicates that the power supply is experiencing a problem that the user should investigate. This signal from each supply is OR-ed on the power distribution board, and then becomes one PSALERT# output signal to the system.

5.4 SMBus Monitoring Interface

The 670W and 830W power supplies are compatible with both SMBus 2.0 ‘high power’ and I^2C Vdd based power and drive. This bus operates at 3.3V. The SMBus pull-ups are located on the server board.

The SMBus provides power monitoring, failure conditions, warning conditions, and FRU data. Two pins have been reserved on the connector to provide this information. One pin is the Serial Clock (PSM Clock). The second pin is used for Serial Data (PSM Data). Both pins are bi-directional and are used to form a serial bus.

5.4.1 Usage Modes

There are two usage models depending on the system. The system shall control the usage model by setting the Usage Mode bit.

5.4.1.1 Default Mode

In this mode, the LEDs and registers must automatically clear when a warning event has occurred, because there is no software, BIOS, or other agent that will access the power supply via the SMBus to do any clearing.

5.4.1.2 Intelligent Mode

A system management controller or BIOS agent exists that can read and clear status. In this mode, the LEDs and registers should latch when a warning event occurs so that the system and user can read their status before it changes during transient events. There should also be a mechanism to allow the system management or BIOS to ‘force’ the LED states in order to identify which power supply should be replaced.

5.4.2 Events

Critical events will cause the power supply to shutdown and latch the LED and SMBAlert signal no matter what mode the power supply is in; “default” or Intelligent.”

Warning events latch the LED and SMBAlert signal when in “intelligent” mode. If in the “default” mode, the LED and SMBAlert signal will de-assert as soon as the condition driving the event clears.

5.4.3 Mean Time Between Failures (MTBF)

The backplane assembly shall have a minimum MTBF at continuous operation of 400,000 hours at 100% load and 45 C, as calculated by Bellcore RPP, or 1 million hours demonstrated at 100% load and 45 C.

6. Hot Swap Hard Disk Drive Bays

The chassis can support either an Active SAS/SATA or a Passive SAS/SATA backplane. The backplanes provide the platform support for hot-swap SAS or SATA hard drives.

The passive backplane acts as a “pass-through” for the SAS/SATA data from the drives to the SAS/SATA controller on the baseboard or a SAS/SATA controller add-in card. It provides the physical requirements for the hot-swap capabilities. The active backplane has a built-in SAS controller that requires an SAS controller on the baseboard or a SAS add-in card for communication. The Active SAS/SATA backplane reduces the number of required cables by only using two SAS/SATA connectors to drive up to six hard drives.

When the hot swap drive bay is installed, a bi-color hard drive LED is located on each drive carrier to indicate specific drive failure or activity. For pedestal systems, these LEDs are visible upon opening the front bezel door.

6.1 Intel® Server Chassis SC5400 4HDD and 6HDD Passive SAS/SATA Hot Swap Back Plane (HSBP) Overview

The Intel® Server Chassis SC5400 4HDD or 6HDD Passive SAS/SATA Hot Swap Backplane (HSBP) is a monolithic printed circuit board. The architecture is based on the Vitesse* Server Board and storage management controller VSC410* and supports up to four or six SAS/SATA drives.

The 4HDD and 6HDD SAS/SATA HSBP supports the following feature set.

- Vitesse* Server Board and storage management controller VSC410
- Serial Flash memory
- I^2C EEPROM
- Temperature Sensor
- Four I^2C interfaces
- One Vitesse* SFF8485 (SGPIO) Interface
- Compliance with SCSI Accessed Fault Tolerant Enclosures (SAF-TE) specification, version 1.00 and addendum
- Compliance with SCSI Enclosure Service (SES) specification.
- Compliance with Intelligent Platform Management Interface (IPMI) 1.5.
- Support for up to four or six SAS1.5/3.0Gbps,SATA I or SATA II Drives
- Hot Swap Drive support
- Two 4-pin Standard HD Power Connectors

The figure below shows the functional blocks of the passive 6HDD SAS/SATA HSBP.

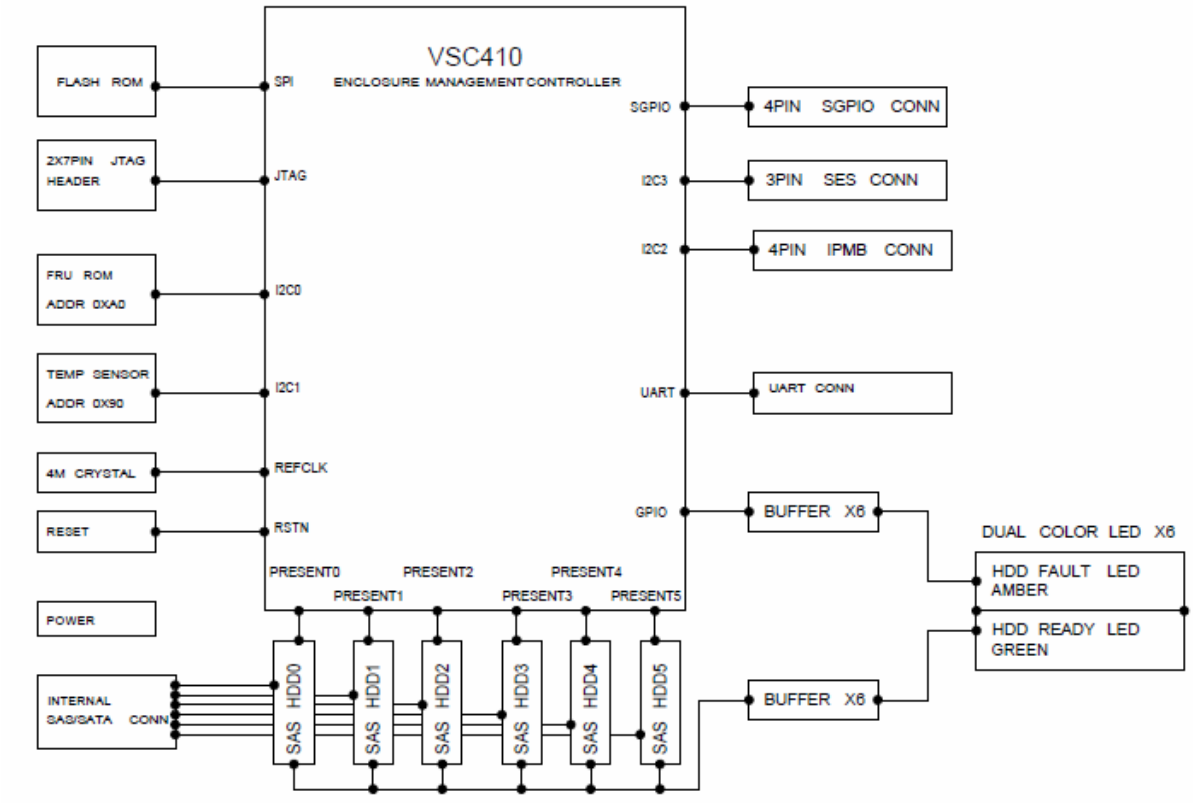


Figure 20. 6HDD Passive SAS/SATA HSBP Block Diagram

6.1.1 Server Board and Storage Management Controller VSC410*

The Vitesse* VSC410 baseboard and storage management controller for the SAS/SATA backplane monitors various aspects of the storage enclosure. The chip provides out-of-band SAF-TE, SES management through the SAS/SATA Host I^2C interface and HDD fault LED status management through the SGPIO interface. The VSC410* also supports the IPMI specification by providing management data to a server board management controller through the IPMB.

The VSC410* controller has many general purpose input and output pins (GPIOs) that allow customization. Some of these GPIOs are used for hard disk drive detection and driving hard disk drive FAULT LEDs.

The VSC410* controller comes in a 64-pin Low Profile Quad Flat Pack (LQFP) package, operates from 3.3V and has an input clock frequency of 4MHz.

6.1.1.1 I²C Serial Bus Interface

The VSC410* controller supports four independent I²C interfaces with bus speed of up to 400 Kbits. The I²C bus 0 supports an AT24C64* EEPROM or equivalent I²C -based EEPROM used as FRU. The I²C bus 1 supports a TI TMP75* or equivalent I²C -based temperature sensor. This enables actual temperature value readings to be returned to the host. The Intelligent Platform Management Bus (IPMB) is supported through the I²C port 2. The SCSI Enclosure Service (SES) interface is supported through the I²C port 3.

The following figure provides a block diagram of I²C bus connection implemented on the 4HDD and 6HDD passive SAS/SATA HSBP.

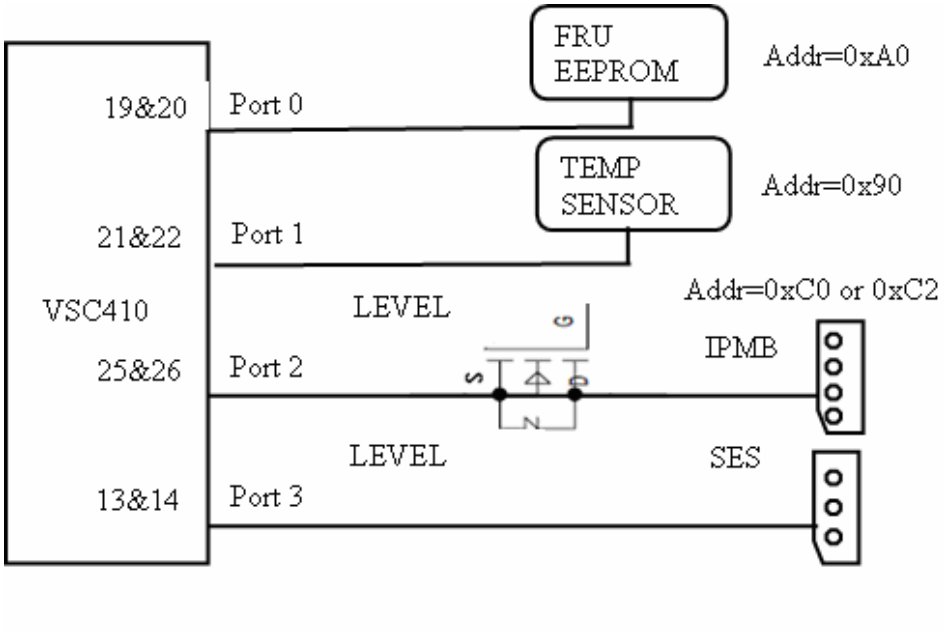


Figure 21. Passive SAS/SATA HSBP I²C Bus Connection Diagram

6.1.1.2 I²C Bus Address and Loading

Table 40. I²C Bus Addressing

TMP75* I²C Address	AT24C64* I²C Address	VSC410* I²C port2
90h	A0h	C0h or C2h

Table 41. 6HDD I²C Bus Loading

Device	Power Well	ViH	ViL	VoL	Ileak	CAP	I²C Address	I²C Bus Name
TMP75*	P3V3	0.7VCC	0.3VCC	0.4V/3mA	1uA	3PF	90h	SMB_LOCAL_CLK SMB_LOCAL_DAT
VSC410*	P3V3	2.0V	0.8V	0.4V/4mA	10uA			SMB_LOCAL_CLK SMB_LOCAL_DAT
AT24C64*	P3V3	0.7VCC	0.3VCC	0.4V/2.1mA	3uA	8PF	A0h	SMB_EEPROM_CLK SMB_EEPROM_DAT
VSC410*	P3V3	2.0V	0.8V	0.4V/4mA	10uA			SMB_EEPROM_CLK SMB_EEPROM_DAT
VSC410*	P3V3	2.0V	0.8V	0.4V/4mA	10uA		C0h or C2h	SMB_3V3_IPMB_CLK SMB_3V3_IPMB_DAT
MMBF170(S)*	P3V3							SMB_3V3_IPMB_CLK SMB_3V3_IPMB_DAT
MMBF170(D)*	P5V							SMB_5VSTB_IPMB_CLK SMB_5VSTB_IPMB_DAT
J4D1	P5V	0.7VCC	0.3VCC	0.4V/3mA	10uA	4/8P		SMB_5VSTB_IPMB_CLK SMB_5VSTB_IPMB_DAT
VSC410*	P3V3	2.0V	0.8V	0.4V/4mA	10uA			SMB_3V3_I2C_CLK SMB_3V3_I2C_DAT
MMBF170(S)*	P3V3							SMB_3V3_I2C_CLK SMB_3V3_I2C_DAT
MMBF170(D)*	P5V							SMB_HBA_I2C_CLK SMB_HBA_I2C_DAT
J4E3	P5V	0.7VCC	0.3VCC	0.4V/3mA	10uA	4/8P		SMB_HBA_I2C_CLK SMB_HBA_I2C_DAT

6.1.1.3 Temperature Sensor

The 4HDD and 6HDD passive SAS/SATA HSBP provides a TI TMP75* or equivalent temperature sensor. The host can query the TMP75* at any time to read the temperature.

The temperature sensor has an I²C address of 0x90h on Port 1 of the VSC410* controller.

6.1.1.4 Serial EEPROM

The 4HDD and 6HDD SAS/SATA HSBP provides an Atmel AT24C64* or equivalent serial EEPROM for storing the FRU information. The AT24C64* EEPROM provides 64K bits of serial electrically erasable and programmable read-only memory.

The serial EEPROM has an I²C address of 0xA0h and resides on Port 0 of the VSC410* controller.

6.1.2 General Purpose Input/Output (GPIO)

The VSC410* controller supports GPIO pins that are customizable. The following table lists the GPIO pins with their assigned functions.

Table 42. 6HDD VSC410* Controller GPIO Assignment

VSC410* Pin Name	I/O Type	Power Well	Programming Description	System Function	Reset State	Initial Value	Connection
P0_0	O	3.3V	U3B1 FLASH ROM and U3C1 EEPROM write protect control	FM_EEPROM_WP			Pull up 4.7K to 3.3V
P0_1	I	3.3V	IPMB Address allocation input	SMB_3V3_IPMB_ADD			Pull up 4.7K to 3.3V
P0_2	O	3.3V	HDD0 Fault LED control	LED_DRV0_FLT_N			Pull up 4.7K to 3.3V
P0_3	I	3.3V	HDD0 Present detection	FM_DRV0_PRSNT_N			Pull up 4.7K to 3.3V
P0_4	O	3.3V	HDD1 Fault LED control	LED_DRV1_FLT_N			Pull up 4.7K to 3.3V
P0_5	I	3.3V	HDD1 Present detection	FM_DRV1_PRSNT_N			Pull up 4.7K to 3.3V
P0_6	O	3.3V	HDD2 Fault LED control	LED_DRV2_FLT_N			Pull up 4.7K to 3.3V
P0_7	I	3.3V	HDD2 Present detection	FM_DRV2_PRSNT_N			Pull up 4.7K to 3.3V
P1_0	O	3.3V	HDD3 Fault LED control	LED_DRV3_FLT_N			Pull up 4.7K to 3.3V
P1_1	I	3.3V	HDD3 Present detection	FM_DRV3_PRSNT_N			Pull up 4.7K to 3.3V
P1_2	O	3.3V	HDD4 Fault LED control	LED_DRV4_FLT_N			Pull up 4.7K to 3.3V
P1_3	I	3.3V	HDD4 Present detection	FM_DRV4_PRSNT_N			Pull up 4.7K to 3.3V
P1_4	O	3.3V	HDD5 Fault LED control	LED_DRV5_FLT_N			Pull up 4.7K to 3.3V
P1_5	I	3.3V	HDD5 Present detection	FM_DRV5_PRSNT_N			Pull up 4.7K to 3.3V
P1_6	O	3.3V	Test Point	TP_LED_DRV6_FLT_N			
P1_7	O	3.3V	Test Point	TP_FM_DRV6_PRSNT_N			
P2_0	O	3.3V	Test Point	TP_LED_DRV7_FLT_N			
P2_1	O	3.3V	Test Point	TP_FM_DRV7_PRSNT_N			
P2_2	O	3.3V	Test Point	TP_LED_DRV8_FLT_N			
P2_3	O	3.3V	Test Point	TP_FM_DRV8_PRSNT_N			
P2_4	O	3.3V	Test Point	TP_LED_DRV9_FLT_N			
P2_5	O	3.3V	Test Point	TP_FM_DRV9_PRSNT			

VSC410* Pin Name	I/O Type	Power Well	Programming Description	System Function	Reset State	Initial Value	Connection
				_N			
P2_6	O	3.3V	Test Point	TP_LED_DRV10_FLT_N			
P2_7	O	3.3V	Test Point	TP_FM_DRV10_PRSNT_N			
P3_0	I/O	3.3V	Clock signal of SGPIO interface	SGPIO_CLK			
P3_1	I/O	3.3V.	Load signal of SGPIO interface	SGPIO_LOAD			
P3_2	I/O	3.3V	SDATAIN signal of SGPIO interface	SGPIO_DATAOUT0			
P3_3	I/O	3.3V	SDATAOUT signal of SGPIO interface	SGPIO_DATAOUT1			

6.1.3 External Memory Device

The 4HDD and 6HDD passive SAS/SATA HSBP contains a non-volatile 8Mbit Serial SPI FLASH Memory for Boot and Run-Time/Configuration code storage. The device resides on the SPI interface of VSC410* controller.

The Serial SPI Flash memory operates from the 3.3V rail.

6.1.4 LEDs

The 4HDD and 6HDD passive SAS/SATA HSBP contain a green STATUS LED and amber FAULT LED for each of the six hard disk drives. The STATUS LED is driven by the SAS/SATA hard disk drive itself. The FAULT LED is driven by the VSC410* controller whenever a condition, as defined by the firmware, is detected.

Table 43. LED Function

Status LED	Condition	Definition
Green	On	HDD Active
	Blink (0.5s on 0.5s off, 50% duty cycle of a 1s)	Spin up/spin down(SAS HDD)
	Blink (1s on 1s off, 50% duty cycle of a 2s)	Formating(SAS HDD)
Amber on	On	HDD Fail
	Blink	Rebuild

Note:

For SAS drives, Green LED will be on when drive is installed and ready. For SATA drives Green LED will be off when drive is installed and ready.

6.1.5 SAS/SATA Drive Connectors

The 4HDD and 6HDD SAS/SATA HSBP provides four or six 22-pin SAS/SATA connectors for hot swap hard disk drives supporting a 1.5GHz and 3.0GHz transfer rate.

Table 44. 22-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	SATA_DRVnA_RX_P
S3	SATA_DRVnA_RX_N
S4	GND
S5	SATA_DRVnA_TX_N
S6	SATA_DRVnA_TX_P
S7	GND
P1	TP_DRVn_P1
P2	TP_DRVn_P2
P3	TP_DRVn_P3
P4	GND
P5	GND
P6	FM_DRVn_PRSNT_N
P7	P5V_DRVn_PRECHG
P8	P5V
P9	P5V
P10	GND
P11	LED_DRVn_READY_N
P12	GND
P13	P12V_DRVn_PRECHG
P14	P12V
P15	P12V

6.1.6 Power Connectors

The four HDD and six HDD passive SAS/SATA HSBP provides two standard 4-pin hard disk drive power connectors. The following table defines the pin-out of the 4-pin Power Connectors.

Table 45. Power Connector Pin-out

Pin	Signal
1	P12V
2	GND
3	GND
4	P5V

6.1.7 Clock Generation and Distribution

The 4HDD and 6HDD SAS/SATA HSBP provides one clock source. A 4-MHz crystal provides clock to the VSC410* controller.

6.1.8 7-Pin SAS/SATA Host Connectors

The 4HDD and 6HDD passive SAS/SATA HSBP provides four or six 7-pin SAS/SATA connectors that will be connected to the host interface of the server board or HBA via mated cable.

The following table defines the pin-out of the 7-pin SAS/SATA host connector.

Table 46. 7-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	SATA_DRVnA_RX_P
S3	SATA_DRVnA_RX_N
S4	GND
S5	SATA_DRVnA_TX_N
S6	SATA_DRVnA_TX_P
S7	GND

Note:
n=0, 1, 2, 3, 4, 5.

6.1.9 IPMB Header - IPMB

The following table defines the pin-out of the 4-pin IPMB Header. This connector is white in color.

Table 47. IPMB Header Pin-out

Pin	Signal Name	Description
1	SMB_5VSTB_IPMB_DAT	Data
2	GND	GND
3	SMB_5VSTB_ IPMB_CLK	Clock
4	SMB_5VSTB_ IPMB_ADDR	IPMI interface address selection. Primary (Low)= 0xC0, Secondary(High) = 0xC2

6.1.10 SGPIO Header - SGPIO

The following table defines the pin-out of the 4-pin SGPIO Header. This connector is black in color.

Table 48. SGPIO Header Pin-out

Pin	Signal Name	Description
1	SGPIO_CLK	Clock
2	SGPIO_LOAD	Load
3	SGPIO_DATAOUT0	DATAIN
4	SGPIO_DATAOUT1	DATAOUT

6.1.11 SES Header - SES

The following table defines the pin-out of the 3-pin SES Header. This connector is white in color.

Table 49. SES Header Pin-out

Pin	Signal Name	Description
1	SMB_HBA_I2C_DAT	Data
2	GND	Ground
3	SMB_HBA_I2C_CLK	Clock

6.1.12 Passive Hot Swap Backplane (HSBP) Cables Explained

Passive backplanes ship with three cables. Depending on the intended configuration, the cables should be utilized in the following manner:

6.1.12.1 IPMB Cable

- Always Installed – white 4-pin IPMB connector on HSBP to white 4 pin IPMB connector on motherboard
- If using one HSBP (Primary), connect the cable to HSBP_A on the motherboard
- If using two HSBPs (Primary & Secondary), connect the second cable to HSBP_B on the motherboard

6.1.12.2 SGPIO Cable

- Always used when using onboard SATA or SAS – black 4-pin connector on HSBP to black 4-pin SGPIO connector on motherboard
- If using the onboard SATA, connect the cable to the SATA GPIO connector on the motherboard
- If using the onboard SAS, connect the cable to the SAS GPIO connector on the motherboard

6.1.12.3 SES Cable

- Only used with SAS controllers – white 3-pin connector on HSBP to white 3-pin SES connector on motherboard
- Connect to white SES connector on motherboard, OR
- Connect to SES connector on add in peripheral card

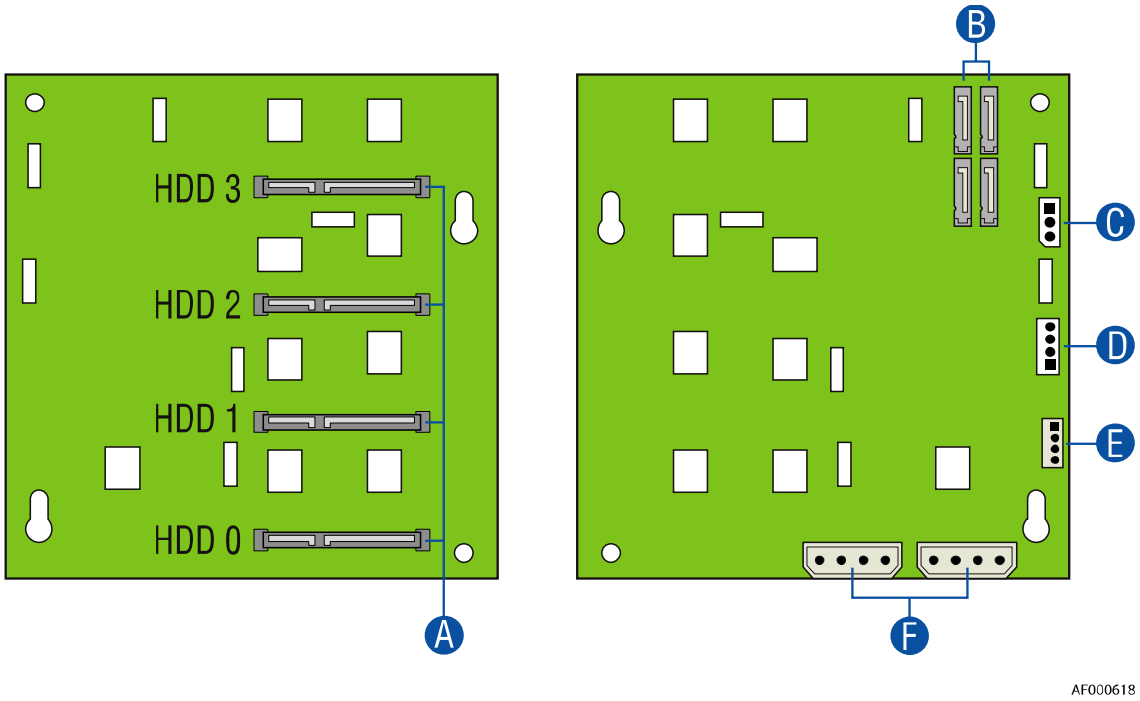
6.1.13 Board Layouts

The figure below shows the board layout and connector placement of the 6HDD passive SAS/SATA hot swap backplane.

A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors
C: IPMB header
D: SGPIO header
E: SES header
F: Power Connectors

Figure 22. Intel® Server Chassis SC5400 6HDD Passive SAS/SATA HSBP Board Layout

The figure below shows the board layout and connector placement of the 4HDD passive SAS/SATA hot swap backplane.



A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors
C: SES header
D: SGPIO header
E: IPMB header
F: Power Connectors

Figure 23. Intel® Server Chassis SC5400 4HDD Passive SAS/SATA HSBP Board Layout

Note:

Secondary side is mirrored.

6.1.14 Connector Specifications

Table 50. 6HDD Passive SAS/SATA Hot Swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST,DISK D	Black	J3F1,J4F1
6	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1,J3R1,J3T1
2	Foxconn LD1807V-S52TC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Black	J4B1,J4B2, J4B3, J4B4, J4C1, J4C2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D1
1	Wieson G2420C888-008H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	Black	J4E1
1	Wieson G2420C888-005H*	CONN,HDR,1 X 3,PLG,VT,2MM,093ST,KP PG	White	J4E3

Table 51. 4HDD Passive SAS/SATA Hot Swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2, 093ST,DISK D	Black	J3D1,J4D1
4	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1
2	Foxconn LD1807V-S52TC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Black	J4A1,J4A2, J4A3, J4A4
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4C2
1	Wieson G2420C888-008H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	Black	J4B3
1	Wieson G2420C888-005H*	CONN,HDR,1 X 3,PLG,VT,2MM,093ST,KP PG	White	J4B1

6.1.15 SAS/SATA Hot Swap Drive Cage Upgrade Kit

The 4HDD and 6HDD SAS/SATA drive cage upgrade kit allows for installation of up to 10 hot swap SAS/SATA drives in the server. The kit includes a SAS/SATA hot-swap drive bay with mounting hardware.

With this kit, the SAS/SATA hot swap drive cage can be connected to the SAS/SATA connectors on the server board or to a SAS/SATA RAID card, through the mated cable. The RAID level that is supported depends on the feature set of the SAS or SATA controller. The kit order codes are as follows:

- AXX4DRV3G
- AXX6DRV3G

6.2 Intel® Server Chassis SC5400 4HDD and 6HDD Active SAS/SATA Hot Swap Back Plane (HSBP) Overview

The Intel® Server Chassis SC5400 4HDD or 6HDD Active SAS/SATA Hot Swap Backplane (HSBP) is a monolithic printed circuit board. The architecture is based on the Vitesse VSC7161* SAS Expander with enclosure management controller and has support for up to six SAS or SATA drives.

The 4HDD and 6HDD SAS/SATA HSBP supports the following feature set:

- 1.5 Gbps and 3.0 Gbps self-configuring Serial Attached SCSI (SAS) Expander with embedded v3000 processor (Vitesse* Stanford-I 32-bit RISC CPU) for local control and Expander or enclosure management functions
- Non-volatile SPI Flash
- I^2C_based EEPROM
- Temperature Sensor
- Two I^2C interfaces
- SAS, SATA and SATA-II extension compatible
- Compliance with SCSI Enclosure Service (SES) specification
- Compliance with Intelligent Platform Management Interface (IPMI) 1.5
- Support for up to six SAS 3.0GHz/1.5GHz, SATAII or SATAI Drives
- Hot Swap Drive support
- Two 4-pin Standard HD Power Connectors

The figure below shows the functional blocks of the Active 6HDD SAS/SATA HSBP.

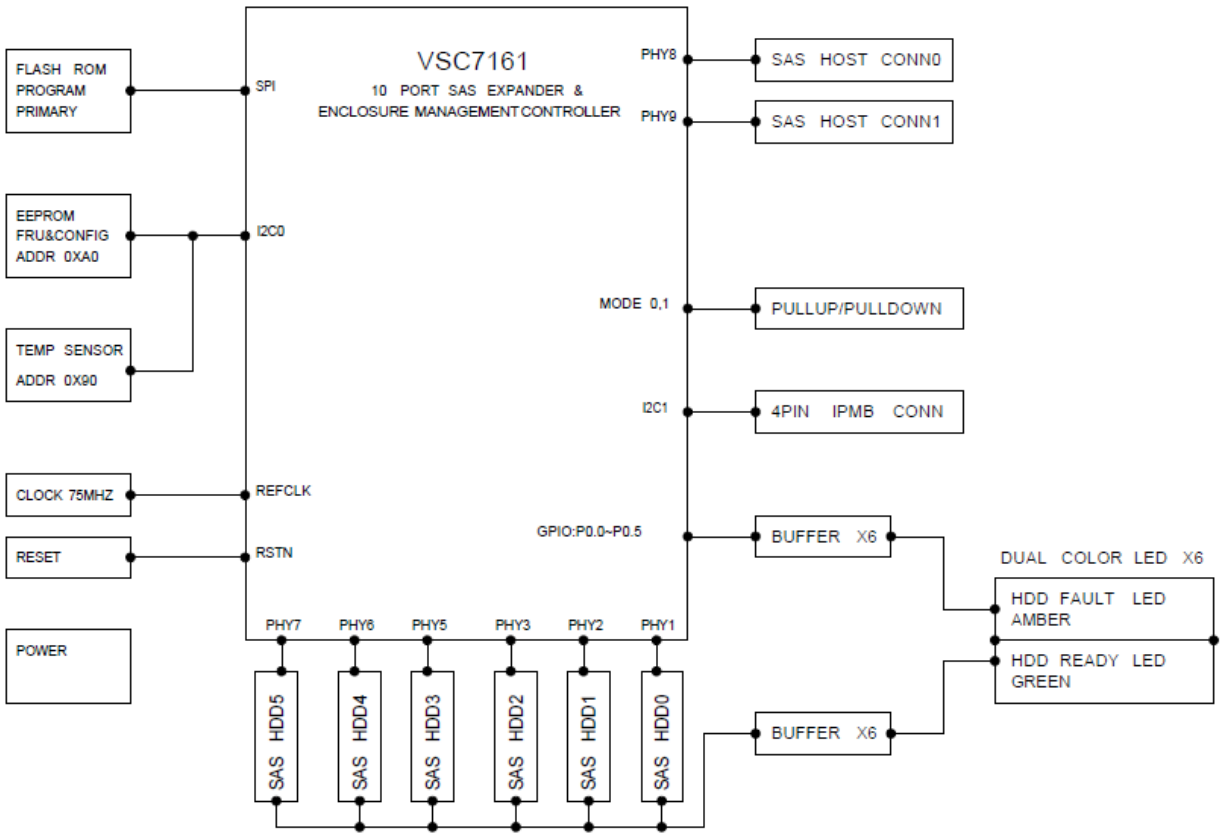


Figure 24. 6HDD Active SAS/SATA HSBP Block Diagram

6.2.1 SAS Expander Vitesse VSC7161*

The VSC7161* device is a 10-port self-configuring SAS Expander that supports 1.5 Gbps and 3.0 Gbps. This device is used for server and enclosure applications for mid-range and enterprise storage systems requiring active SAS port expansion. Its features include:

- 1.5 Gbps and 3.0 Gbps 10-port self-configuring Serial Attached SCSI (SAS) Expander
- Automatic link speed detection and negotiation
- ANSI T10 SAS 1.1 compliant
- Software compatible with other Vitesse* Enclosure Management processors for SCSI, Fiber Channel, Serial ATA (SATA), SFF-8067*, IPMI, and others
- SMP virtual PHY target capability
- STP/SATA bridging support (one per PHY)
- STP Initiator
- Integrated SSP Engine for in-band SES

- Two multimaster two-wire serial interfaces
- Flexible General Purpose I/O for LEDs, Fan Tach, and other functions.

The VSC7161* contains all the functions needed to implement a SAS enterprise server or JBOD system. Typically, this device distributes SAS signals to an array of disk drives in either a server or an external enclosure. The embedded v3000 CPU serves as an SMP management application client and can provide enclosure management functions using a two-wire serial interface or vendor-specific SMP implementation. As the SMP management application client, the CPU (in Master mode) handles all SMP initiator requests and all SMP response functions.

6.2.1.1 Expander Management (EM) subsystem of SAS Expander

The VSC7161* Serial Attached SCSI Expander embeds an Expander Management (EM) subsystem that implements SMP dual-function target and initiator ports for in-band, vendor-unique enclosure management control.

A 75 MHz v3000 CPU with 32 KB of zero wait-state internal SRAM is included in the Expander Management (EM) subsystem. An external flash ROM stores the code for the v3000 CPU. In Master mode HSBP adopts, the v3000 CPU provides all Enclosure Management services using the Vitesse* Software Development Kit (SDK).

The v3000 CPU communicates with other devices in the enclosure through several two-wire serial interface ports, general purpose I/O, and LED drivers. It assembles enclosure status for transmission to the host controller through vendor-unique SMP frames or SSP frames for in-band SCSI Enclosure Services (SES) or through a two-wire serial interface port.

The figure below shows the architecture of Expander Management (EM) subsystem.

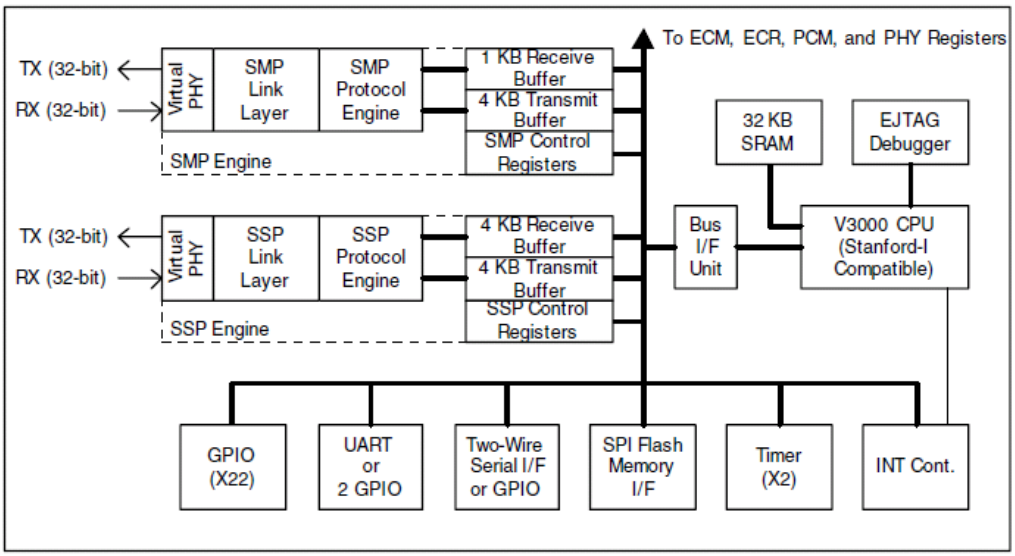


Figure 25. Expander Management(EM) subsystem

6.2.1.2 SAS Host Interface

Port 8 and Port 9 of VSC7161* SAS Expander were only used as SAS host interface, each port connects to SAS controller of server board or HBA via a separate 7-pin SAS connector.

The following table defines pin-out of the 7-pin SAS connector:

Table 52. 7-pin SAS Connector Pin-out

Connector Contact Number	Signal Name
1	GND
2	SASn_EP_RX_P
3	SASn_EP_RX_N
4	GND
5	SASn_EP_TX_N
6	SASn_EP_TX_P
7	GND

6.2.1.3 I²C Serial Bus Interface

The VSC7161* SAS Expander supports two independent I²C interface ports with bus speed of up to 400 Kbits. The I²C bus at port 0 supports a TI TMP75* or equivalent I²C-based temperature sensor. This enables actual temperature value readings to be returned to the host; this bus also supports an AT24C64* EEPROM or equivalent I²C –based EEPROM used as FRU. The Intelligent Platform Management Bus (IPMB) is supported through the I²C port 1.

The following figure provides a block diagram of I²C bus connection implemented on the 4 and 6 HDD Active SAS/SATA HSBP.

z

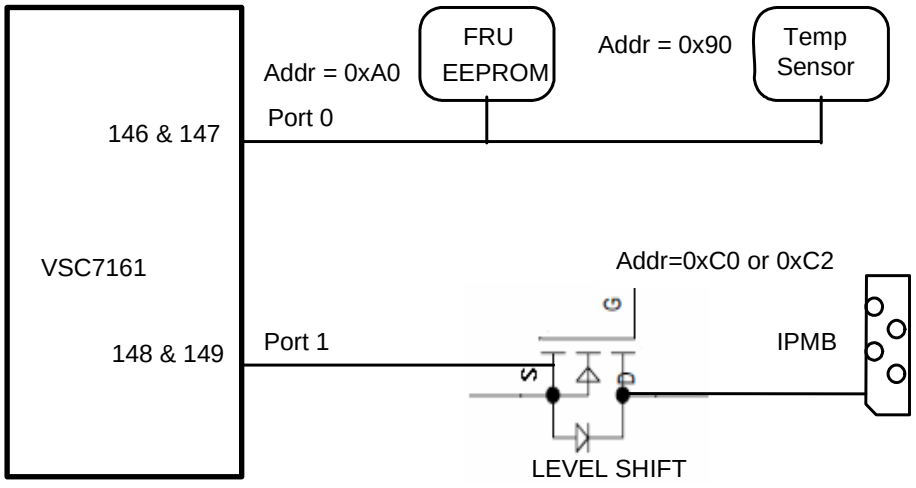


Figure 26. Active SAS/SATA HSBP I²C Bus Connection Diagram

6.2.1.4 I²C Bus Address and Loading

Table 53. I²C Bus Addressing

TMP75* I²C Address	AT24C64* I²C Address	VSC410* I²C port2
90h	A0h	C0h or C2h

Table 54. 6HDD I²C Bus Loading

Device	Power Well	ViH	ViL	VoL	Ileak	CAP	I²C Address	I²C Bus Name
TMP75*	P3V3	0.7VCC	0.3VCC	0.4V/3mA	1uA	3PF	90h	SAS_I2C0_DAT, SAS_I2C0_CLK
VSC7161*	P3V3	2.0V	0.8V	0.4V/4mA	10uA			SAS_I2C0_DAT, SAS_I2C0_CLK
AT24C64*	P3V3	0.7VCC	0.3VCC	0.4V/2.1mA	3uA	8PF	A0h	SAS_I2C0_DAT, SAS_I2C0_CLK
VSC7161*	P3V3	2.0V	0.8V	0.4V/4mA	10uA		C0h or C2h	SAS_I2C1_DAT, SAS_I2C1_CLK
MMBF170(S)*	P3V3							SAS_I2C1_DAT, SAS_I2C1_CLK
MMBF170(D)*	P5V							SMB_IPMB_5V_CLK, SMB_IPMB_5V_DAT
J4D2	P5V	0.7VCC	0.3VCC	0.4V/3mA	10uA	4/8P		SMB_IPMB_5V_CLK, SMB_IPMB_5V_DAT

6.2.1.5 Temperature Sensor

The 4HDD and 6HDD active SAS/SATA HSBP provides a TI TMP75* or equivalent temperature sensor. The host can query the TMP75* at any time to read the temperature.

The temperature sensor has an I²C address of 0x90h on Port 0 of the VSC7161* SAS Expander.

6.2.1.6 Serial EEPROM

The 4HDD and 6HDD active SAS/SATA HSBP provides an Atmel AT24C64* or equivalent serial EEPROM for storing the FRU information. The AT24C64* EEPROM provides 64K bits of serial electrically erasable and programmable read-only memory.

The serial EEPROM has an I²C address of 0xA0h and resides on Port 0 of the VSC7161* SAS Expander.

6.2.2 General Purpose Input/Output (GPIO)

The VSC7161* SAS Expander supports GPIO pins that are customizable. The following table lists the GPIO pins with their assigned functions.

Table 55. VSC7161* SAS Expander GPIO Assignment

VSC7161* PIN Name	I/O Type	Power Well	Programming Description	System Function	Reset State	Initial Value	Connection
P0_0	O	3.3V	HDD0 Fault LED control	LED_DRV0_FLT_N			Pull up 4.7K to 3.3V
P0_1	O	3.3V	HDD1 Fault LED control	LED_DRV1_FLT_N			Pull up 4.7K to 3.3V
P0_2	O	3.3V	HDD2 Fault LED control	LED_DRV2_FLT_N			Pull up 4.7K to 3.3V
P0_3	O	3.3V	HDD3 Fault LED control	LED_DRV3_FLT_N			Pull up 4.7K to 3.3V
P0_4	O	3.3V	HDD4 Fault LED control	LED_DRV4_FLT_N			Pull up 4.7K to 3.3V
P0_5	O	3.3V	HDD5 Fault LED control	LED_DRV5_FLT_N			Pull up 4.7K to 3.3V
P0_6	O	3.3V	Test Point P0_6	TP_EP_P0_6			
P0_7	O	3.3V	Test Point P0_7	TP_EP_P0_7			
P0_8	O	3.3V	FLASH(U3B1) write protect control	FM_ROM0_WP_N			Pull up 4.7K to 3.3V
P0_9	O	3.3V	U3B2(not stuffed) write protect control	FM_ROM1_WP_N			Pull up 4.7K to 3.3V
P0_10	O	3.3V	FRU(U3E2) write protect control	FM_FRU_WP			Pull up 4.7K to 3.3V
P0_11	O	3.3V	Test Point P0_11	TP_EP_P0_11			
P0_12	OI	3.3V	Test Point P0_12	TP_EP_P0_12			
P0_13	OI	3.3V	Test Point P0_13	TP_EP_P0_13			
P0_14	OI	3.3V	Test Point P0_14	TP_EP_P0_14			
P0_15	OI	3.3V	Test Point P0_15	TP_EP_P0_15			
P0_16	I	3.3V	IPMB Address allocation input	SMB_IPMB_ADDR			Pull up 4.7K to 3.3V
P0_17	OI	3.3V	Test Point P0_17	TP_EP_P0_17			
P0_18	O	3.3V	Test Point P0_18	TP_EP_P0_18			
P0_19	OI	3.3V	Test Point P0_19	TP_EP_P0_19			
P0_22	O	3.3V	Test Point P0_22	TP_EP_P0_22			
P0_23	O	3.3V	Test Point P0_23	TP_EP_P0_23			

6.2.3 External Memory Device

The 4HDD and 6HDD active SAS/SATA HSBP contains a non-volatile 8Mbit Serial SPI FLASH Memory for Boot and Run-Time/Configuration code storage. The device resides on the SPI interface of VSC7161* SAS Expander.

The Serial SPI Flash memory operates from the 3.3V rail.

6.2.4 LEDs

The 4 and 6 HDD Active SAS/SATA HSBP contains a green STATUS LED and amber FAULT LED for each of the six hard disk drives. The STATUS LED is driven by the SAS/SATA hard disk drive itself. The FAULT LED is driven by the VSC410* controller whenever a condition, as defined by the firmware, is detected.

Table 56. LED Function

Status LED	Condition	Definition
Green	On	HDD Active
	Blink (0.5s on 0.5s off, 50% duty cycle of a 1s)	Spin up/spin down(SAS HDD)
	Blink (1s on 1s off, 50% duty cycle of a 2s)	Formating(SAS HDD)
Amber On	On	HDD Fail
	Blink	Rebuild

Note:

For SAS drives, Green LED will be on when drive is installed and ready. For SATA drives Green LED will be off when drive is installed and ready.

6.2.5 SAS/SATA Drive Connectors

The 4HDD and 6HDD active SAS/SATA HSBP provides four or six 22-pin SAS/SATA connectors for hot swap hard disk drives supporting a 1.5GHz and 3.0GHz transfer rate.

The following table defines the pin-out of the 22-pin SAS/SATA Drive Connector:

Table 57. 22-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	DRVnA_RX_P
S3	DRVnA_RX_N
S4	GND
S5	DRVnA_TX_N
S6	DRVnA_TX_P
S7	GND

Connector Contact Number	Signal Name
P1	TP_DRVn_P1
P2	TP_DRVn_P2
P3	TP_DRVn_P3
P4	GND
P5	GND
P6	GND
P7	P5V_DRVn_PRECHG
P8	P5V
P9	P5V
P10	GND
P11	LED_DRVn_READY_N
P12	GND
P13	P12V_DRV2_PRECHG
P14	P12V
P15	P12V

6.2.6 Power Connectors

The 4HDD and 6HDD active SAS/SATA HSBP provides two standard 4-pin hard disk drive power connectors. The following table defines the pin-out of the 4-pin Power Connectors.

Table 58. Power Connector Pin-out

Pin	Signal
1	P12V
2	GND
3	GND
4	P5V

6.2.7 Clock Generation and Distribution

The 4HDD and 6HDD active SAS/SATA HSBP provides one clock source. A 75-MHz oscillator provides the clock to the VSC7161* SAS Expander.

6.2.8 IPMB Header - IPMB

The following table defines the pin-out of the 4-pin IPMB Header.

Table 59. IPMB Header Pin-out

Pin	Signal Name	Description
1	SMB_IPMB_5V_DAT	Data
2	GND	GND
3	SMB_IPMB_5V_CLK	Clock
4	SMB_IPMB_5V_ADDR	IPMI interface address selection. Primary(Low) = 0xC0, Secondary(High) = 0xC2

6.2.9 Active Hot Swap Backplane (HSBP) Cables Explained

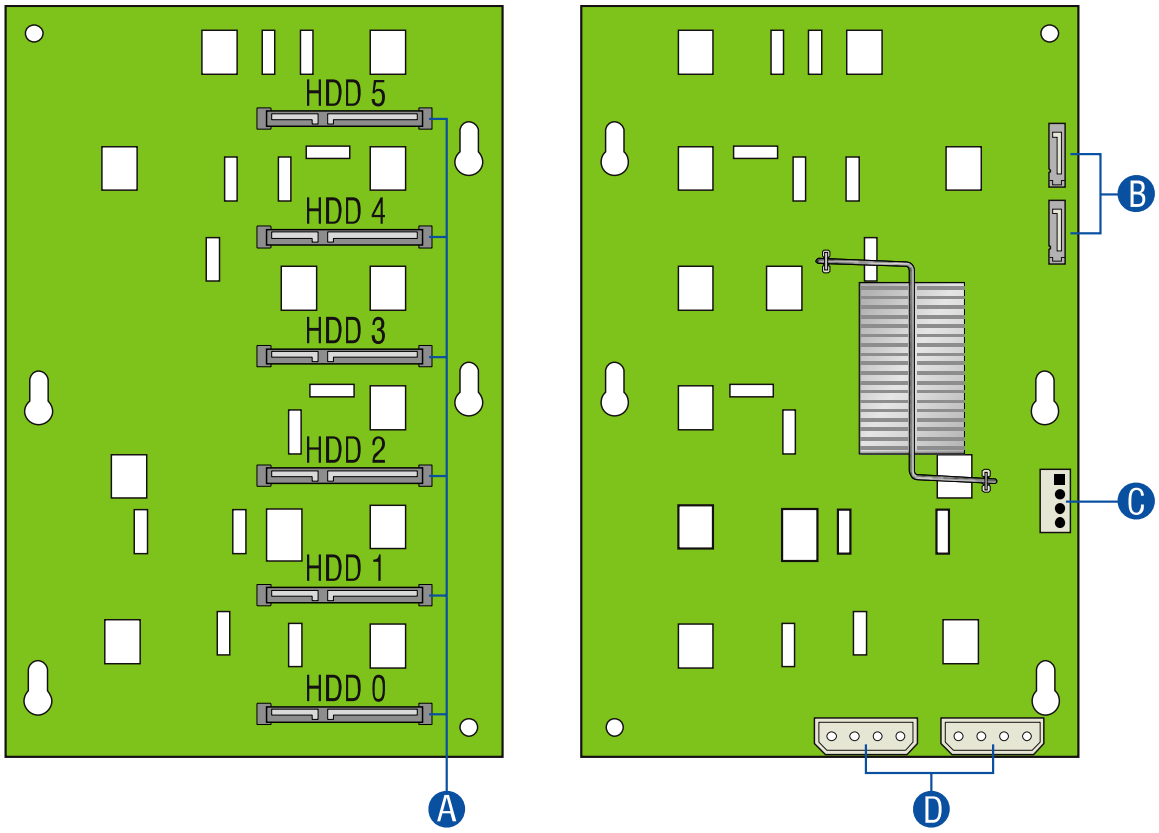
Expander backplanes ship with only one cable (IPMB). This cable should be utilized in the following manner:

6.2.9.1 IPMB Cable

- Always Installed – white 4-pin IPMB connector on HSBP to white 4-pin IPMB connector on motherboard
- If using one HSBP (Primary), connect the cable to HSBP_A on the motherboard
- If using two HSBPs (Primary & Secondary), connect the second cable to HSBP_B on the motherboard

6.2.10 Board Layouts

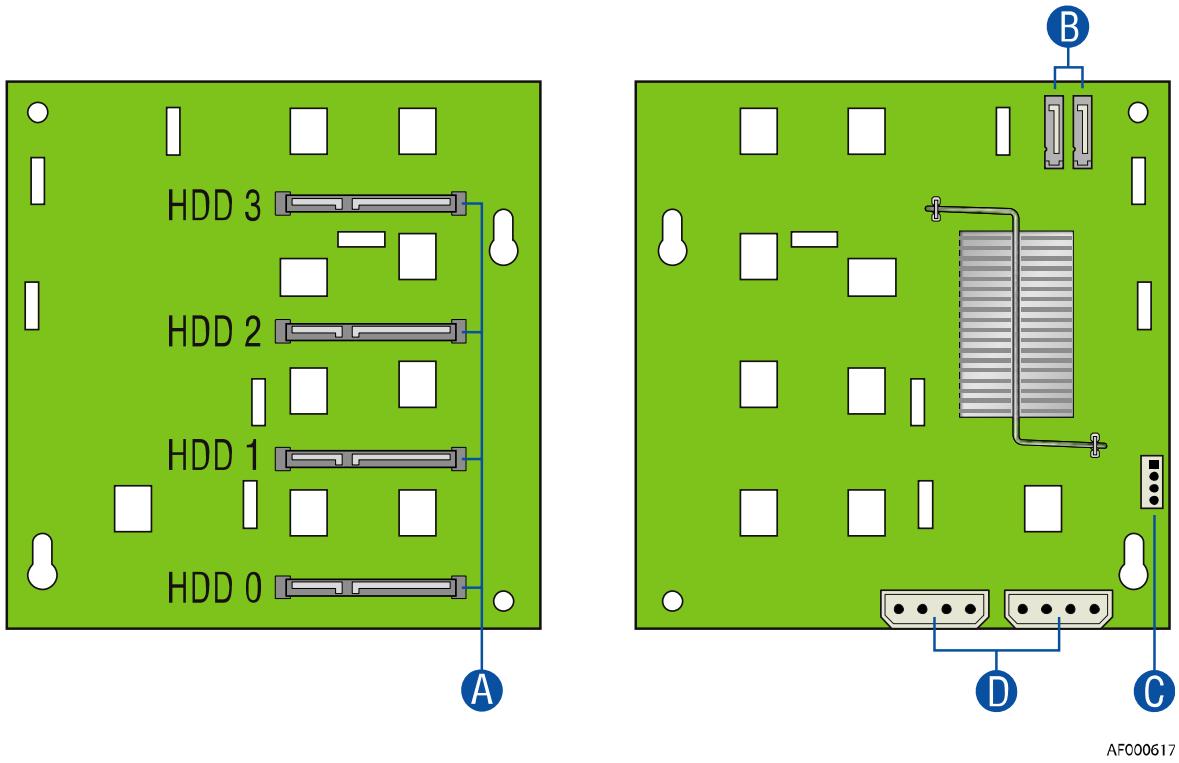
The following figures show the board layout and connector placement of the 6HDD active SAS/SATA hot swap backplane.



A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors
C: IPMB header
D: Power Connectors

Figure 27. Intel® Server Chassis SC5400 6HDD Active SAS/SATA HSBP Board Layout

The figures below show the board layout and connector placement of the 4HDD active SAS/SATA hot swap backplane.



A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors
C: IPMB header
D: Power Connectors

Figure 28. Intel® Server Chassis SC5400 4HDD Active SAS/SATA HSBP Board Layout

Note:

Secondary side is mirrored.

6.2.11 Connector Specifications

Table 60. 6HDD Active SAS/SATA Hot Swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST,DISK D	Black	J3F1,J4F1
6	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1,J3R1,J3T1
2	Foxconn LD1807V-S52UC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Blue	J4B1,J4B2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D2

Table 61. 4HDD Active SAS/SATA Hot Swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST, DISK D	Black	J3F1,J4F1
4	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1, J3R1,J3T1
2	Foxconn LD1807V-S52UC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Blue	J4B1,J4B2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D2

6.2.12 SAS/SATA Hot Swap Drive Cage Upgrade Kit

The SAS/SATA drive cage upgrade kit allows for installation of up to 10 SAS/SATA drives in the server. The kit includes a SAS/SATA hot-swap drive bay with mounting hardware.

With this kit, the SAS/SATA hot swap drive cage can be connected to the SAS/SATA connectors on the server board, or to a SAS/SATA RAID card, through the mated cable. The RAID level that is supported depends on the feature set of the SAS or SATA controller.

The kit order codes are as follows:

- AXX6DRV3GEXP
- AXX4DRV3GEXP

7. Chassis Interconnect

The following figures illustrate the connections between components of the Intel® Server Chassis SC5400 and a server baseboard. Components include the front panel, hard drive bays, 5.25” drives, chassis fans, and power supply.

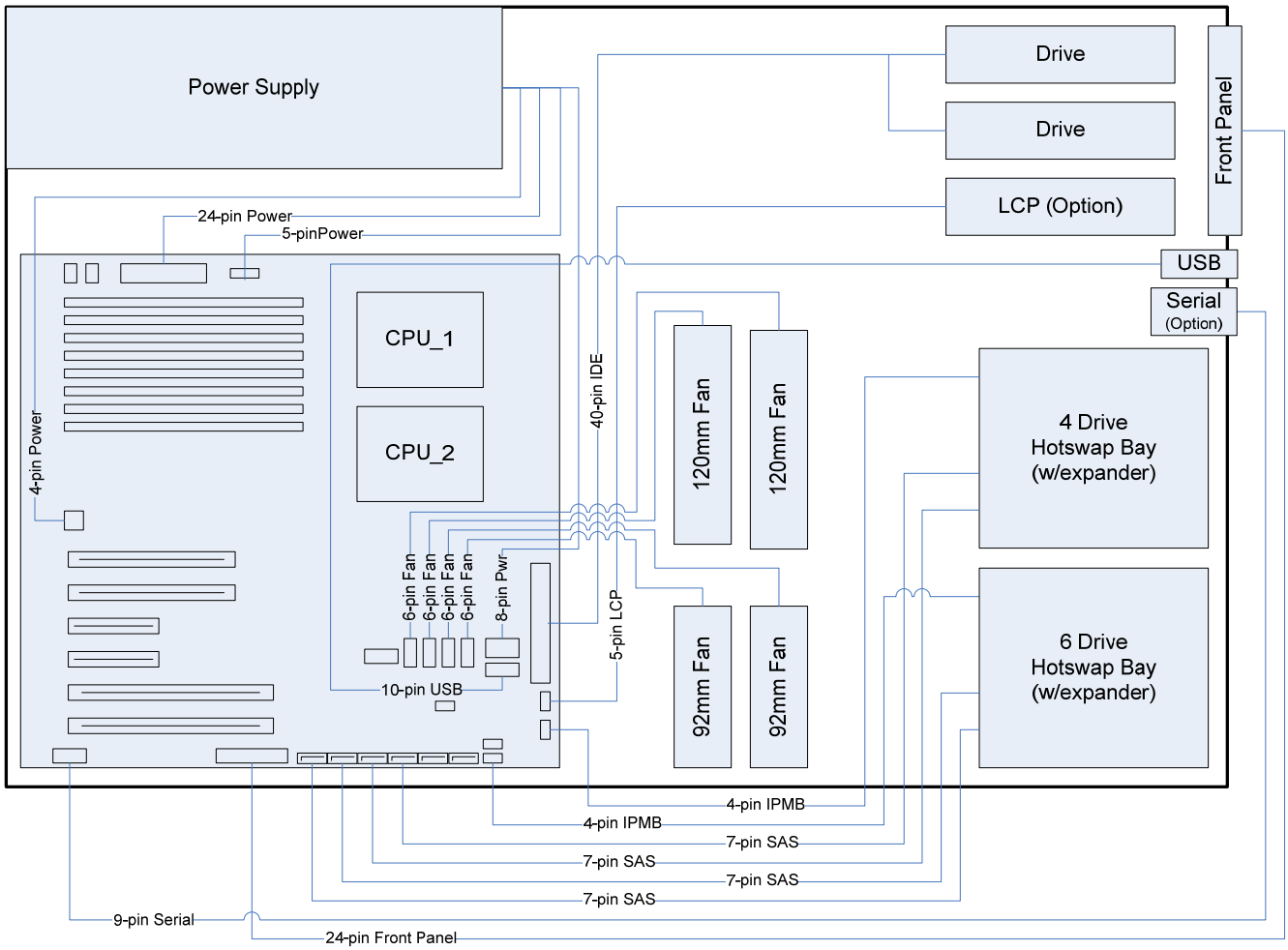


Figure 29. Chassis Interconnect Diagram (HSRP w/Expander Backplanes)

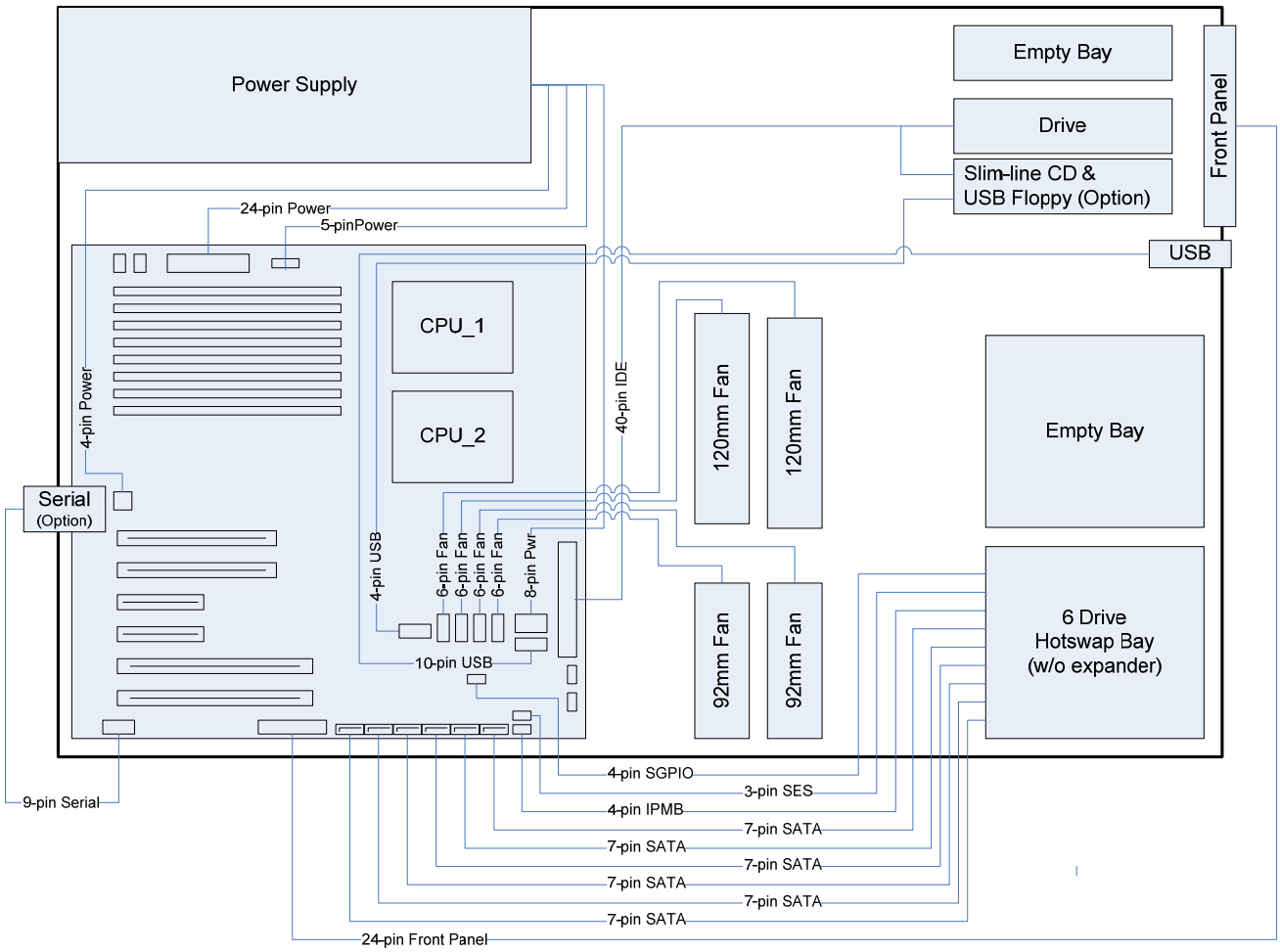


Figure 30. Chassis Interconnect Diagram (BASE w/Non-Expander Backplane)

7.1 Chassis Internal Cables

The following cables are provided as part of the chassis kit and accessories.

Table 62. Intel® Server Chassis SC5400 System Cables

Cable Description	Source
Front panel cable 24-pin	Intel® Server Chassis SC5400 (BASE, BRP and LX)
ATA 100 (IDE) cable	Intel® Server Chassis SC5400 (BASE, BRP and LX)
Fan cable for 92-mm Hot Swap Fan (2ea)	Intel® Server Chassis SC5400LX
Fan cable for 120-mm Hot Swap Fan (2ea)	Intel® Server Chassis SC5400LX
SAS/SATA data cables for Hot Swap drive bays	AXX4DRV3G, AXX6DRV3G, AXX4DRV3GEXP, AXX6DRV3GEXP Accessory
SES 3-pin cable	AXX4DRV3G, AXX6DRV3G Accessory
IPMB 4-pin cable	AXX4DRV3G, AXX6DRV3G, AXX4DRV3GEXP, AXX6DRV3GEXP Accessory
SGPIO 4-pin cable	AXX4DRV3G, AXX6DRV3G Accessory
SATA cables for fixed drives	Boxed Board
Local Control Panel (LCP) I^2C cable	Accessory
USB cable	Intel® Server Chassis SC5400 (BASE, BRP and LX)
Serial COM cable	Intel® Server Chassis SC5400 (BASE, BRP and LX)
Intrusion switch cable	Intel® Server Chassis SC5400 (BASE, BRP and LX)

7.1.1 Front Panel Cable

A 24-conductor ribbon cable with 24-pin IDC connectors links the front panel and SSI Revision 3.61-compliant server board.

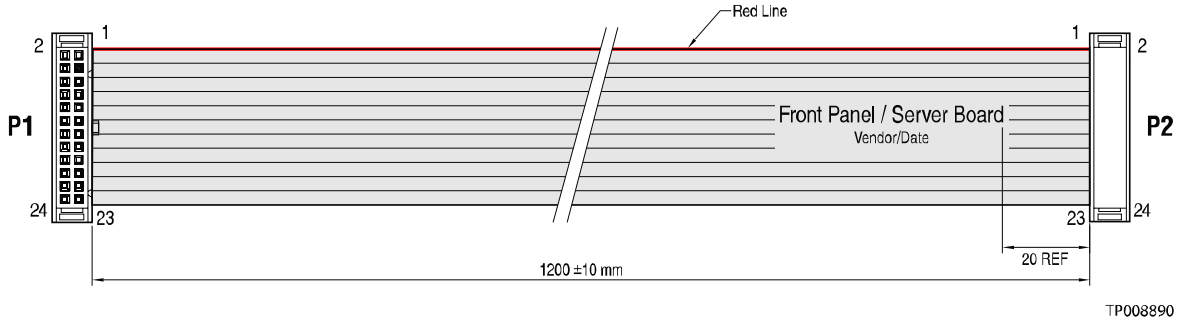


Figure 31. Chassis Panel Cable

7.1.2 USB Cable and Connectors

A 10-conductor USB cable with 10-pin connectors is used for connecting the front panel-mounted USB connector to the server board.

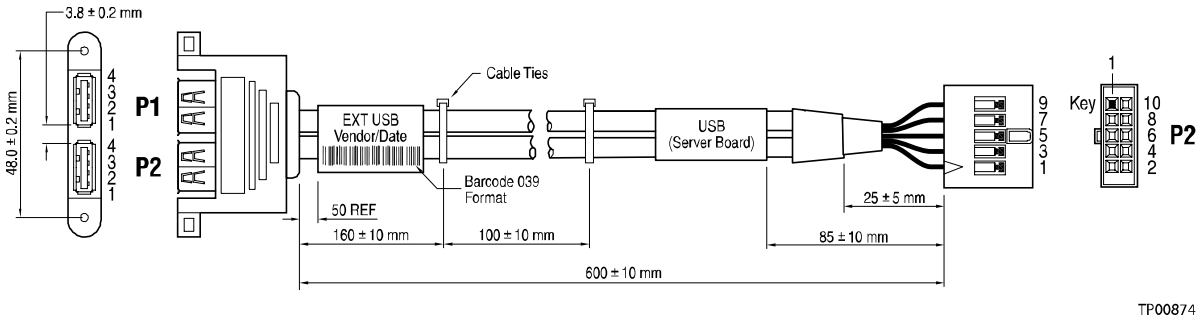


Figure 32. USB Cable Drawing

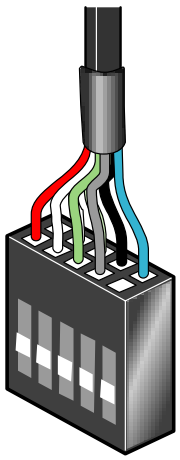


Figure 33. USB Connector

7.1.3 Hot Swap Fan Cables and Connectors

There are four hot swap fans. The 92-mm fans are labeled fans 1 and 2 and use a white 6-pin connector. The 120-mm fans are labeled fans 3 and 4 and use a 6-pin blue connector.

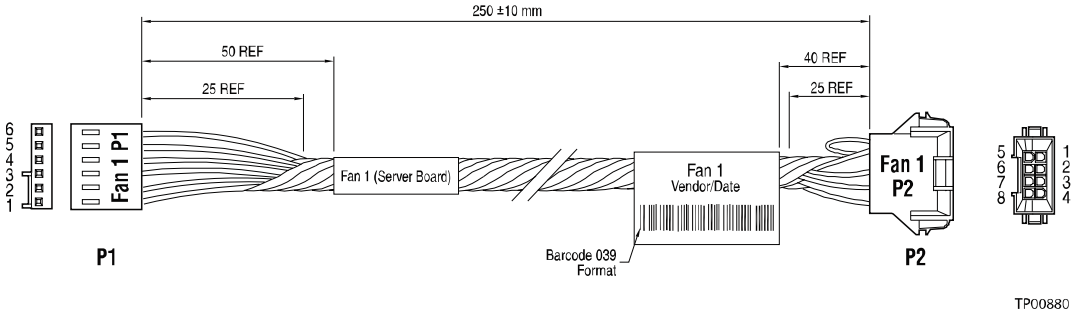


Figure 34. Hot Swap Fan Cable

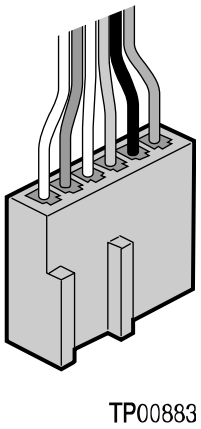


Figure 35. Hot Swap Fan 6-pin Cable Connector

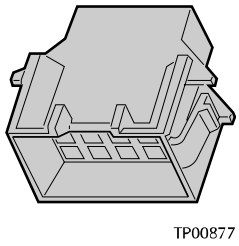


Figure 36. Hot Swap 8-pin Fan Cable Connectors

7.1.4 Serial Cable

The 8-conductor cable provided is terminated in a 2x5 header at one end and a 9-pin panel mount D-sub connector on the other.

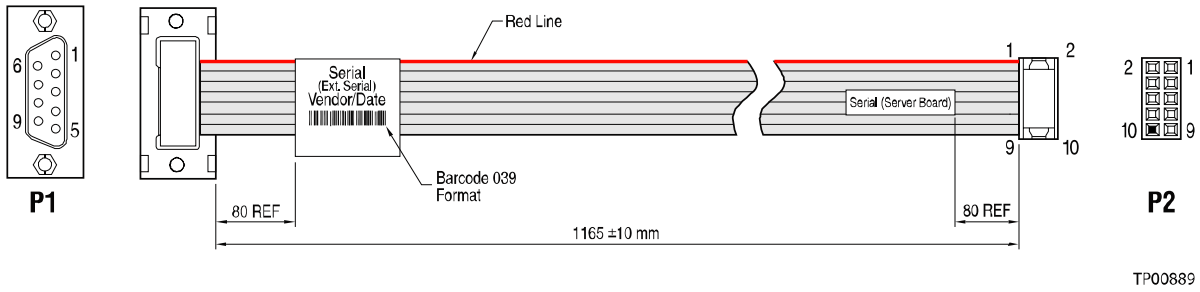


Figure 37. Serial Cable

7.1.5 SATA Data Cable

SATA cables are provided to interface from the server board to the hot swap backplane. The SATA cables ship with the upgrade kit.

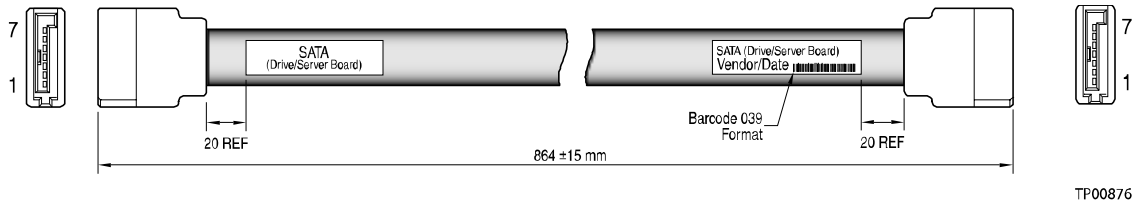


Figure 38. SATA Cable

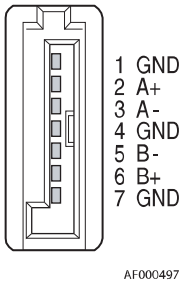


Figure 39. SATA Cable Connector

7.1.6 IPMB cable for 6-Drive Bays (4-pin)

The IPMB cable is used for communication between the backplane firmware and the baseboard. Communication events include fan control, drive insertion, drive removal, and drive failures. This interface is also used to update backplane firmware.

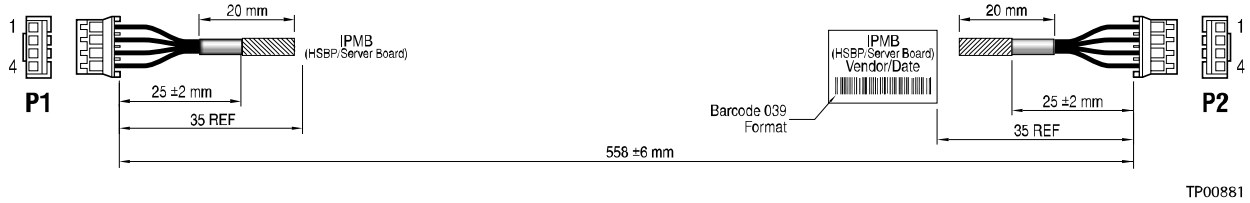


Figure 40. IPMB Cable

7.1.7 SES Cable for 6-Drive Bays (3-pin)

The SES cable is a private I^2C bus between IO controller (HW or SW RAID) and backplane used for enclosure management communication.

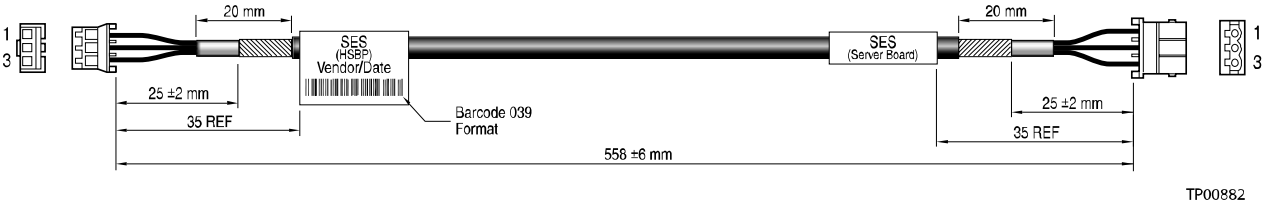


Figure 41. SES Cable

7.1.8 SGPIO Cable for 6-Drive Bays (4-pin)

The SGPIO cable acts as an enclosure management interface between ESB2 and backplane that is used by SW RAID to provide basic array device status indication via visual LED's.

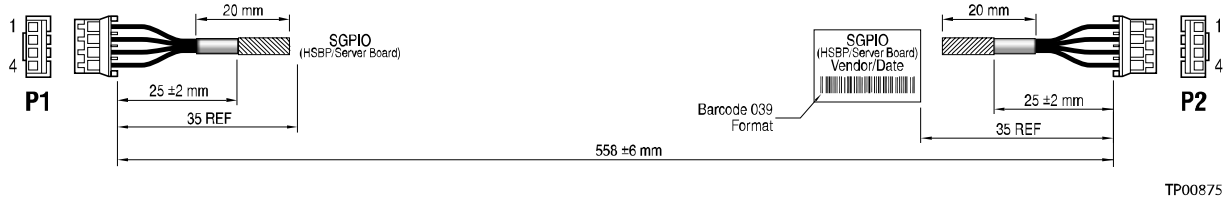


Figure 42. SGPIO Cable

8. System-Compatible Server Boards

The Intel® Server Chassis SC5400 supports the following Intel® server boards:

- Intel® Server Board S5000PSL
- Intel® Server Board S5000XVN
- Intel® Server Board S5000XSL

9. Upgrade Accessories

Principle upgrades include the tool-less four-drive fixed drive bay, four and six-drive SAS/SATA hot swap drive bays, rack mount conversion kit, and slimline CD/USB Floppy Drive Kit.

9.1 SAS/SATA Hot Swap Drive Bays - AXX6DRV3G and AXX4DRV3G

The optional hot-swap SAS/SATA hard disk drive bays, AXX6DRV3G and AXX4DRV3G, are available for all the Intel® Server Chassis SC5400 configurations. It is compatible with either SAS or SATA 3.5” hard drives. The kits include the following:

- Drive rails
- Data cables
- Drive mounting bay
- IPMB cable
- SES cable
- SGPIO cable
- Common installation guide
- SATA/SAS configuration label

9.2 SAS/SATA Hot Swap Drive Bays - AXX6DRV3GEXP and AXX4DRV3GEXP

The optional hot-swap Expander SAS/SATA hard disk drive bays, AXX6DRV3GEXP and AXX4DRV3GEXP, are available for all the Intel® Server Chassis SC5400 configurations. It is compatible with either SAS or SATA 3.5” hard drives. The kits include the following:

- Drive rails
- Data cables
- Drive mounting bay
- IPMB cable
- Common installation guide
- SATA/SAS configuration label

9.3 Rack Conversion Kit - ARIGRACK

The Rack Conversion Kit includes all parts needed to convert a pedestal chassis into a rack mount chassis. The conversion kit includes rack bezel plastic parts; rack handles, and rack mounting rails.

9.4 Slim-line CD and USB Floppy Drive Kit - AXXCDUSBFDBRK

This accessory allows mounting of a slim-line optical drive and USB floppy drive into a single standard 5.25” external peripheral bay.

10. Reliability, Serviceability, and Availability

10.1 Mean Time Between Failure

The following is the calculated Mean Time Between Failures (MTBF) at maximum configuration at 35 C. These values are derived using a historical failure rate and multiplied by factors for application, electrical and/or thermal stress and for device maturity. MTBF estimates should be viewed as “reference numbers” only.

	Server Model					
Subassembly (Server in 35°C ambient air)	**Base**		**BRP**		**LX**	
	MTBF	**FIT**	**MTBF**	**FIT**	**MTBF**	**FIT**
	(hours)	(failures/10^9 hrs)	(hours)	(failures/10^9 hrs)	(hours)	(failures/10^9 hrs)
Power Supply (670W)	220,000	4,545				
Power Supply (830w + dist.module)			380,000	2,632	380,000	2,632
Cooling fans(Non-redundant)	250,000	4,000	250,000	4,000		
Cooling fans(Redundant)					125,000	8,000
Back Plane	1,300,000	769	1,300,000	769	1,300,000	769
Front Panel board	5,000,000	200	5,000,000	200	5,000,000	200
Intrusion Switch	20,000,000	50	20,000,000	50	20,000,000	50
Totals without motherboard =	104,550	9,565	130,700	7,651	8,5800	11,651

10.2 Serviceability

The system is designed for service by qualified technical personnel only.

The desired Mean Time To Repair (MTTR) of the system is 30 minutes including diagnosis of the system problem. To meet this goal, the system enclosure and hardware have been designed to minimize the mean time to repair.

The following are the maximum times that a trained field service technician should take to perform the listed system maintenance procedures, after diagnosis of the system.

Table 63. Maximum Maintenance Procedure Times

Remove Cover	Time
Remove and replace hard disk drive	1 minute
Remove and replace 5 ¼ peripheral device	5 minutes
Remove and replace power supply	5 minutes
Remove and replace drive cage fan	2 minutes
Remove and replace expansion board (PCI Adaptor Card)	5 minutes
Remove and replace front panel board	5 minutes
Remove and replace server board (with no expansion boards)	15 minutes
Overall Mean Time To Repair (MTTR)	30 minutes

11. Environmental Limits

11.1 System Office Environment

Table 64. System Office Environment Summary

Parameter	Limits
Operating temperature	+5^{o}C to +35^{o}C with the maximum rate of change not to exceed 10^{o}C per hour.
Non-operating temperature	-40^{o}C to +70^{o}C
Non-operating humidity	90%, non-condensing @ 30^{o}C
Acoustic noise	6.0 BA LWA in a typical office ambient temperature (18-25C)
Operating shock	No errors with a half sine wave shock of 2G (with 11-millisecond duration).
Package shock	Operational after a free fall, 18 – 24 inch depending on the weight.
ESD	15kV per Intel Environmental Test Specification

11.2 System Environmental Testing

The system will be tested per the Environmental Standards Handbook, Intel Doc 25-GS0009. These tests shall include:

- Temperature operating and Non-operating
- Humidity non-operating
- Packaged and unpackaged shock
- Packaged and unpackaged Vibration
- AC Voltage, frequency, and source interrupt
- AC surge
- Acoustics
- Electrostatic Discharge (ESD)
- EMC radiated

12. Product Regulatory Compliance

The Intel® Server Chassis SC5400 is designed and tested to meet the standards and regulation listed below when configured with the Intel® server boards specified.

12.1 Product Safety Compliance

The Intel® Server Chassis SC5400 complies with the following safety requirements:

- UL 1950 – CSA 950 (US/Canada)
- EN 60 950 (European Union)
- IEC 60 950 (International)
- CE – Low Voltage Directive (73/23/EEC) (European Limits)
- EMKO-TSE (74-SEC) 207/94 (Nordics)

12.2 Product EMC Compliance

The system has been tested and verified to comply with the following EMC regulations when configured with the Intel® server boards specified. For information on compatible server boards, refer to Intel's Server Builder website (http://www.intel.com/go/serverbuilder) or contact your local Intel representative.

- FCC (Class A Verification) – Radiated and Conducted Emissions (USA)
- ICES-003 (Class A) – Radiated and Conducted Emissions (Canada)
- CISPR 22, 3rd Edition (Class A) – Radiated and Conducted Emissions (International)
- EN45022 (Class A) – Radiated and Conducted Emissions (European Union)
- EN45024 (Immunity) (European Union)
- EN6100-3-2 and -3 (Power Harmonics and Fluctuation and Flicker)
- CE – EMC Directive (89/33/EEC) (European Union)
- VCCI (Class A) – Radiated and Conducted Emissions (Japan)
- RRL (Class A) – Radiated and Conducted Emissions (Korea)

12.3 Product Ecology Requirements

All materials, parts and subassemblies must not contain restricted materials as defined in Intel's Environmental Product Content Specification of Suppliers and Outsourced Manufacturers. Substances banned under Restriction of Hazardous Substances (RoHS) European Directive are included in the Intel's Environmental Product Content Specification.

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

Note:

RoHS implementing details are not fully defined and may change.

Threshold limits and banned substances are noted as follows:

- Quantity limit of 0.1% by mass (1000 PPM) for: Lead; Mercury; Hexavalent Chromium; Polybrominated Biphenyls Diphenyl Ethers (PBDE); and Quantity limit of 0.01% by mass (100 PPM) for Cadmium
- All plastic parts shall not use brominated flame retardant or any other halogenated retardants that are not accepted by environmental programs such as Blue Angels, Nordic White Swan, and Swedish TCO.
- All plastic parts that weigh >25gm shall be marked with the ISO11469 requirements for recycling. Example >PC/ABS<
- Packaging materials may not contain more than 100 ppm (total) of lead, cadmium, chromium or mercury.
- If sold as a retail product, packaging materials must be marked with applicable recycling logos for Europe (green dot) and Japan (Eco-marks).
- Product documentation shall incorporate all safety-required information to conform to certifiers and regulators and the certifications issued for the product.
- All cords and cables shall contain < 100 ppm of cadmium.

12.4 Product Regulatory Compliance Markings

This product is provided with the following Product Certification Markings:

- UL / cUL Listing Mark
- CE Mark
- German GS Mark
- Russian GOST Mark
- FCC, Class A Verification Marking
- ICES-003 (Canada EMC Compliance Marking)
- VCCI, Class A Mark
- Australian C-Tick Mark
- Taiwan BSMI Certification Number and Class A Warning

12.5 Electromagnetic Compatibility Notices

12.5.1 USA

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124
1-800-628-8686

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit other than the one to which the receiver is connected.

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment. The customer is responsible for ensuring compliance of the modified product.

Only peripherals (computer input/output devices, terminals, printers, etcetera) that comply with FCC Class B limits may be attached to this computer product. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception.

All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals that are not shielded and grounded, may result in interference to radio and TV reception.

12.5.2 FCC Verification Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124-6497

Phone: 1 (800)-INTEL4U or 1 (800) 628-8686

12.5.3 ICES-003 (Canada)

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques”, NMB-003 édictée par le Ministre Canadian des Communications.

English translation of the above notice:

“This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Canadian Department of Communications.”

12.5.4 Europe (CE Declaration of Conformity)

This product has been tested in accordance to, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

12.5.5 Japan EMC Compatibility

Electromagnetic Compatibility Notices (International):

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

English translation of the preceding notice:

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI) from Information Technology Equipment. If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual."

12.5.6 BSMI (Taiwan)

The BSMI Certification number and the following warning are located on the product safety label, which is located on the bottom side (pedestal orientation) or side (rack mount configuration).

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，
可能會造成射頻干擾，在這種情況下，使用者會
被要求採取某些適當的對策。

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Glossary

Word / Acronym	Definition
ACA	Australian Communication Authority
ANSI	American National Standards Institute
ATX	Advanced Technology Extended
Auto-Ranging	Power supply that automatically senses and adjust itself to the proper input voltage range (110 VAC or 220 VAC). No manual switches or manual adjustments are needed.
BMC	Baseboard Management Controller
CFM	Cubic Feet per Minute (airflow)
CMOS	Complementary Metal Oxide Silicon
Dropout	A condition that allows the line voltage input to the power supply to drop to below the minimum operating voltage.
EEB	Entry E-Bay
EMP	Emergency Management Port
FP	Front Panel
FRB	Fault Resilient Booting
FRU	Field Replaceable Unit
HSBP	Hot Swap Backplane
Latch Off	A power supply, after detecting a fault condition, shuts itself off. Even if the fault condition disappears the supply does not restart unless manual or electronic intervention occurs. Manual intervention commonly includes briefly removing and then reconnecting the supply, or it could be done through a switch. Electronic intervention could be done by electronic signals in the Server System.
LCD	Liquid Crystal Display
LCP	Local Control Panel
LPC	Low-Pin Count
Monotonically	A waveform changes from one level to another in a steady fashion, without intermediate retrenchment or oscillation.
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
Noise	The periodic or random signals over frequency band of 10 Hz to 20 MHz.
OTP	Over Temperature Protection
Over-current	A condition in which a supply attempts to provide more output current than the amount for which it is rated. This commonly occurs if there is a ‘short circuit’ condition in the load attached to the supply.
OVP	Over Voltage Protection
PDB	Power Distribution Board
PFC	Power Factor Correction
PSU	Power Supply Unit
PWOK	A typical logic level output signal provided by the supply that signals the Server System that all DC output voltages are within their specified range
RI	Ring Indicate
Ripple	The periodic or random signals over frequency band of 10 Hz to 20 MHz.
Rise Time	Rise time is defined as the time it takes any output voltage to rise from 10% to 95% of its nominal voltage.
Sag	The condition where the AC line voltage drops below the nominal voltage conditions
SAS	Serial Attached SCSI

Word / Acronym	Definition
SATA	Serial ATA
SCA	Single Connector Attachment
SDR	Sensor Data Record
SE	Single-Ended
SSI	Server Standards Infrastructure
Surge	The condition where the AC line voltage rises above nominal voltage.
THD	Total Harmonic Distortion
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
VCCI	Voluntary Control Council for Interference
VSB or Stand By	An output voltage that is present whenever AC power is applied to the AC inputs of the supply.