Kontron Carrier Grade Server TIGW1U

Technical Product Specification

June 2010

Rev 1.4

Contents

Revision History

Date	Version	Description
June 2010	006	Corrected DC power supply connector pin-out table in section 3.3.11
December 2009	005	Kontron version: Changed all Z-U130 Value Solid State Drive (VSSD) references to SMART Embedded USB Solid-State Drive (eUSB SSD)
April 2008	004	Updated DC Power Supply information in section 9.3.2: Changed part number Changed pinout information
June 2007	003	Updated block diagram in "System Overview" to include NIC port numbers. Added information to "System Overview" and "Ethernet Front Panel (EFP) Board" about second MAC address on Ethernet port 1 for IPMI access to Baseboard Management Controller. Updated rear panel illustrations in "System Overview" and illustration in "AC Power Subsystem" to show correct power supply unit numbering. Updated acoustic specification and added cooling requirements to environmental specifications in "System Overview". Updated interconnection diagram in "Cables and Connectors" and to reflect captive front-panel board power harness. Added section for GCM interface connector to "Cables and Connectors". Added note in "SysCon Board" regarding non-support of SDHC cards. Updated illustrations in "SysCon Board" to match production version of board. Updated illustrations in "AC Power Sybsystem" to reflect captive front-panel board power harness. Corrected input voltages in input connector pin-out in "DC Power Subsystem".
March 2007	002	Updated multiple figures to show new fan mounting. Updated all descriptions of RAID support. Updated and corrected interconnection block diagram. Updated description of front-panel Flex cable to include baseboard signal names as well as SFP board signal names. Updated and corrected all descriptions and specifications of front-panel LEDs.
January 2007	001	Initial release specific to TIGW1U server. (Previously was combined document for TIGW1U server and IP Network Server NSW1U.)

1.0   Introduction

This document provides an overview of the Kontron Carrier Grade Server TIGW1U, including information about the chassis hardware, cables, connectors, system boards, power subsystem, and regulatory requirements.

1.1   Document Structure and Outline

This document is organized into the following chapters:

Chapter 1.0, "Introduction" — Provides an overview of this document.

Chapter 2.0, "System Overview" — Provides an overview of the Kontron Carrier Grade Server TIGW1U chassis hardware.

Chapter 3.0, "Cables and Connectors" — Describes the cables and connectors used to interconnect the system board set and the server system components.

Chapter 4.0, "SAS Front Panel (SFP) Board" — Describes the specifications of the front panel I/O boards including SAS RAID features.

Chapter 5.0, "SMART Embedded USB Solid-State Drive" — Describes the specifications of the optional SMART Embedded USB Solid-State Drive.

Chapter 6.0, "PCI/PCI-X* Riser Card" — Describes the specifications of the standard PCI-X riser card.

Chapter 7.0, "PCI Express* Riser Card" — Describes the specifications of the optional PCI Express riser card.

Chapter 8.0, "AC Power Subsystem" — Describes the specifications of the AC-input power subsystem.

Chapter 9.0, "DC Power Subsystem" — Describes the specifications of the DC-input power subsystem.

Chapter 10.0, "Regulatory Specifications" — Describes system compliance to regulatory specifications.

2.0   System Overview

This chapter describes the features of the Kontron Carrier Grade Server TIGW1U.

This chapter is organized into the following sections.

- Introduction
- External Chassis Features
- Internal Chassis Features
- Server Management
- Specifications

2.1   Introduction

The Kontron Carrier Grade Server TIGW1U is a compact, high-density, rack-mount server system with support for two low-voltage Dual-Core Intel® Xeon® processors and 24 GBytes of DDR2-667 FBD ECC DIMM memory). The server supports high availability features such as hot-swappable disk drives and hot-swappable and redundant power supply modules. The scalable architecture of the TIGW1U server supports a variety of operating systems.

Figure 1 shows the assembled TIGW1U server. Figure 2 shows the system with the top cover and the front bezel removed.

Figure 1.   Carrier Grade Server TIGW1U (Top Cover On)

AF000800
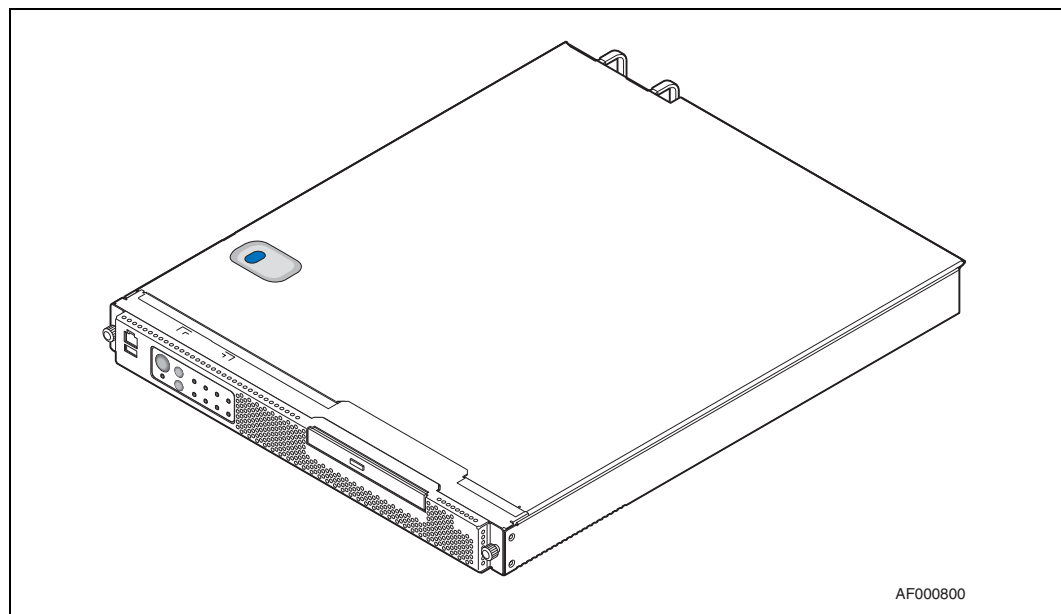
Figure 2. **Carrier Grade Server TIGW1U (Top Cover Off)**

AF000801
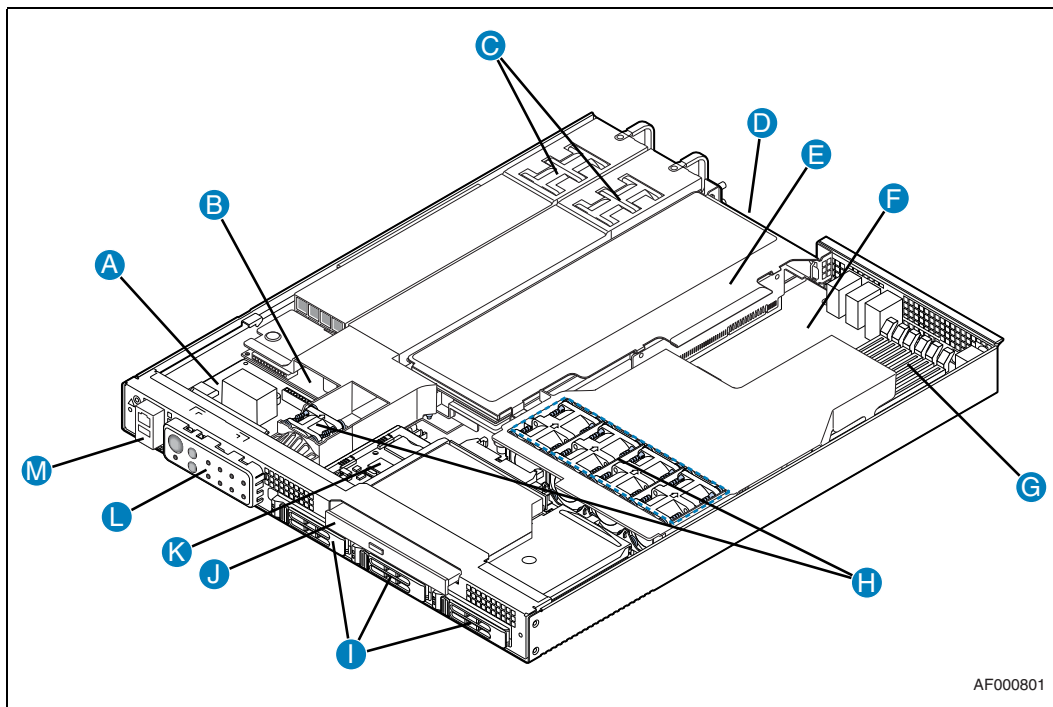
Item	Description	Item	Description
A	Front panel board	H	System fans
B	Power distribution board (PDB)	I	Three SAS hard disk drive bays (see note)
C	Power supply units, AC or DC input (one PSU standard, second PSU optional)	J	DVD drive
D	PCI-X* or PCI Express* card bracket	K	SAS controller
E	Riser card assembly (PCI-X or PCI Express)	L	Front panel LEDs and switches
F	S5000PHB server board	M	Serial port (RJ45) and USB 2.0 connectors
G	System memory		

2.1.1 Carrier Grade Server TIGW1U Features

Table 1 provides a list and brief description of the server features.

Table 1. **Carrier Grade Server TIGW1U Feature List**

Feature	Description
Compact, high-density system	Rack-mount server with a height of 1U (1.75 inches) and a depth of 20.0 inches
Configuration flexibility	Two-way capability in low profile and cost/value-effective packaging Stand-alone system Two Dual-Core Intel® Xeon® processors 5100 series or two Quad-Core Intel® Xeon® processors 5400 series
Serviceability	Rear access to hot-swappable power supplies Front access to hot-swappable hard disk drives

Table 1.   Carrier Grade Server TIGW1U Feature List (Continued)

Feature	Description	
Availability	Supports two hot-swappable 450 W power supplies in a redundant (1+1) configuration (with optional second PSU) Integrated support for software RAID levels 0 & 1 using three internal hot-swappable 2.5-inch SAS disk drives, and RAID levels 0, 1, and 10 when using additional external SAS drive(s) through rear-panel connector. Supports ROMB (RAID On Mother Board) hardware RAID operation for RAID 0, 1, and 5 capability with addition of optional Intel® RAID Activation Key and ECC Mini-DIMM. Memory rank sparing	
Manageability	Remote management and diagnostics support Emergency management port (serial and LAN) IPMI 2.0 compliant Support for optional SMART Embedded USB Solid-State Drive	
Upgradeability and investment protection	Supports Dual-Core Intel® Xeon® processors 5100 series or Quad-Core Intel® Xeon® processors 5400 series Multi-generational chassis Supports Intel® 64 architecture	
System-level scalability	Supports up to 24 Gbytes of DDR2-533 or DDR2-667, registered SDRAM FBD DIMM memory Supports two Dual-Core Intel® Xeon® processors 5100 series or two Quad-Core Intel® Xeon® processors 5400 series Full-height, full-length, 64-bit x 100/66 MHz PCI-X or x8 PCI Express slot Three internal hot-swappable 2.5-inch SAS hard disk drives with RAID support Supports up to four external SAS hard disk drives Low-profile PATA optical (DVD or CD) drive	
Front panel	Power switch Reset switch NMI switch ID switch Main power LED HDD activity LED	NIC activity LED ID LED Power fault Telco alarm/relay LED Critical fault Telco alarm/relay LED Major fault Telco alarm/relay LED Minor fault Telco alarm/relay LED
I/O	Front Access • Serial B port (RJ45) • USB 2.0 port	Rear Access • Four GbE NIC ports • SAS 4x drive port with RAID support • Telco alarms port • Serial B port (RJ45) • Two USB 2.0 ports • GCM 100 Mbps management port (requires Intel® RMM2 accessory) • Dual PS/2 ports for keyboard and mouse • Video port

The S5000PHB server board is mounted horizontally toward the rear of the chassis behind the system fan array. The server board uses two LGA 771 processor sockets, and has six DIMM slots for up to 24 Gbytes of error checking and correcting (ECC) FBD memory. The server board contains one PCI Super Slot to accommodate a full-height, full-length PCI, PCI-X, or x8 PCI Express (PCIe) add-in board by means of a riser card, plus input/output (I/O) ports and various controllers.

The hot-swappable power supply modules are installed at the left-rear of the chassis, as shown in Figure 2. AC-input and DC-input modules are available, and two 450 W power supply modules can be installed for a 1+1 redundant configuration. A filler module for the empty power supply location is supplied for systems without power supply redundancy.

Up to three 2.5-inch SAS hard drives can be mounted in the hot-swap drive bays, which are located in the bottom front of the chassis.

Figure 2 shows the location of the hot-swappable drives, which are accessible when the front bezel is removed. Integrated support for software RAID levels 0 and 1 (and level 10 with connection of external SAS drives through a rear-panel connector) is provided. ROMB (RAID On Mother Board) hardware RAID with RAID 0, 1, and 5 capability is supported with installation of an optional Intel® RAID Activation Key and a mini-DIMM memory module.

A slim-line DVD drive is mounted above the hard drives, as shown in Figure 2, using a drive tray assembly inserted into the front of the system.

The front panel I/O board (referred to as the *SAS front panel board* or *SFP board*) is located in front of the power supplies and extends behind the hot-swappable SAS hard drives. The hard drives dock into the SFP board. The SFP board also provides the user interface for the system's front panel and for the SIO (system management) serial port.

The front bezel can be customized to meet OEM industrial design requirements. The bezel design allows adequate airflow to cool the system components. The front bezel is removed to access the HDD drive trays.

The system contains one 40 × 40 × 28 mm single-rotor fan to cool the PCI area of the server board and an array of four 40 × 40 × 56 mm dual-rotor fans to cool the CPU, memory, and the other server board components. The PCI fan is located to the left of the hard drive area and in front of the power distribution board (PDB) and the CPU/memory fans are directly behind the hard drives and directly in front of the server board, as shown in Figure 2. The PCI fan connector is located on the SFP board to the left of the PCI fan. The connectors for the CPU/memory fans are on the SFP board in front of the fans.

Figure 3 shows a functional block diagram of the Carrier Grade Server TIGW1U.

Figure 3.   **Carrier Grade Server TIGW1U Functional Block Diagram**

2.2 External Chassis Features

2.2.1 Front Panel

Figure 4 shows the front view of the system with the bezel installed and Figure 5 shows the front of the system with the bezel removed. Removing the bezel provides access to the three hot-pluggable hard drive tray assemblies and to the optical drive.

The hard drive and optical drive areas are described in the following sections.

Figure 4. Front View (Bezel Installed)

AF000806
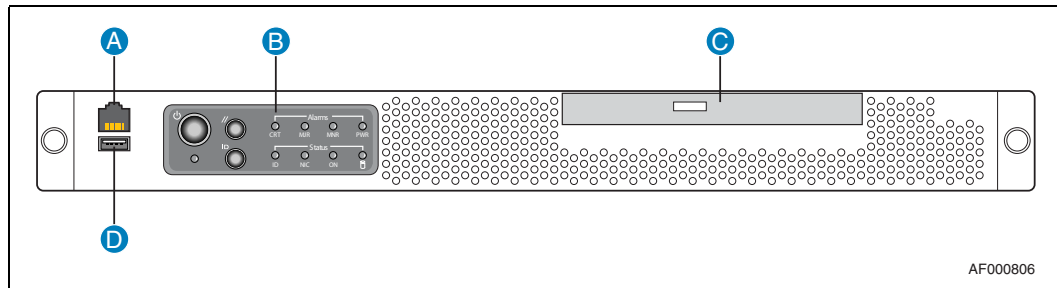
Item	Description	Item	Description
A	Front-panel Serial B port (RJ45)	C	Optical drive (or filler panel)
B	Front-panel control switches and status LEDs	D	USB 2.0 port 2

Figure 5. Front View (Bezel Removed)

AF000807
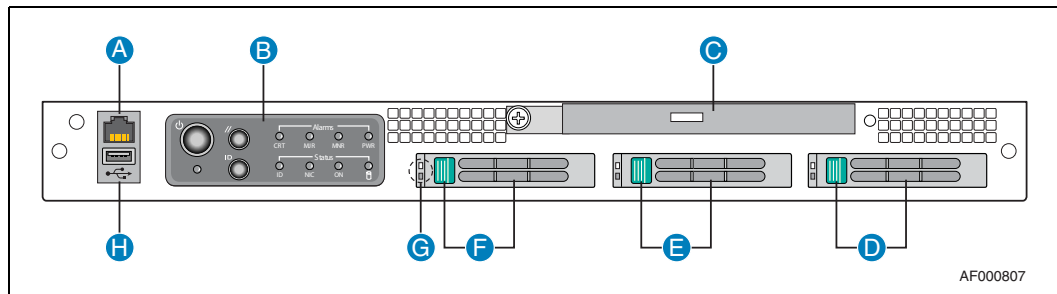
Item	Description	Item	Description
A	Front-panel serial B port (RJ45)	E	Drive bay 1 and handle
B	Front-panel control switches and status LEDs	F	Drive bay 2 and handle
C	Optical drive (or filler panel)	G	HDD activity (green) and fault (amber) LEDs (per drive)
D	Drive bay 0 and handle	H	USB 2.0 port 2

2.2.2   Front Panel Features

The front panel features are shown in Figure 6 and described in Table 2. All front panel control switches and status LEDs are contained on the SFP board. See Section 4.13 for a detailed description of the control switches and status LEDs on the front panel.

Figure 6.   Front Panel Details

AF000808
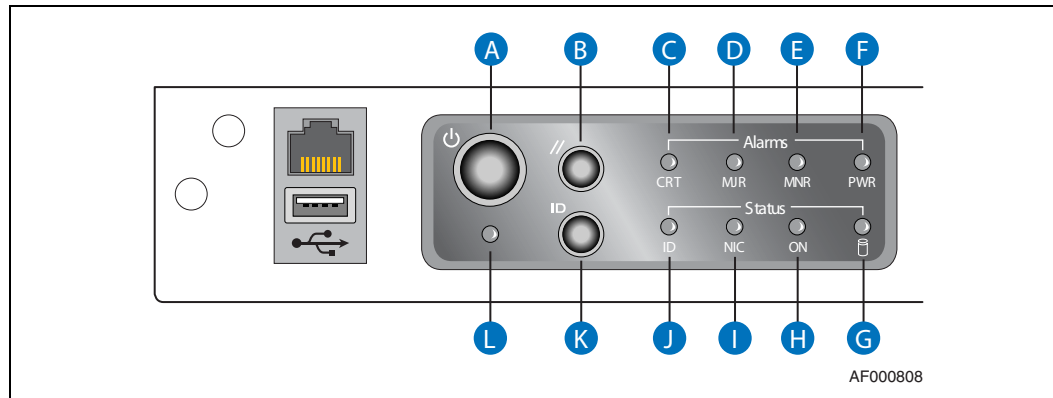
Table 2.   Front Panel Features

Item	Feature	Description
	Front Panel Switches	
A	Power switch	Toggles the system power
B	Reset switch	Resets the system
K	ID switch	Toggles the system ID LED
L	NMI switch	Asserts NMI to the server board
	Front Panel Alarms LEDs	
C	Critical (yellow or red†)	When continuously lit, this indicates the presence of a Critical System Fault. A critical system fault is an error or event with a fatal system impact. In this case, the system cannot continue to operate. An example is the loss of a large section of memory, or other corruption that renders the system not operational. The critical alarm relay is engaged when the LED is lit.
D	Major (yellow or red†)	When continuously lit, this indicates the presence of a Major System Fault. A major system fault is an error or event that has discernible impact to system operation. In this case, the system can continue to operate but in a "degraded" fashion (reduced performance or loss of non-fatal feature reduction). An example is the loss of one of two mirrored disks. The major alarm relay is engaged when the LED is lit.
E	Minor (yellow)	When continuously lit, this indicates the presence of a Minor System Fault. A minor system fault is an error or event that has little impact to actual system operation. An example is a correctable ECC error. The minor alarm relay is engaged when the LED is lit.
F	Power (yellow)	When continuously lit, this indicates the presence of a Power System Fault. The power alarm relay is engaged when the LED is lit.
†	Critical and major alarm indicators are bi-color LEDs that can be configured to be yellow or red by an SDR TAM setting. Yellow is the default.	

Table 2. **Front Panel Features (Continued)**

Item	Feature	Description
	Front Panel Status LEDs	
G	Disk Activity/Fault LED (green/amber)	Indicates hard drive activity when green, or a hard drive fault when amber. This is an OR'ed display for all three internal drives.
H	Main power LED (green)	When continuously lit, this indicates the presence of DC power in the server. The LED goes out when the power switch is turned off (standby mode) or the power source is disrupted.
I	NIC activity LED (green)	Indicates NIC activity.
J	System ID LED (white)	This LED can be toggled remotely or by front-panel ID switch for identification purposes.

2.2.3   Hard Drives

The chassis provides three hot-swappable hard drive tray assemblies at the front, as shown in Figure 7. The tray assemblies accommodate SAS 2.5-inch hard disk drives.

Figure 7.   Hard Drive Positions

AF000809
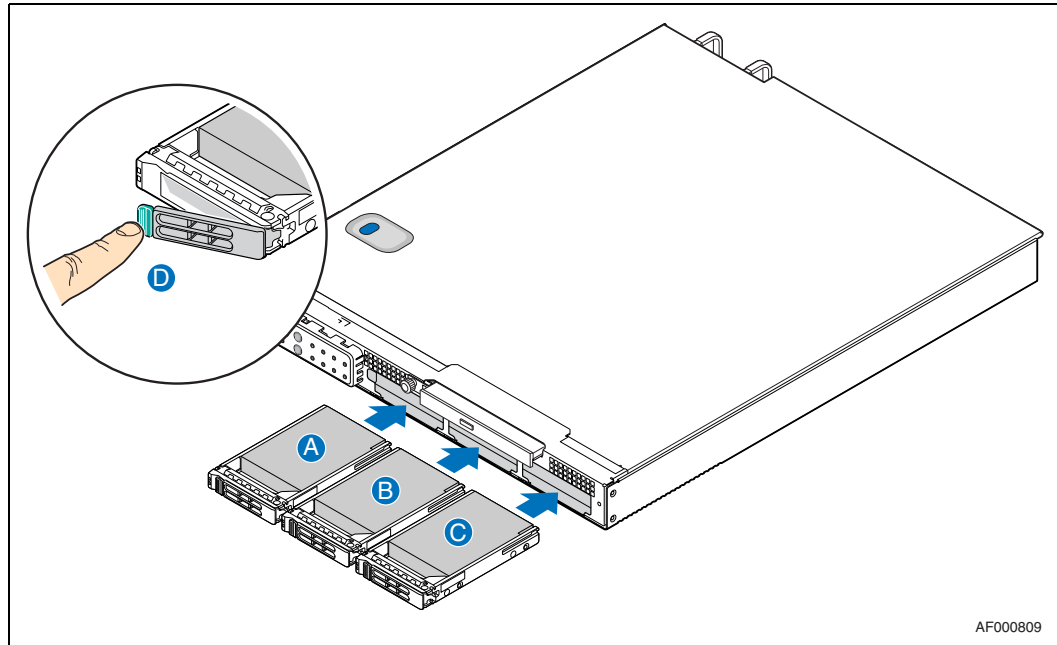
2.2.3.1   SAS Hard Drive Tray Assembly

Each hard drive must be mounted to a drive tray as shown in Figure 8, The drive is attached to the tray by four screws inserted into the sides of the drive.

Figure 8.   SAS Hard Drive Tray

AF000810
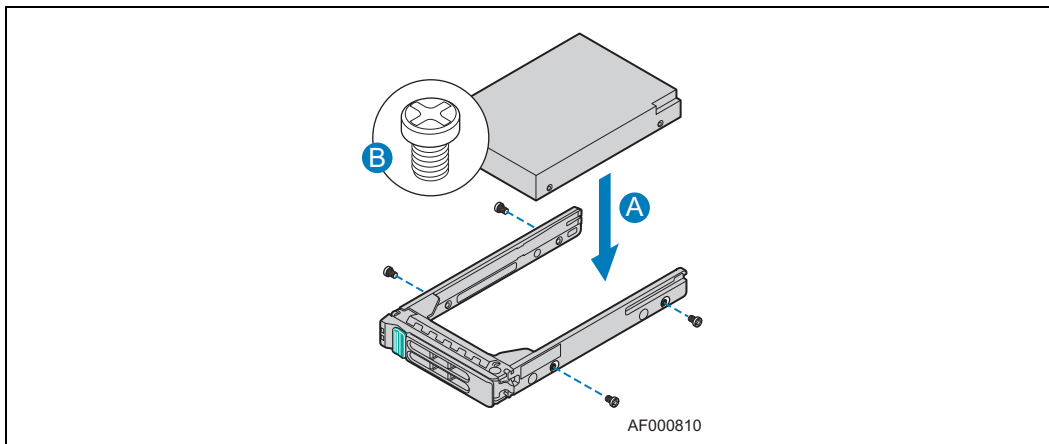
2.2.4   Optical Drive

The chassis provides an ptical drive location at the front of the chassis above the three hard drive bays, as shown in Figure 7. The optical drive is mounted in a non-hot-swappable tray that is secured to the chassis by one captive fastener. The optical drive tray assembly accommodates a 0.5-inch (12.7 mm) slim-line optical drive.

The optical drive tray assembly is installed from the front of the system through the front wall of the chassis. See Figure 9.

Note: The optical drive tray assembly can be removed only when the system is powered off, the bezel is removed, and the IDE signal and optical drive power cables have been disconnected from the back of the drive tray assembly.

Figure 9.   Optical Drive Tray Mounting

AF000811
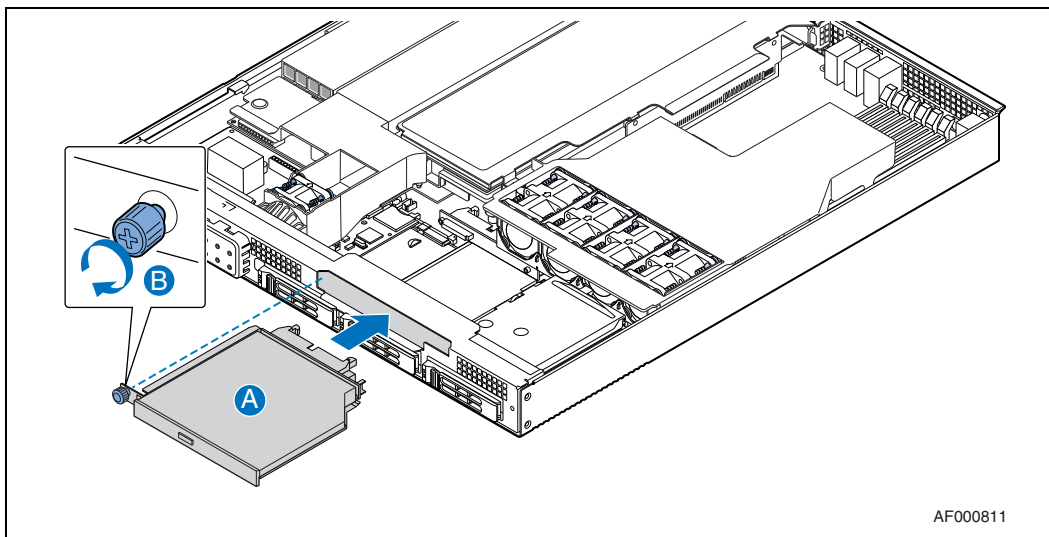
2.2.4.1   Optical Drive Tray Assembly

As shown in Figure 10, the optical drive is installed in a drive tray assembly before installing it into the system. An interface board that provides power and signal cable connections is installed on the rear of the optical drive.

Two cables are required to interconnect the optical drive to the server board and to the EFP board.

- A 40-wire IDE cable connects the 2 × 20 IDE connector on the optical drive interface board to the 2 × 20 IDE connector on the server board.

- A two-wire discrete power cable connects the 1 × 2 connector on the optical drive interface board to the EFP board.

Figure 10.   Optical Drive Tray Assembly

AF000812
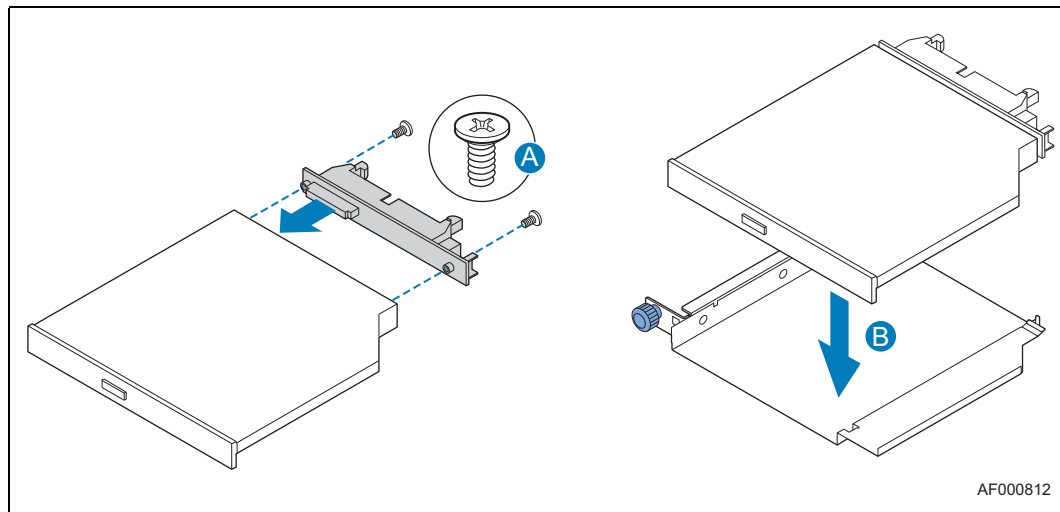
2.2.5 System Rear View

Figure 11. System Rear View

AF000813

Item	Description	Item	Description
A	PS/2 mouse connector	J	Power supply 2 DC input connector †
B	COM2 (Serial B) port connector (RJ45)	K	External 4x SAS connector
C	GbE NIC port 3 connector (RJ45)	L	Management port. Requires optional Intel® Remote Management Module 2 or filler panel
D	GbE NIC port 2 connector (RJ45)	M	GbE NIC port 1 connector (RJ45) ††
E	PCI card I/O bracket or filler panel (shown)	N	GbE NIC port 4 connector (RJ45)
F	Ground studs (used with DC-input systems)	O	USB connectors, ports 0 (bottom) and 1 (top)
G	Power supply 1 †	P	Telco alarms connector (DB15)
H	Power supply 1 DC input connector †	Q	Video connector
I	Power supply 2 (optional) or filler panel†	R	PS/2 keyboard connector
†	Items G through J in Figure 11 illustrate the DC-input configuration. AC-input power supply modules are also available.		
††	Port 1 has a second MAC address and IP address that provide access to the baseboard management controller to enable remote IPMI management over LAN.		

2.3 Internal Chassis Features

2.3.1 Intel® Server Board S5000PHB

See the *Intel® Server Board S5000PHB Technical Product Specification* for detailed information about this server board.

2.3.2 PCI/PCI Express Adapter Subsystem

The S5000PHB server board implements a PCI super slot that contains the signals necessary for a PCI-X* or PCI Express* (PCIe*) expansion slot. One of two low-profile riser cards is inserted into the super slot to access the required signals and provide the appropriate connector for a PCI/PCI-X or PCI Express adapter card. The server accommodates full-length, full-height adapter cards and the card's I/O bracket is accessible through an opening in the rear panel of the system.

The system is delivered with the PCI/PCI-X riser card installed in the system board riser slot. To use a PCIe adapter card, the PCI-X riser card must be replaced with a PCIe riser card, which may be ordered as an accessory.

To add an adapter card to the system, a user removes the riser card assembly from the system and removes the I/O filler panel from the rear of the server. After attaching the appropriate riser card to the PCI or PCIe adapter card, the assembly is plugged into the super slot connector near the center of the server board. See the *Intel® Server Board S5000PHB Technical Product Specification* for electrical characteristics for this PCI/PCIe adapter subsystem.

Note: See the *Kontron Carrier Grade Server TIGW1U Tested Hardware and Operating System List* (THOL) for a list of supported adapter cards.

The PCI-X riser card implements a 64-bit PCI slot with bus speeds of 33 MHz or 66 MHz for PCI adapter cards or 66 MHz, 100 MHz, or 133 MHz for PCI-X cards.

The PCI Express riser card implements a x8 link interface, and can be used with adapter cards that implement x1, x4, or x8 interfaces.

2.3.3   Power Subsystem

The power subsystem consists of up to two hot-swappable power supply units (PSU) and a power distribution board (PDB). The system can be configured and operated with either an AC or DC input PSU located at the left rear of the chassis that docks into a common PDB. The system can contain up to two PSUs and can be configured as follows:

- Two PSUs installed, (1+1) power redundancy for maximally loaded system
- One PSU installed, non-redundant for maximally loaded system

When the system is configured with two power supply modules, the hot-swap feature allows the user to replace a failed PSU without interrupting system operation. To ensure that all components remain within specification under all system environmental conditions, it is recommended that PSU hot-swap operations not exceed two minutes in duration.

Power from the power subsystem is carried directly to the server board through a docking connector between the PDB and the server board. Front panel board power is provided from the PDB through a cable. Peripheral devices are powered from the front panel board via discrete cables between the device and the front panel board. One PSU is capable of handling the worst-case power requirements for a fully configured Carrier Grade Server TIGW1U. This includes two low-voltage Dual-Core Intel® Xeon® processors, 24 Gbytes of memory, three 2.5-inch SAS hard drives, and one full-height, full-length PCI or PCI Express add-in board at 25 W.

Note: The total power requirements exceeds the 240 VA energy hazard limits, which defines an operator-accessible area. Only qualified technical individuals should access the processor, memory, and I/O areas on the Intel® Server Board S5000PHB while the system is energized.

See Chapter 8.0, "AC Power Subsystem", or Chapter 9.0, "DC Power Subsystem", in this document for detailed power specifications.

Figure 12.   AC-input Power Supply Module (Input End)

AF000826
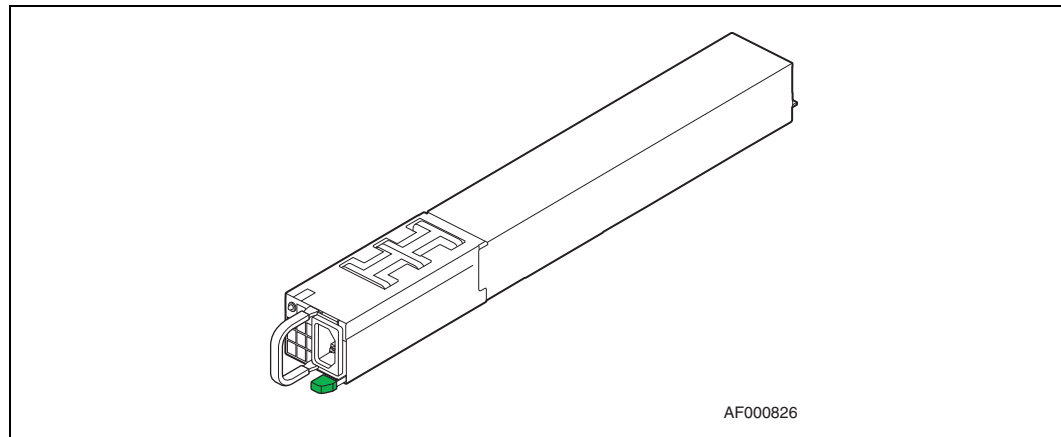
Figure 13.   DC-input Power Supply Module (Input End)

AF000828
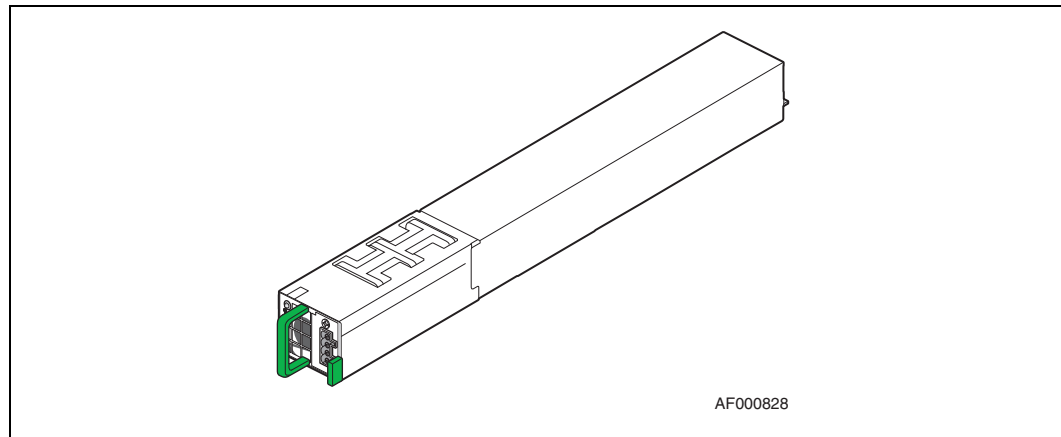
Figure 14.   AC-input or DC-input Power Supply Module (Output End)

AF000827
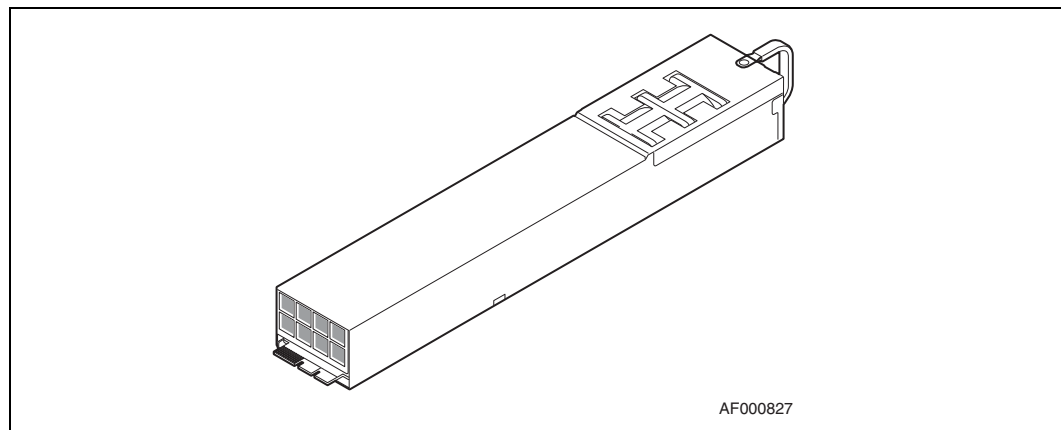
2.3.4   Cooling Subsystem

There are three cooling areas in the Carrier Grade Server TIGW1U:

- Front panel board area
- PCI area
- CPU / memory / HDD area

Figure 15.   System Cooling Areas
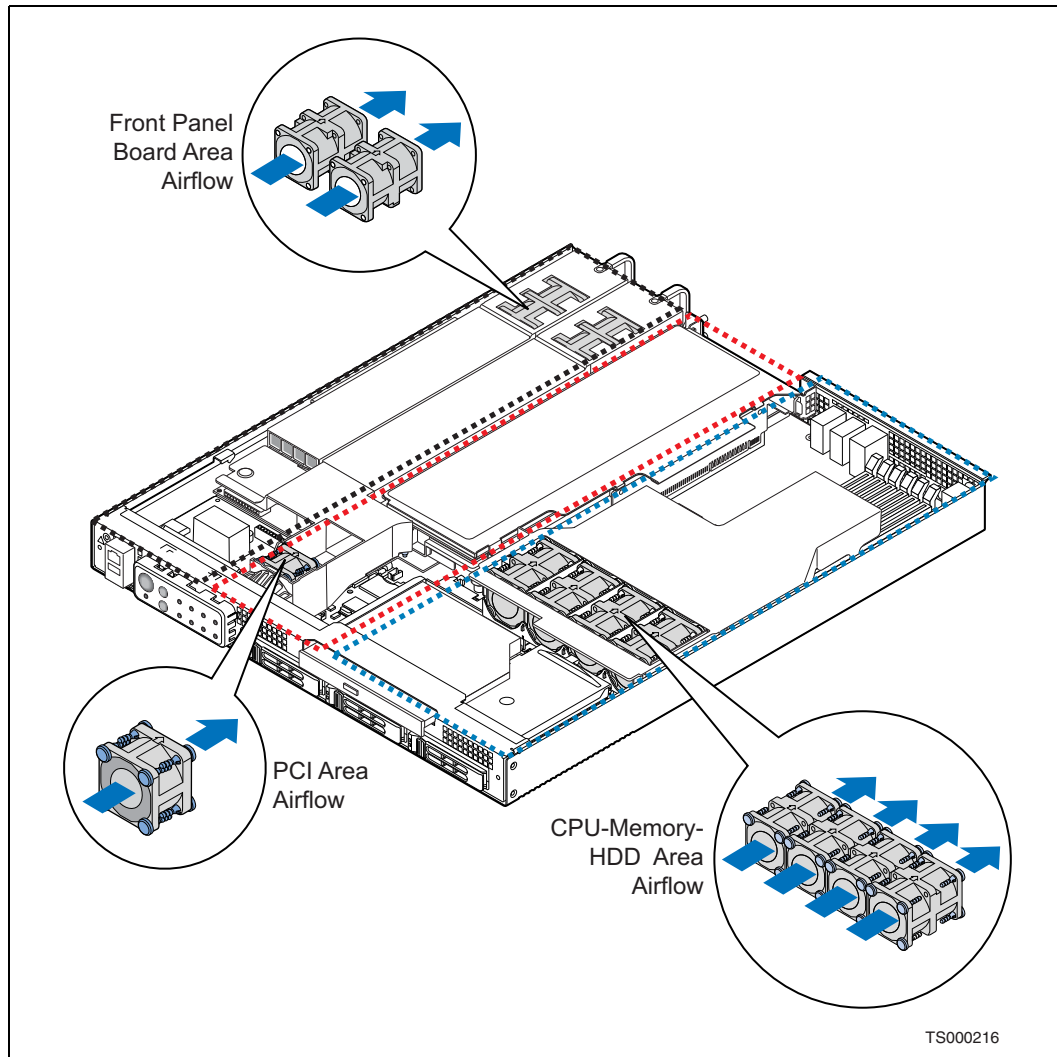
2.3.4.1   Front Panel Board Cooling Area

The left one-fourth of the front panel board and the portion of the PDB in this area are cooled by the 40 × 40 × 56 mm dual-rotor fans in the PSU modules. See Figure 15. One PSU is sufficient to cool this portion of the front panel board area and two PSUs provide cooling redundancy for this area.

The PSU fans draw air in through the front bezel and through vents in the left front side of the chassis. Air is moved over this portion of the front panel board and PDB through the PSU and then exhausted out the rear of each PSU. The left wall of the PCI fan air duct and the PSU guide wall provide an air flow barrier between the front panel board cooling area and the PCI cooling area.

2.3.4.2   PCI Cooling Area

The 40 × 40 × 28 mm single-rotor PCI fan cools the portions of the server board, PDB, and front-panel board that are in this area as shown in Figure 15, and any PCI or PCI Express adapter card installed in the riser card.

The PCI fan draws air in through the front bezel and exhausts out the rear of the system. A plastic air duct directs the air flow in this area, house the PCI fan, and provides air flow barriers between

- The front panel board and the PCI cooling areas.
- The PCI and the CPU-memory-HDD cooling areas.

A second plastic part behind the PCI air duct continues the air flow barrier between the PCI cooling area and the CPU / memory / HDD cooling area. The riser card provides the third portion of the air flow barrier between the PCI cooling area and the CPU / memory / HDD cooling area.

2.3.4.3   CPU-Memory-HDD Cooling Area

The system uses four 40 × 40 × 56 mm dual-rotor fans that slide into individual pockets in a sheet metal bracket between the SFP board and the server board, immediately in front of the processors and their heatsinks.

Air is drawn in through the front bezel and exhausted out the rear of the chassis. The CPU / memory / HDD cooling area air flow path is isolated from the rest of the system by the PCI air ducts and riser card. Air entering the CPU / memory air duct is preheated by the hard drives.

2.3.4.4   Fan Speed Control

The S5000PHB server board contains three pulse-width-modulation (PWM) circuits that provide duty cycle controlled PWM signals to the system fans in three separate domains. The PSU fans are not controlled by the system. PWM 1 controls the CPU2 and memory area fan, PWM2 controls the CPU1 fans, and PWM3 controls the PCI cooling area fan as shown in Figure 16.

The fan speeds are set per Table 3 based on ambient temperature feedback from the front panel board, and baseboard (PCI area) sensors. If the processors reach their throttling temperature the fans will ramp to higher speeds. If a system fan fails, the remaining system fans will be set for maximum speed.

Figure 16.   Fan PWM Domains

AF000833-B
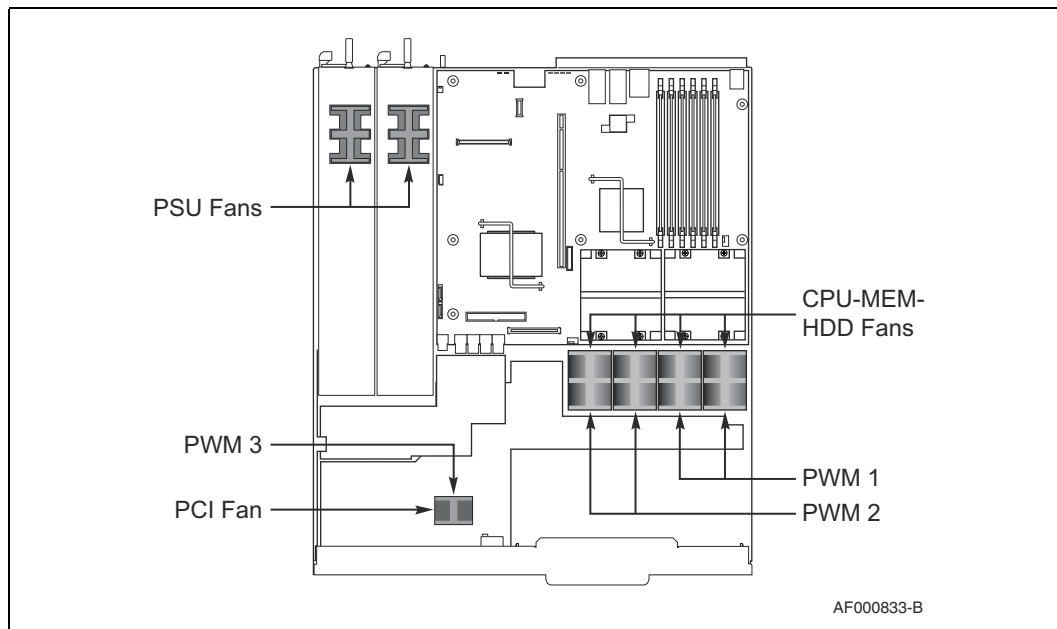
Table 3.   Fan Speed Settings

Temperature	PCI Area Fan PWM Duty Cycle	CPU1 Area Fan PWM Duty Cycle	CPU2 & Mem Area Fan PWM Duty Cycle
0° C to 23° C	55%	55%	55%
24° C	56%	56%	56%
25° C	57%	57%	57%
26° C	58%	58%	58%
27° C	59%	59%	59%
28° C	60%	60%	60%
29° C	62%	62%	62%
30° C	66%	66%	66%
31° C	71%	71%	71%
32° C	77%	77%	77%
33° C	84%	84%	84%
34° C	92%	92%	92%
35° C	100%	100%	100%

2.3.4.5   Cooling Summary

The cooling subsystem is sized to provide cooling for:

- Two processors
- 24 Gbytes of 667 MHz DRx8 FBD memory
- Three 15,000 RPM SAS 2.5-inch hard drives at a maximum of 18 W per drive
- One PCI, PCI-X, or PCI Express card at a maximum of 25 W

The cooling subsystem meets acoustic and thermal requirements at the lower fan speed settings. At higher fan speed settings, thermal requirements are met for the maximum ambient temperatures, but acoustic requirements are not met. The environmental specifications are summarized in Section 2.5.1, "Environmental Specifications".

2.4 Server Management

See the *Intel® Server Board S5000PHB Technical Product Specification* and the Core (ESB2) EPS for a detailed description of the server management design and features.

The server management sub-system consists of a micro-controller, communication buses, sensors, system BIOS, and server management firmware. The baseboard management controller (BMC) component of the ESB2-EO provides on-board platform instrumentation.

Table 4 summarizes the supported features:

Table 4.   Server Management Features

Element	Supported
IPMI Messaging, Commands, and Abstractions	Yes
Baseboard Management Controller (BMC)	Yes
Sensors	Yes
Sensor Data Records (SDRs) and SDR Repository	Yes
FRU Information	Yes
Autonomous Event Logging	Yes
System Event Log (SEL)	3276 Entries
BMC Watchdog Timer, covering BIOS and run-time software	Yes
IPMI Channels, and Sessions	Yes
EMP (Emergency Management Port) - IPMI Messaging over Serial/Modem. This feature is also referred to as DPC (Direct Platform Control) over serial/modem.	Yes
Serial/Modem Paging	Yes
Serial/Modem Alerting over PPP using the Platform Event Trap (PET) format	Yes
DPC (Direct Platform Control) - IPMI Messaging over LAN (available via both on-board network controllers) Available over dedicated management port (ESB2 NIC 1)	Yes
LAN Alerting using PET	Yes
Platform Event Filtering (PEF)	Yes
ICMB (Intelligent Chassis Management Bus) - IPMI Messaging between chassis	Yes
PCI SMBus support	Yes
Fault Resilient Booting	Yes
BIOS logging of POST progress and POST errors	Yes
Integration with BIOS console redirection via IPMI v2.0 Serial Port Sharing	Yes
Access via web browser	No †
SNMP access	Yes
Telnet access	No
DNS support	Yes
† Requires optional Intel® Remote Management Module 2 (Intel® RMM2)	

Table 4.   Server Management Features (Continued)

Element	Supported
DHCP support (dedicated NIC only)	Yes
Memory Sparing/Mirroring sensor support * does not support mirroring	Yes/No*
Alerting via Email	Yes
Keyboard, Video, Mouse (KVM) redirection via LAN	No †
High speed access to dedicated NIC	Yes
† Requires optional Intel® Remote Management Module 2 (Intel® RMM2)	

2.5 Specifications

2.5.1 Environmental Specifications

The system is tested to the environmental specifications indicated in Table 5. All testing is performed per procedures defined in *Bellcore GR-63-CORE NEBS Physical Protection*, *Bellcore GR-1089-CORE EMC and Electrical Safety — Generic Criteria for Network Telecommunications Equipment*, and the *Intel Environmental Standards Handbook*.

Table 5.   Environmental Specifications Summary

Environment	Specification
Temperature, operating	+5° C to +40° C (41° F to 104° F)
Temperature, non-operating	-40° C to +70° C (-40° F to +158° F)
Altitude	0 to 900m (2,950 ft.) @ 40° C, temperature derated by 1° C for each additional 300m (985 ft.)
Humidity, non-operating	95%, non-condensing at temperatures of 23° C (73° F) to 40° C (104° F)
Vibration, operating	Swept sine survey at an acceleration amplitude of 0.1 G from 5 to 100 Hz and back to 5 Hz at a rate of 0.1 octave/minute, 90 minutes per axis on all three axes as per Bellcore GR-63-CORE standards
Vibration, non-operating	Swept sine survey at an acceleration amplitude of 0.5 G from 5 to 50 Hz at a rate of 0.1 octaves/minute, and an acceleration amplitude of 3.0 G from 50 to 500 Hz at a rate of 0.25 octaves/minute, on all three axes as per Bellcore GR-63-CORE standard. 2.2 Grms, 10 minutes per axis on all three axes as per the *Intel Environmental Standards Handbook*
Shock, operating	Half-sine 2 G, 11 ms pulse, 100 pulses in each direction, on each of the three axes as per the *Intel Environmental Standards Handbook*
Shock, non-operating	Trapezoidal, 25 G, 170 inches/sec delta V, three drops in each direction, on each of the three axes as per *Intel Environmental Standards Handbook*
Acoustic	Sound power: ≤ 7 bels at ambient temperatures <24° C measured at bystander positions in operating mode
System Cooling Requirement	1200 BTU/hr with single power supply unit 1250 BTU/hr with dual power supply units
RoHS	Complies with RoHS Directive 2002/95/EC

2.5.2 Physical Specifications

Table 6 provides the physical dimensions of the Carrier Grade Server TIGW1U system.

Table 6.   Physical Dimensions

Height	1.70 inches (43.2 mm)
Width	16.93 inches (430.0 mm)
Depth	20.0 inches (508 mm)
Front clearance	2.0 inches (76 mm)
Side clearance	1.0 inches (25 mm)
Rear clearance	3.6 inches (92 mm)

3.0 Cables and Connectors

This chapter describes interconnections between the components of the Kontron Carrier Grade Server TIGW1U and provides overview diagrams and tables to describe the signals and pin-outs for the system connectors. See the *Intel® Server Board S5000PHB Technical Product Specification* for connector signal descriptions and pin-outs not listed in this section.

The information in this chapter is organized into the following sections:

- System Interconnect Block Diagram
- Cable and System Interconnect Descriptions
- User-Accessible Interface Connections

3.1   System Interconnect Block Diagram

Figure 17.   Interconnect Block Diagram

3.2   Cable and System Interconnect Descriptions

3.2.1   Flex Circuit

The flex circuit is an impedance-controlled flexible circuit with 140 signal connections which interconnects the SFP to the server board.

This cable routes all of the signals between the server board and the SFP board including:

- All of the front panel I/O signals
- The 4X SAS signals routed from the SAS controller on the SFP board through the cable to the server board external connector on the back of the system.

Figure 18.   Flex Circuit Cable Connection
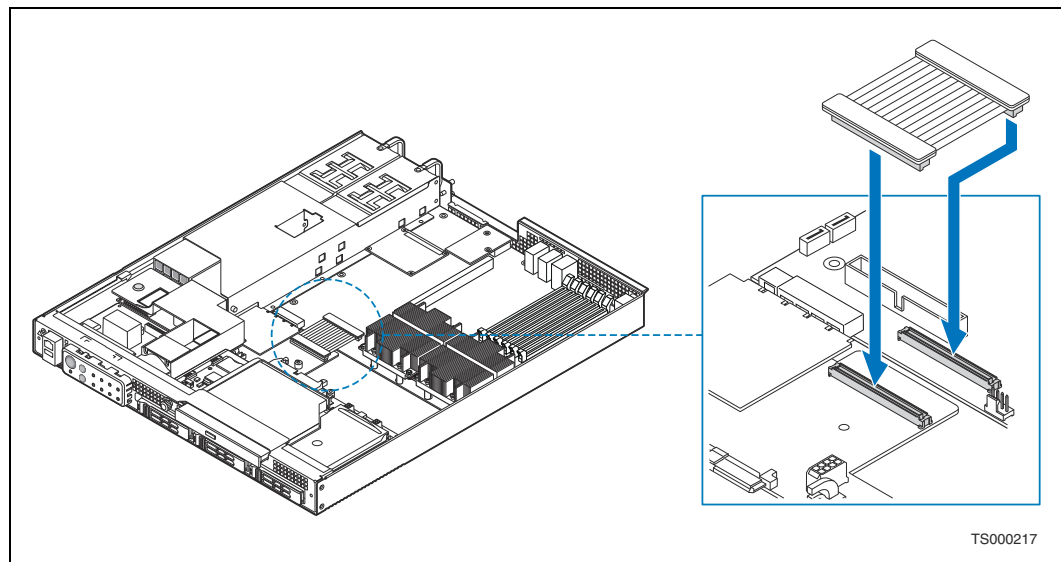
Table 7 lists the pin-out for the front panel flex connector to the server board.

Table 7.   SFP Board Flex Cable Pin-Out (Sheet 1 of 5)

Pin #	SFP Board Signal Name	Server Board Signal Name
1	FP_FLEX_PRES1	FLEX_PRES2
2	SYSCON_USB_P	USB_P3P
3	IPMB_I2C_SCL	SMB_CLK
4	SYSCON_USB_N	USB_P3N
5	IPMB_I2C_SDA	SMB_DATA
6	GND	GND
7	FP_USB_FLT_N	OC_N[3]
8	CLK_100M_DOBSON_P	CLK_100M_PCIE_P
9	GND	GND
10	CLK_100M_DOBSON_N	CLK_100M_PCIE_N
11	EXP_SB_7N	PCIE2_TX3_N
12	NC_FLEX_CONN_SPARE_12	NC

Table 7. **SFP Board Flex Cable Pin-Out (Sheet 2 of 5)**

Pin #	SFP Board Signal Name	Server Board Signal Name
13	EXP_SB_7P	PCIE2_TX3_P
14	GND	GND
15	CRITICAL_ALARM	DU_HD_LED
16	EXP_NB_7N	PCIE2_RX3_N
17	GND	GND
18	EXP_NB_7P	PCIE2_RX3_P
19	EXP_SB_6N	PCIE2_TX2_N
20	POWER_ALARM	DU_LED4
21	EXP_SB_6P	PCIE2_TX2_P
22	GND	GND
23	MAJOR_ALARM	DU_LED2
24	EXP_NB_6N	PCIE2_RX2_N
25	GND	GND
26	EXP_NB_6P	PCIE2_RX2_P
27	EXP_SB_5N	PCIE2_TX1_N
28	TELCO_LED_SELECT	TELCO_LED_SELECT
29	EXP_SB_5P	PCIE2_TX1_P
30	GND	GND
31	MINOR_ALARM	DU_LED3
32	EXP_NB_5N	PCIE2_RX1_N
33	GND	GND
34	EXP_NB_5P	PCIE2_RX1_P
35	EXP_SB_4N	PCIE2_TX0_N
36	FP_PWR_ENABLE	PWR_ENABLE
37	EXP_SB_4P	PCIE2_TX0_P
38	GND	GND
39	FP_PWR_GOOD	FP_PWR_GOOD
40	EXP_NB_4N	PCIE2_RX0_N
41	GND	GND
42	EXP_NB_4P	PCIE2_RX0_P
43	EXP_SB_3N	PCIE1_TX3_N
44	NIC_ACT_LED_N	NIC_ACT_LED_N
45	EXP_SB_3P	PCIE1_TX3_P
46	GND	GND
47	PWR_LED_ON_N	PWR_LED_N
48	EXP_NB_3N	PCIE1_RX3_N
49	GND	GND
50	EXP_NB_3P	PCIE1_RX3_P
51	EXP_SB_2N	PCIE1_TX2_N
52	FP_NMI_BTN_N	NMI_BTN_N

Table 7.   SFP Board Flex Cable Pin-Out (Sheet 3 of 5)

Pin #	SFP Board Signal Name	Server Board Signal Name
53	EXP_SB_2P	PCIE1_TX2_P
54	GND	GND
55	FP_PWR_BTN_N	PWR_BTN_N
56	EXP_NB_2N	PCIE1_RX2_N
57	GND	GND
58	EXP_NB_2P	PCIE1_RX2_P
59	EXP_SB_1N	PCIE1_TX1_N
60	FP_RST_BTN_N	RST_BTN_N
61	EXP_SB_1P	PCIE1_TX1_P
62	GND	GND
63	FP_ID_BTN_N	ID_BTN_N
64	EXP_NB_1N	PCIE1_RX1_N
65	GND	GND
66	EXP_NB_1P	PCIE1_RX1_P
67	EXP_SB_0N	PCIE1_TX0_N
68	ID_LED_N	ID_LED_BUF_N
69	EXP_SB_0P	PCIE1_TX0_P
70	GND	GND
71	FP_TEMP_PWM	TEMP_SENSOR
72	EXP_NB_0N	PCIE1_RX0_N
73	GND	GND
74	EXP_NB_0P	PCIE1_RX0_P
75	FP_USB_N	USB_P2N
76	GND	GND
77	FP_USB_P	USB_P2P
78	GND	GND
79	GND	GND
80	SYSCON_USB_FLT_N	USB_OC_N[2]
81	FAN1_TACH	FAN1_TACH
82	FAN2_TACH	FAN2_TACH
83	FAN3_TACH	FAN3_TACH
84	FAN4_TACH	FAN4_TACH
85	FAN5_TACH	FAN5_TACH
86	FAN6_TACH	FAN6_TACH
87	FAN7_TACH	FAN7_TACH
88	FAN8_TACH	FAN8_TACH
89	FAN9_TACH	FAN9_TACH
90	FAN_CPU1_PWM	FAN_CPU1_PWM
91	FAN_PCI_PWM	FAN_PWM
92	FAN_CPU2_PWM	FAN_CPU2_PWM

Table 7. **SFP Board Flex Cable Pin-Out (Sheet 4 of 5)**

Pin #	SFP Board Signal Name	Server Board Signal Name
93	GND	GND
94	GND	GND
95	EMP_DTR_N	DTR2_N
96	EMP_INUSE_L	EMP_INUSE_L
97	EMP_RTS_N	RTS2_N
98	EMP_SOUT	SOUT2
99	EMP_SIN	SIN2
100	EMP_CTS_L	CTS2_N
101	EMP_DSR_N	DSR2_N
102	EMP_DCD_L	DCD2_N
103	GND	GND
104	GND	GND
105	SAS_TX_P<7>	SAS_RX7_P
106	FP_SYS_RESET_N	SYS_RESET_N
107	SAS_TX_N<7>	SAS_RX7_N
108	GND	GND
109	RAID_MODE	RAID_MODE_R
110	SAS_RX_N<7>	SAS_TX7_N
111	GND	GND
112	SAS_RX_P<7>	SAS_TX7_P
113	SAS_TX_P<6>	SAS_RX6_P
114	IBUTTON_PRESENT	IBUTTON_PRES_N
115	SAS_TX_N<6>	SAS_RX6_N
116	GND	GND
117	SERIAL_CLK_LED	SMB_SERIAL_CLK1
118	SAS_RX_N<6>	SAS_TX6_N
119	GND	GND †
120	SAS_RX_P<6>	SAS_TX6_P
121	SAS_RX_P<4>	SAS_TX4_P
122	SERIAL_DATA_IN_LED	FAULT_LED_SHIFT_OUT
123	SAS_RX_N<4>	SAS_TX4_N
124	GND	GND
125	RSET_LED	RSM_RST_N
126	SAS_TX_N<4>	SAS_RX4_N
127	GND	GND
128	SAS_TX_P<4>	SAS_RX4_P
129	SAS_TX_P<5>	SAS_RX5_P
130	SPKR_2400HZ	SAS_RAID_SPKR
131	SAS_TX_N<5>	SAS_RX5_N
132	GND	GND

Table 7.   SFP Board Flex Cable Pin-Out (Sheet 5 of 5)

Pin #	SFP Board Signal Name	Server Board Signal Name
133	SAS_DISABLE_N	SAS_DISABLE_N
134	SAS_RX_N<5>	SAS_TX5_N
135	GND	GND
136	SAS_RX_P<5>	SAS_TX5_P
137	P3V3_STBY	P3V3_STBY
138	GND	GND
139	P3V3_STBY	P3V3_STBY
140	FP_FLEX_PRES1	GND
MP1	GND	
MP2	GND	

3.2.2   IDE Signal Cable

The IDE signal cable is a standard 40-conductor (28 AWG) ribbon cable with 2×20 position, 0.050-inch centers connectors. This cable connects between the optical drive interface adapter and connector J2J1 on the server board. Figure 19 illustrates the physical details of the cable assembly. All dimensions are in inches.

Figure 19.   IDE Signal Cable Physical Details
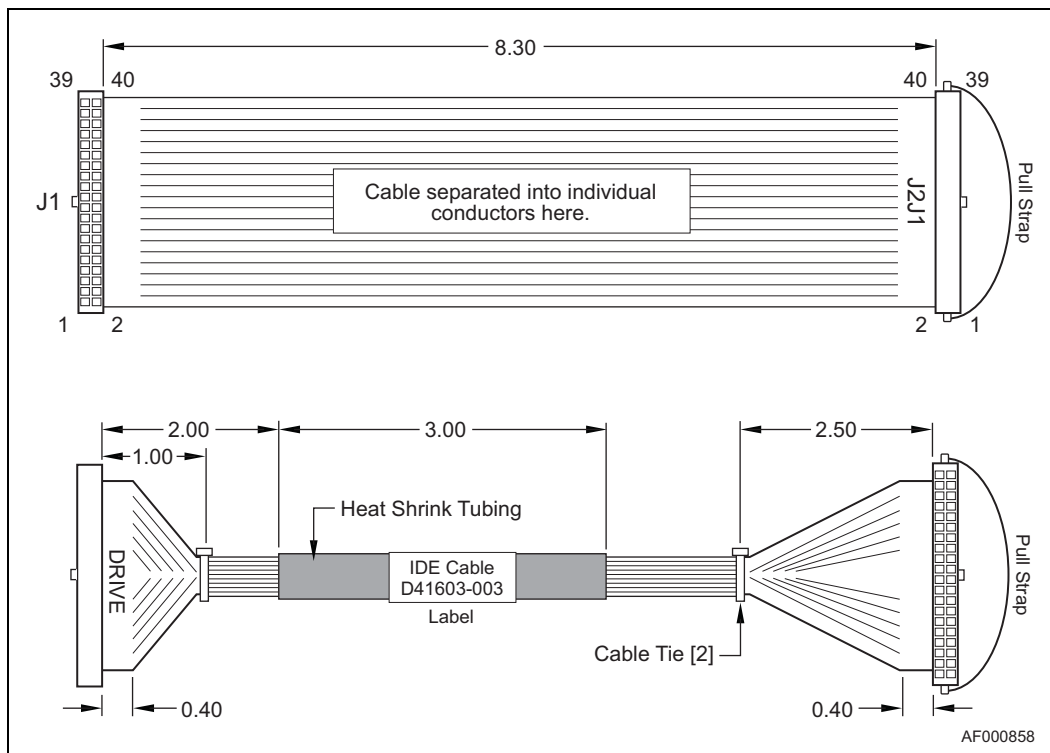
3.2.3   Optical Drive Power Cable

Figure 20 illustrates the physical details of the optical drive power cable assembly, with all dimensions in inches. In the Carrier Grade Server TIGW1U, this cable connects between the 2-pin power connector on the optical drive interface adapter and a 2-pin power connector on the front panel board.

Figure 20.   Optical Drive Power Cable Physical Details
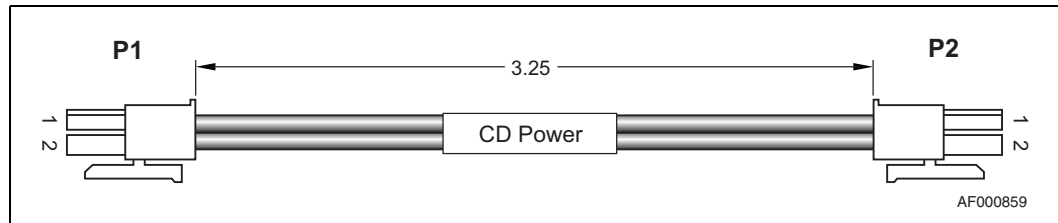
Table 8.   Optical Drive Power 1×2 Connector Pin-Out

Pin #	Signal
1	P5V
2	GND

3.2.4   Front Panel Board Power Harness

The power distribution board uses a 12-conductor, 20 AWG discrete wire harness with one 1 × 12 connector to supply power to the front panel board. Table 9 shows the 1 × 12 connector pin-out.

Table 9.   Front Panel Board Power Harness Connector Pin-Out

Pin #	Signal
1	P3V3
2	P5V_STBY
3	GND
4	GND
5	P12V
6	P12V
7	P12V
8	GND
9	GND
10	P5V
11	P5V
12	GND

3.2.5 SMART Embedded USB Solid-State Drive Signal and Power Cable (Optional)

The optional SMART Embedded USB Solid-State Drive (eUSB SSD) connects to the SFP board with a single signal and power cable. The parts kit that is supplied with the eUSB solid-state drive includes two interface cables that are identical except for their length. TheTIGW1U server uses the longer of the two cables (part no. D47975-001). The physical details of this cable are shown in Figure 21 (all dimensions in inches), and the pin-out of the connectors is given in Table 10.

Figure 21. eUSB Solid-State Drive Signal and Power Cable Physical Details
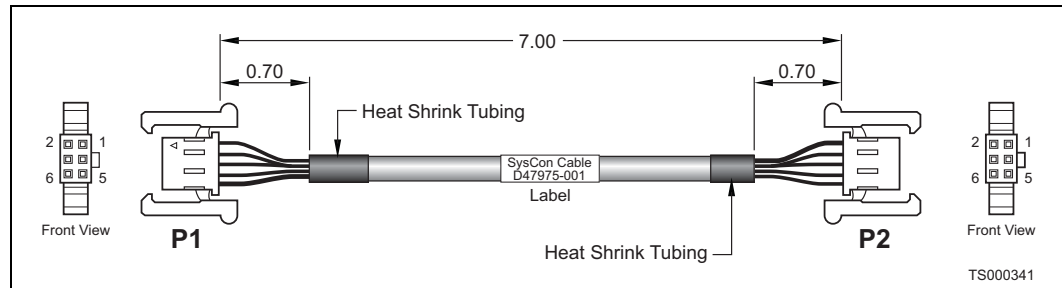
Table 10. eUSB Solid-State Drive 2 x 3 Connector Pin-Out

Pin #	Signal
1	GND
2	Keyed (no connect)
3	SYSCON_USB_P
4	SYSCON_PWR
5	SYSCON_USB_N
6	GND

3.2.6 RAID Smart Battery Cable

The Intel® RAID Smart Battery cable connects the optional Intel® RAID Smart Battery to the SFP board when operating theTIGW1U server in SAS hardware RAID mode (for example, for RAID 5 operation).

Figure 22.   RAID Smart Battery Cable Physical Details
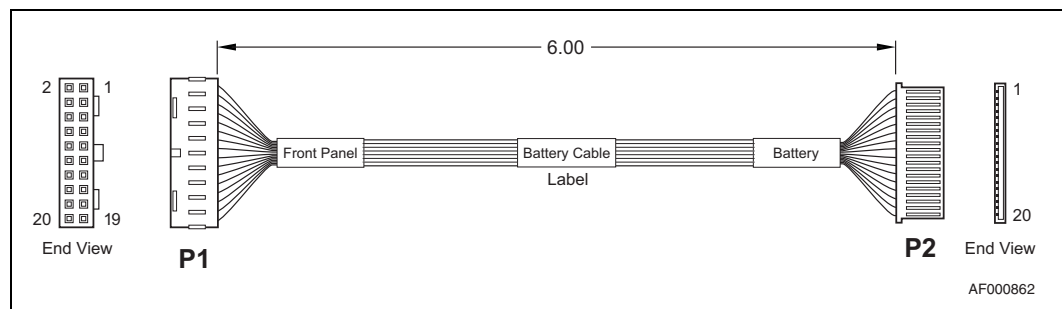
Table 11.   **RAID Smart Battery Cable Connector Pin-Out**

Pin #	Signal Name	Pin #	Signal Name
1	P12V	2	GND
3	NC_P5V_IBBU	4	GND
5	VBAT_RAID	6	GND
7	P3V3_STBY_PWRGD_IBBU	8	GND
9	VBAT_RAID	10	GND
11	IBBU_RST_N	12	GND
13	IBBU_SMB_SCK	14	GND
15	IBBU_SMB_SDA	16	IBBU_PFAIL_N
17	IBBU_DDR_SEL	18	IBBU_BBE
19	IBBU_BBSTROBE	20	TM_STATUS

3.2.7   Fan Power Cables

The PCI fan uses a wire harness assembly with a 4-pin connector that mates to a connector on the SFP board. The connector pin-out is shown in Table 12.

Table 12.   **PCI Fan 2 x 2 Connector Pin-Out**

Pin #	Signal
1	P12V
2	Fan Tachometer Signal
3	GND
4	Fan Speed Control

The four dual-rotor CPU fans all use the same type of wiring harness, which terminates in an 8-pin connector that mates to a connector on the SFP board. Table 13 provides the pin-out of these connectors.

Table 13.   **CPU Dual-Rotor Fan 2x4 Connector Pin-Out**

Pin #	Signal Name	Pin #	Signal Name
1	P12V	5	P12V
2	FRONT_FAN_TACH	6	REAR_FAN_TACH
3	GND	7	GND
4	FAN_CPU_PWM (Fan Speed Control)	8	FAN_CPU_PWM (Fan Speed Control)

3.3 User-Accessible Interface Connections

3.3.1 Keyboard and Mouse Ports

Two stacked PS/2 ports support both a keyboard and a mouse. Each port can support either a mouse or keyboard. Table 14 details the pin-out of the PS/2 connector.

Figure 23. Keyboard and Mouse Connectors

AF000837
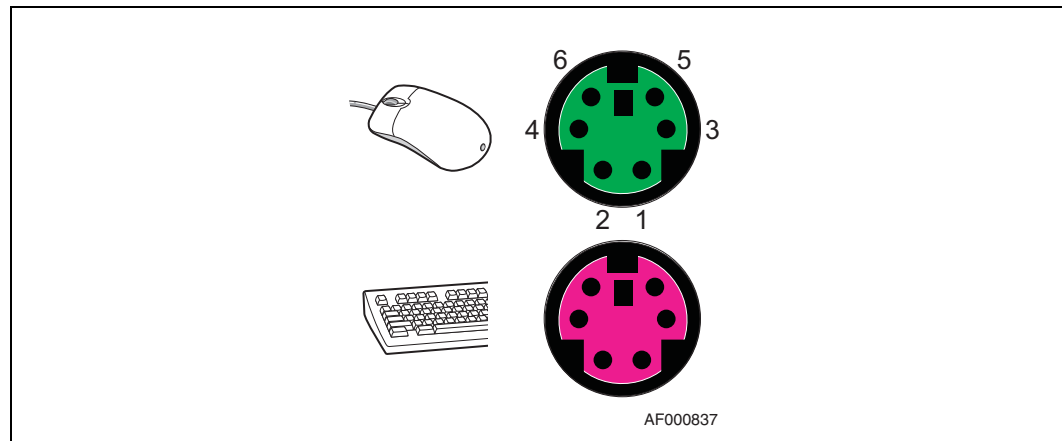
Table 14. Keyboard and Mouse Port Pin-Out

Pin #	Signal
1	KEYDAT (keyboard data)
2	MSEDAT (mouse data)
3	GND (ground)
4	Fused Vcc (+5V)
5	KEYCLK (keyboard clock)
6	MSECLK (mouse clock)

3.3.2 Serial Port B

Two serial port connectors (Serial B) are provided, one on the front panel and one at the rear I/O panel, both using 8-pin RJ45 connectors. An RJ45 connector allows connection to serial port concentrators. For applications that require a DB-9 serial port connection, an adapter cable must be used.

Both the front and rear serial port connectors connect to COM2. Users can connect to either the front or the rear serial port connector, but should *never* connect to *both* connectors at the same time.

The connector pin-out differs slightly between the front-panel and rear-panel connectors, specifically in relation to Pin 6 and Pin 7. On the front-panel serial port connector, Pin 6 is used as a serial port selection input. Grounding the EMP_INUSE_L signal that appears on Pin 6 disables the rear-panel serial port connection so that only the front-panel connection is active. This allows users to plug into and use the front-panel connector without regard for whether anything is connected to the rear-panel connector. The front-panel serial port connector always carries the DSR signal on Pin 7.

On the rear-panel serial port connector, a server board jumper configures Pin 7 to carry either the DSR (Data Set Ready) signal or the DCD (Data Carrier Detect) signal as required by a particular serial port concentrator. The default jumper setting selects the DSR signal, which conforms to the Cisco* serial port standard. See the *Intel® Server Board S5000PHB Technical Product Specification* for details about this jumper or if you need to change the DSR/DCD configuration.

Figure 24.   **Serial B Port Connector**

AF000873
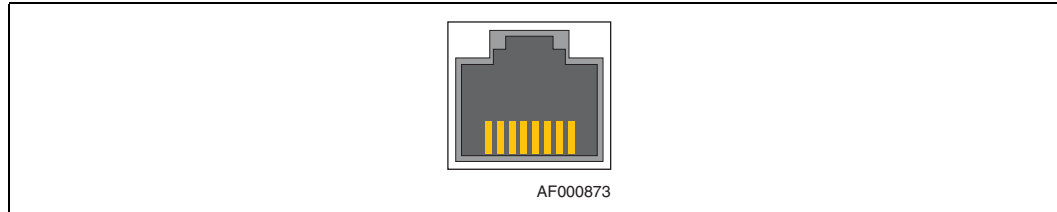
Table 15.   **Front-Panel Serial Port B (RJ45) Connector Pin-Out**

Pin #	EFP Board Signal Name	Description
1	SPB_EMP_RTS_L	RTS (Request To Send)
2	SPB_EMP_DTR_L	DTR (Data Terminal Ready)
3	SPB_EMP_SOUT	TXD (Transmit Data, serial data out)
4	GND	Ground
5	EMP_INUSE_L	When grounded, disables rear-panel serial port
6	SPB_EMP_SIN	RXD (Receive Data, serial data in)
7	SPB_EMP_DSR_L	DSR (Data Set Ready)
8	SPB_EMP_CTS_L	CTS (Clear To Send)

Table 16.   **Rear-Panel Serial B Port (RJ45) Connector Pin-Out**

Pin #	Signal
1	RTS (Request To Send)
2	DTR (Data Terminal Ready)
3	TXD (Transmit Data)
4	GND
5	RIA (Ring Indicator)
6	RXD (Receive Data)
7	Configurable (using jumper J2A2 on system board) to carry either: • DSR (Data Set Ready) [default, Cisco port concentrator compatible] • DCD (Data Carrier Detect)
8	CTS (clear to send)

For server applications that require a DB9 serial connector, an 8-pin RJ45-to-DB9 adapter must be used. The following table provides the pin-out required for the adapter to provide RS-232 support.

Table 17.   RJ-45-to-DB9 Adapter Pin Assignments

RJ45 Pin No.	Signal	Description	DB9 Pin No.
1	RTS	Request to Send	7
2	DTR	Data Terminal Ready	4
3	TD	Transmitted Data	3
4	SGND	Signal Ground	5
5	RI	Ring Indicator	9
6	RD	Received Data	2
7	DSR	Data Signal Ready	6 †
8	CTS	Clear To Send	8
†		When using the rear-panel Serial B port connector, the wiring of the RJ45-to-DB9 adapter should match the configuration of the RJ45 pin-out. If the port has been configured for the DCD rather than DSR on Pin 7, the adapter cable should connect Pin 1 of the DB9 rather than Pin 6.	

3.3.3   Video Port

The video port interface is a standard VGA compatible, 15-pin connector. On-board video is supplied by an ATI* Rage XL video controller with 8 MB of on-board video SGRAM.

Figure 25.   Video Connector

AF000839
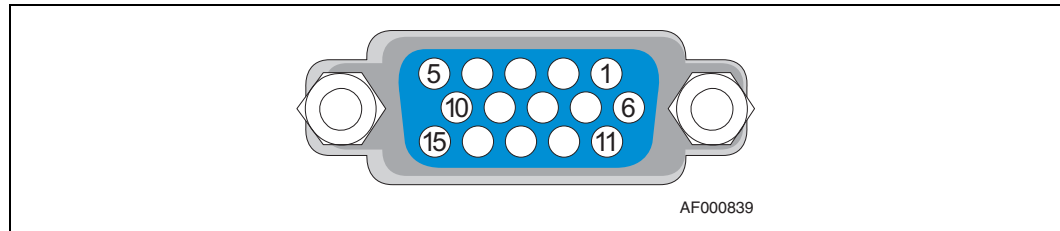
Table 18.   Video Connector Pin-Out

Pin #	Signal
1	Red (analog color signal R)
2	Green (analog color signal G)
3	Blue (analog color signal B)
4	No connection
5	GND
6	GND
7	GND
8	GND
9	Fused Vcc (+5V)
10	GND
11	No connection
12	DDCDAT

Table 18.   **Video Connector Pin-Out**

13	HSYNC (horizontal sync)
14	VSYNC (vertical sync)
15	DDCCLK

3.3.4   Universal Serial Bus (USB) Interface

The server board provides four USB ports. USB ports 0 and 1 are brought to the rear. USB ports 2 and 3 are routed to the front panel board where USB port 2 is brought to the front of the system and USB port 3 is used internally for interfacing to the optional SMART Embedded USB Solid-State Drive. The built-in external USB ports permit direct connection of three USB peripherals without an external hub. If more devices are required, an external hub can be connected to any of the built-in ports.

Figure 26.   **External USB Connector**

AF000840
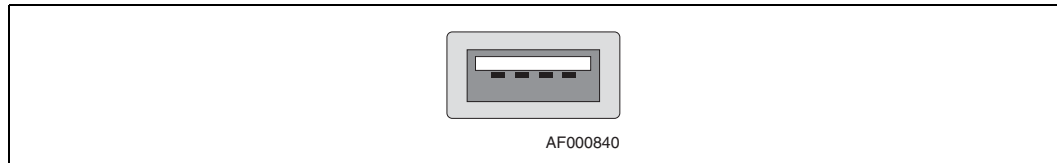
Table 19.   **USB Connector Pin-Out**

Pin #	Signal
1	Fused Vcc (+5V w/over-current monitor of ports 0, 1, 2, and 3)
2	DATAL0 (differential data line paired with DATAH0)
3	DATAH0 (differential data line paired with DATAL0)
4	GND

3.3.5   Ethernet Connectors

The system provides four RJ45 Ethernet NIC connectors. These NIC connectors are located at the back edge of the S5000PHB server board and are accessible on the rear I/O panel. The Ethernet connectors appear as stacked pairs as illustrated in Figure 27. The pin-out of each connector is identical and is defined in Table 20.

Figure 27.   **Stacked Ethernet Connector Pair**

Pin 8 ⟶ ⟵ Pin 1
Pin 1 ⟶ ⟵ Pin 8

AF000838-D
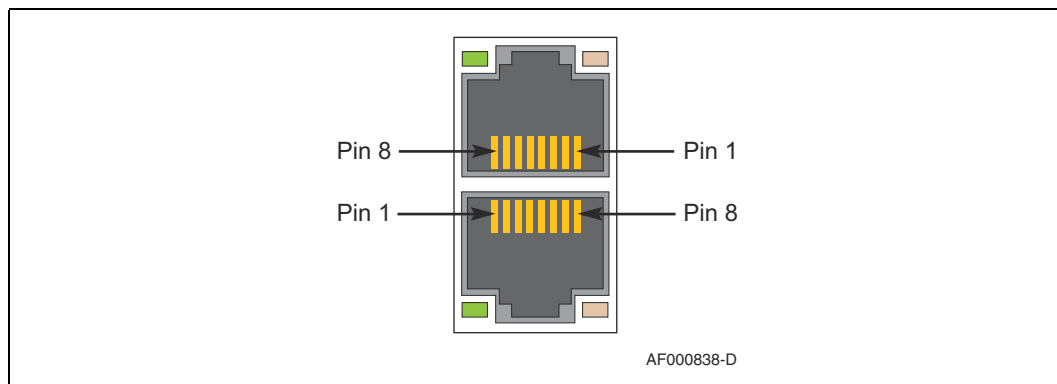
Table 20. **Ethernet Connector Pin-Out**

Pin #	Signal Name	Description
1	BI_DA+	Bi-directional pair A, +
2	BI_DA–	Bi-directional pair A, –
3	BI_DB+	Bi-directional pair B, +
4	BI_DC+	Bi-directional pair C, +
5	BI_DC–	Bi-directional pair C, –
6	BI_DB–	Bi-directional pair B, –
7	BI_DD+	Bi-directional pair D, +
8	BI_DD–	Bi-directional pair D, –

For each Ethernet connector there are two status indicator LEDs integrated into the connector assembly, a green LED to the left of the connector and a bi-color LED to the right of the connector.

The green LED indicates the connection status for each port. If the port is connected to a network but there is no current activity, the green LED is continuously illuminated. When there is activity on the connected network the green LED blinks.

The bi-color LED indicates the connection speed. If the green LED indicates a network connection but the bi-color LED is not lit, then the connection speed is 10 Mbps. If the bi-color LED shows a solid green indication, then the connection speed is 100 Mbps. If the bi-color LED is solid amber, then the connection speed is 1 Gbps.

3.3.6 GCM Remote Management Module Connector

The TIGW1U server supports the installation of an optional Intel® Remote Management Module 2, which provides a 1000 Mbps Ethernet interface through a GCM connector module. The connector outline, pin-out, and LED indications for the GCM connector are the same as for the server's standard Ethernet connectors, as described above.

3.3.7 Telco Alarms Connector

The system provides one Telco DB15 alarms connector on the rear panel. Figure 28 shows the Telco alarms connector as viewed from the back of the server and Table 21 shows the pin-out for the connector.

Figure 28. **Telco Alarms Connector**

AF000841
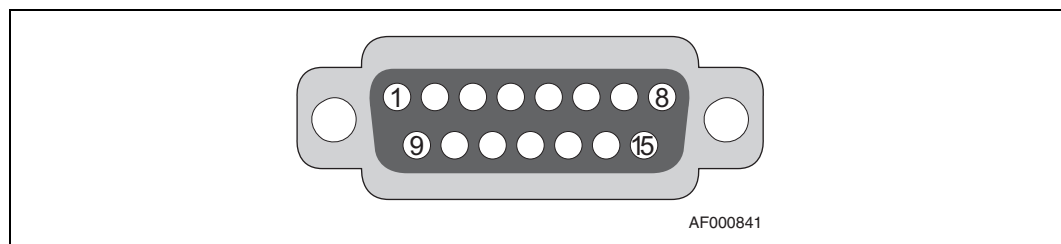
Table 21.   Telco Alarms Connector Pin-Out

Pin	Description	Pin	Description
1	MinorReset +	9	MinorAlarm – NC
2	MinorReset -	10	MinorAlarm - COM
3	MajorReset +	11	MajorAlarm - NO
4	MajorReset -	12	MajorAlarm - NC
5	CriticalAlarm - NO	13	MajorAlarm - COM
6	CriticalAlarm - NC	14	PwrAlarm - NO
7	CriticalAlarm - COM	15	PwrAlarm - COM
8	MinorAlarm - NO		

3.3.8   Internal SAS Hard Disk Drive Connector

The SFP board provides three connectors for the internal hot-swappable 2.5-inch SAS hard disk drives.

Table 22.   2.5-inch SAS Hard Drive Connector Pin-Out

Pin #	Signal Name	Pin #	Signal Name
P1	NC_SASX_P1	S1	GND
P2	NC_SASX_P2	S2	SAS_TX_P<X>
P3	NC_SASX_P3	S3	SAS_TX_N<X>
P4	GND	S4	GND
P5	GND	S5	SAS_RX_N<X>
P6	DRVX_PRSNT_N	S6	SAS_RX_P<X>
P7	DRVX_5V_PCHRG	S7	GND
P8	P5V	S8	GND
P9	P5V	S9	NC_SASX_S9
P10	GND	S10	NC_SASX_S10
P11	ACTLED_DRVX	S11	GND
P12	GND	S12	NC_SASX_S12
P13	DRVX_12V_PCHRG	S13	NC_SASX_S13
P14	P12V	S14	GND

3.3.9 External SAS 4X Hard Disk Drive Connector

The system provides an external SAS 4X hard drive connector for RAID support. The SAS 4X external connector is illustrated in Figure 29, and the pin-out is shown in Table 23.

Figure 29. External SAS 4X Hard Disk Drive Connector

AF000842
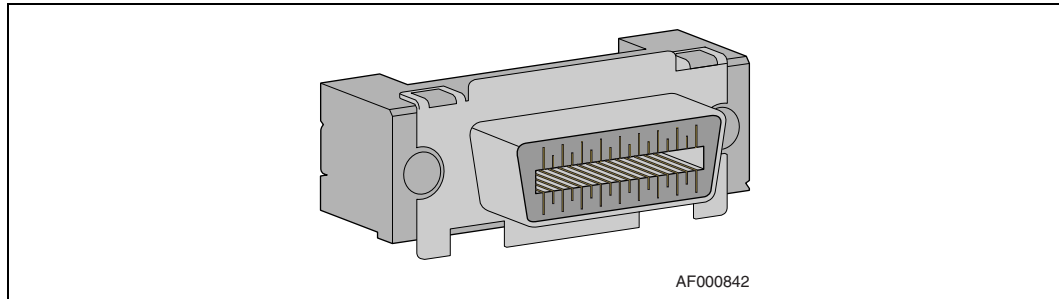
Table 23. External SAS 4X Hard Disk Drive Connector Pin-Out

Pin	Signal	Pin	Signal
S1	SAS_RX4_P	S2	SAS_RX4_N
S3	SAS_RX5_P	S4	SAS_RX5_N
S5	SAS_RX6_P	S6	SAS_RX6_N
S7	SAS_RX7_P	S8	SAS_RX7_N
S9	SAS_TX7_N	S10	SAS_TX7_P
S11	SAS_TX6_N	S12	SAS_TX6_P
S13	SAS_TX5_N	S14	SAS_TX5_P
S15	SAS_TX4_N	S16	SAS_TX4_P
G1	GND	G2	GND
G3	GND	G4	GND
G5	GND	G6	GND
G7	GND	G8	GND
G9	GND		

3.3.10 AC Power Input for AC-Input Power Supply

An IEC320-C13 receptacle is at the rear of each AC-input power module. An appropriately sized power cord and AC main is recommended. See Chapter 8.0, "AC Power Subsystem", for system voltage, frequency, and current draw specifications.

Figure 30. AC Power Input Connector
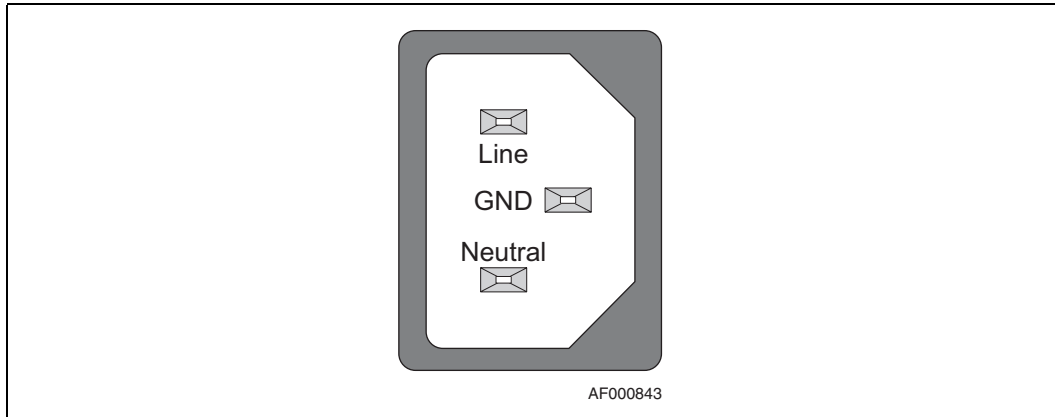
3.3.11 DC Power Input for DC-Input Power Supply

A Molex* MTC 4-pin DC connector (Molex p/n 55757-0420 or an equivalent) is used in the DC power supply modules to provide the DC-input power connection. The required mating connector is a Molex 54927-0420 or equivalent. Use an appropriately-sized power wire and DC main. See Chapter 9.0, "DC Power Subsystem" for system DC voltage and current draw specifications.

Figure 31. DC Power Input Connector
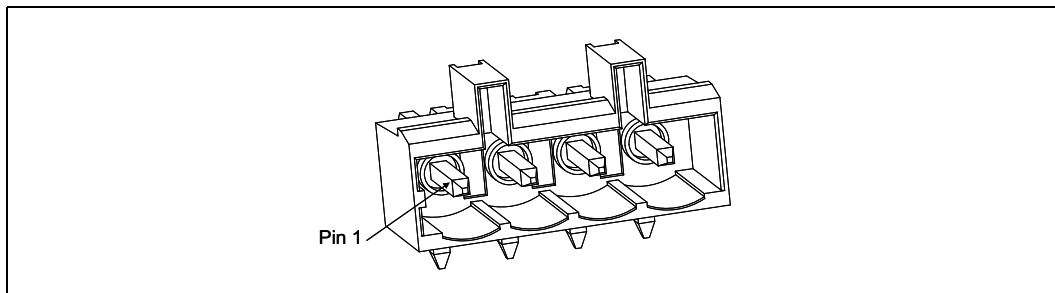
The pin-out of the DC input connector is in Table 24.

Table 24. DC Power Supply Module Input Pin Assignments

Pin#	Description
1	RTN
2	RTN
3	-48V
4	-48V

4.0   SAS Front Panel (SFP) Board

This chapter describes the basic functions and interface requirements of the SAS front panel (SFP) board on the Kontron Carrier Grade Server TIGW1U.

This chapter is organized in the following sections:

- Features
- Overview
- Component Location
- Power Distribution
- I/O Processor Subsystem
- SAS Controller (LSI1068)
- VSC410 Enclosure Management Controller
- Clock Generation/Distribution
- Programmable Logic Device (PLD)
- Hardware RAID
- Software RAID
- Power Good and Reset Control
- Front Panel Switches and Status Indicators

4.1   Features

- Four switches to control power-on, reset, NMI, and the system ID
- One RS-232 front panel port
- One USB 2.0 front panel port
- One USB 2.0 interface to the optional eUSB solid-state drive
- Five fan connectors to provide power, control, and monitoring of four dual-rotor CPU fans and one single-rotor PCI fan
- One power connector for the optical drive port
- One system ID LED that can be controlled remotely or by the system ID switch
- Two system activity LEDs that indicate power-on and NIC activity
- One hard drive dual LED that indicates activity/fault status for all internal SAS drives
- Four individual Telco alarm LEDs indicating critical, major, minor, and power alarms
- DDR2 mini-DIMM connector providing data caching for hardware RAID
- Three SAS connectors to support three independent internal 2.5-inch SAS hard drives
- Support for external SAS 4X disk drive connector on the S5000PHB server board

- Integrated support for software RAID 0/1/10
- Hardware RAID support for RAID 5 capability with installation of optional RAID activation key
- Support for up to 1 Gbyte of optional DDR2 registered ECC memory (mini-DIMM module) for hardware RAID caching
- Support for RAID smart battery to preserve the contents of RAID memory mini-DIMM if power falls below specifications

4.2 Overview

The SAS front panel (SFP) board provides SAS support for the Carrier Grade Server TIGW1U. The standard SFP configuration provides software supported RAID 0 and RAID 1 operation using the internal SAS drives, and RAID 10 if one or more additional SAS drives are connected externally via the SAS 4X connector on the server's rear panel. When fitted with additional hardware components that are available as a RAID activation kit, the SFP board provides RAID 5 capability in addition to hardware RAID 0, 1, and 10.

The SFP board provides seven main categories of functions for the system:

- Cascaded power conversion
  — +12 V to +1.8 V (SFP and DDR2)
  — +1.8 V to 1.2 V (SFP)
  — +1.8 V to +1.35 V (SFP)
  — +1.8 V to +1.5 V (SFP)
  — +3.3 V to +1.8 V (SFP and DDR2)
  — Power Good monitoring and sequencing
- Three SAS ports to internal 2.5-inch disk drives, four ports to external SAS drives through rear-panel connector
  — 1.5 or 3.0 Gbps link rate
- Software RAID 0/1/10
  — LSI Logic* LSI1068 provides software RAID 0/1/10 support [level 10 requires one or more external SAS drives]
- Hardware RAID 0/1/10 and 5
  — Hardware support via the Intel® 80333 I/O controller
  — DDR-II SDRAM DIMM socket, supporting up to 1-Gbyte memory modules for data caching
  — Intel® RAID Smart Battery connector to provide power for the RAID DIMM if power fails
  — Socket for the Intel® RAID Activation Key to enable hardware RAID operation
- Enclosure Management
  — VSC410 enclosure management controller
  — VSC410 interfaces with BMC through IPMB bus
  — Hot swap control and drive fault light indication
- Telco alarm and status indication
  — Telco alarms for Critical, Major, Minor, and PWR faults
  — NIC activity, system ID, power on, oR'ed drive LEDs

— Individual drive activity and fault LEDs
— Drive for audible buzzer on baseboard to indicate hard drive failure
- User interactive switches
 — Front-panel power on, reset, NMI, and ID switches

Figure 32 presents the functional block diagram of the SAS front panel board.

Figure 32.   SAS Front Panel Board Functional Block Diagram
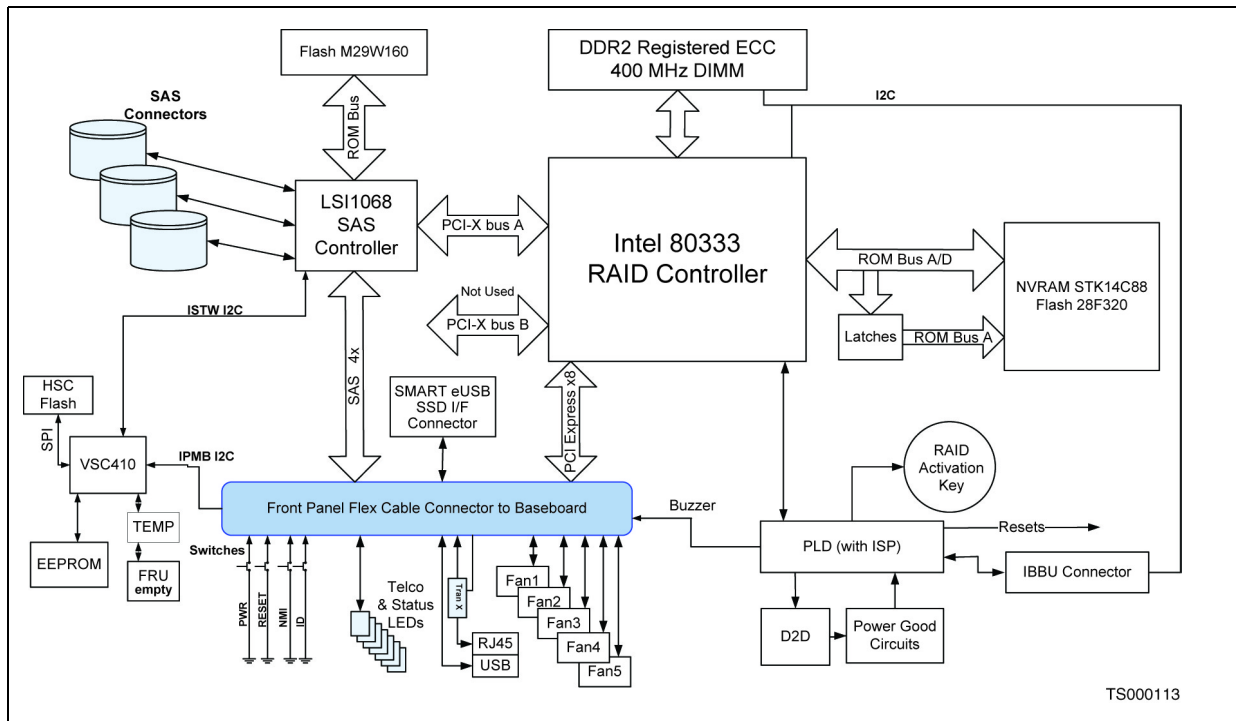
4.3   Component Location

Figure 33 shows the placement of the major components and connectors on the SFP board. Figure 40 on page 24 provides a detail view of the user interface switches and LEDs.

Figure 33.   SAS Front Panel Board Component Locations

TS000227
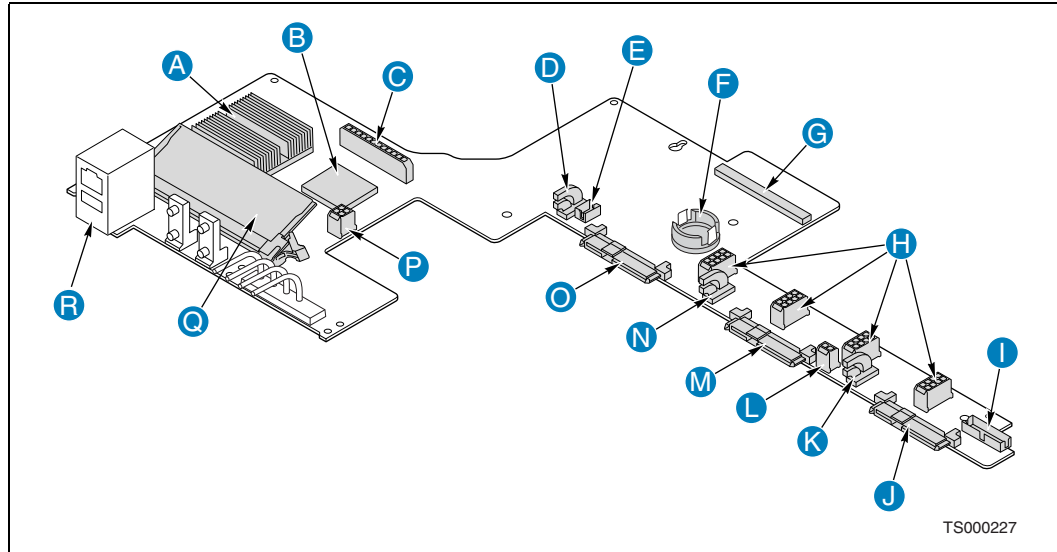
Item	Description	Item	Description
A	Intel® 80333 I/O controller w/ heatsink	J	Drive #0 SAS connector
B	LSI Logic* LSI 1068 SAS controller	K	Drive #0 LEDs and light pipes
C	Front-panel board power connector	L	Optical drive power cable connector
D	Drive #2 LEDs and light pipes	M	Drive #1 SAS connector
E	SMART Embedded USB Solid-State Drive interface connector	N	Drive #1 LEDs and light pipes
F	Intel® RAID Activation Key socket; key optional, required for hardware RAID only	O	Drive #2 SAS connector
G	Front-panel board Flex cable connector	P	PCI fan connector
H	CPU fan connectors (4x)	Q	DDR2 Mini-DIMM socket; memory optional, required only for hardware RAID
I	RAID smart battery connector; battery optional, needed only for hardware RAID	R	Serial Port B and USB port 2 connectors

4.4 Power Distribution

This section details the SFP power distribution. This consists of power provided by the power distribution board (PDB) and the on-board D2D and linear regulators:

- +12 V board input is cascaded to +1.8 V, +1.5 V, +1.35 V, +1.2 V.
- +3.3 V board input is converted to +1.35 V.
- +5 V Standby and +5 V power is provided directly from the PDB board interface.

Figure 34 diagrams the power conversion and distribution functions.

Figure 34.   SFP Board Power Conversion Diagram
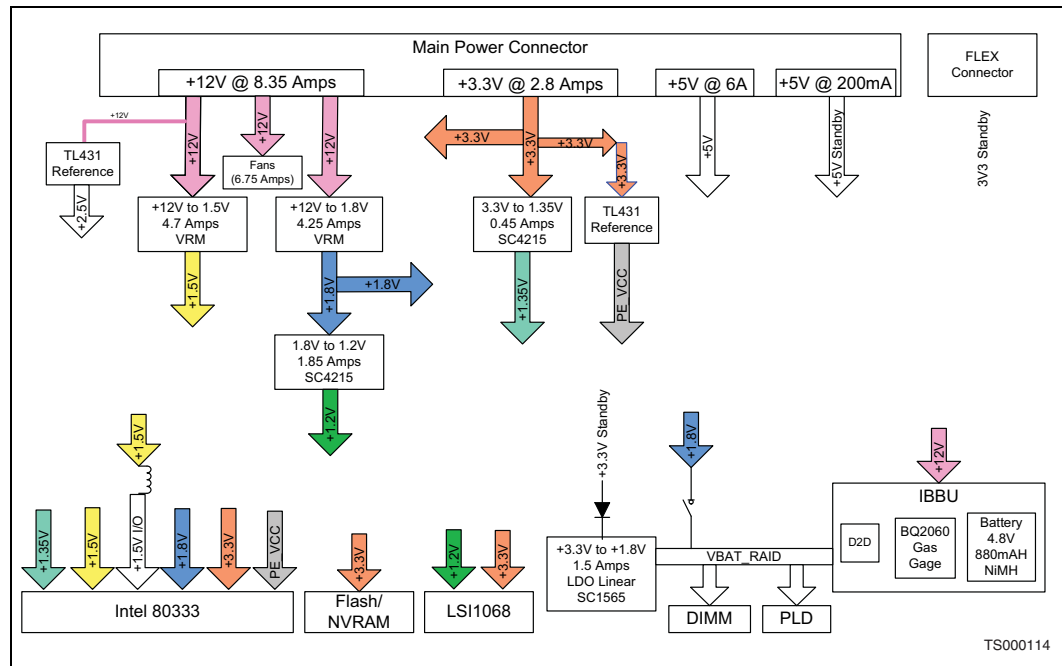
4.4.1 Battery Backup Power Control

The VBAT_RAID power rail can be supplied from several sources. The battery backup power controller determines the appropriate source and activates that source:

- During normal operation VBAT_RAID is supplied by the 1.8 V power rail.
- If main system power is turned off and standby power is available, then the 3.3 V to 1.8 V linear regulator supplies power to VBAT_RAID.
- If all system power fails and the DDR DIMM has critical data stored, then VBAT_RAID is supplied by the RAID smart battery.

4.4.2 12 V to 1.8 V VRM

The 12 V to 1.8V VRM converts the +12 V supply to +1.8 V. The generated +1.8 V is used by the 80333, LSI1068, DDR2, and PLD.

- Output rated at +1.8 V ±2% at a maximum of 6 A continuous. The +1.8 V output will be between +1.76 V and +1.84 V.
- Over-current protection.
- Voltage regulation starts when input voltage exceeds ~7.9 V.

- DOSA standard footprint.
- D2D can be inhibited with the ENABLE_P1V8_N signal (controlled by PLD).

4.4.3   12 V to 1.5 V VRM

The 12 V to 1.5 V VRM converts the +12 V supply to +1.5 V. The generated +1.5 V is used by the 80333.

- Output rated at +1.5 V ±2% at a maximum of 6 A continuous.
- Voltage regulation starts when input voltage exceeds ~7.9 V .
- Over-current protection.
- DOSA standard footprint.
- D2D can be inhibited with the ENABLE_P1V5_N signal (controlled by PLD).

4.4.4   3.3 V to 1.35 DC to DC Linear Converter

The 3.3 V to 1.35 V D2D converts the +3.3 V supply to +1.35 V. The generated +1.35 V is used by the 80333.

- Output rated at +1.35 V ±2% at a maximum of 3 A continuous.
- Over-current and over-temperature protection.
- D2D can be inhibited with the P1V35_ENABLE_N signal (controlled by PLD).

4.4.5   1.8V to 1.2V DC to DC Linear Converter

The 1.8 V to 1.2 V D2D converts the +1.8 V supply to +1.2 V. The generated +1.35 V is used by the LSI1068.

- Output rated at +1.2 V ±2% at a maximum of 3 A continuous.
- Over-current and over-temperature protection.
- D2D can be inhibited with the P1V2_ENABLE_N signal (controlled by PLD).

4.5   I/O Processor Subsystem

This section provides a detailed description of the I/O subsystem of the SFP board, which is based on the 80333 I/O controller device. The I/O processor subsystem has two major functions: To act a PCI Express to PCI-X bridge, and to provide hardware RAID functionality to support RAID 5.

4.5.1   PCI-X to PCI Express Bridge

The 80333 I/O controller acts as PCI-X to PCI Express Bridge. This allows the SFP board to attach to the server board's PCI Express interface and use existing PCI-X SAS controllers.

4.5.2   RAID Controller

The 80333 I/O controller adds hardware RAID capabilities to the SFP board when an optional RAID activation key is installed.

Figure 35. SFP Board I/O Subsystem Block Diagram
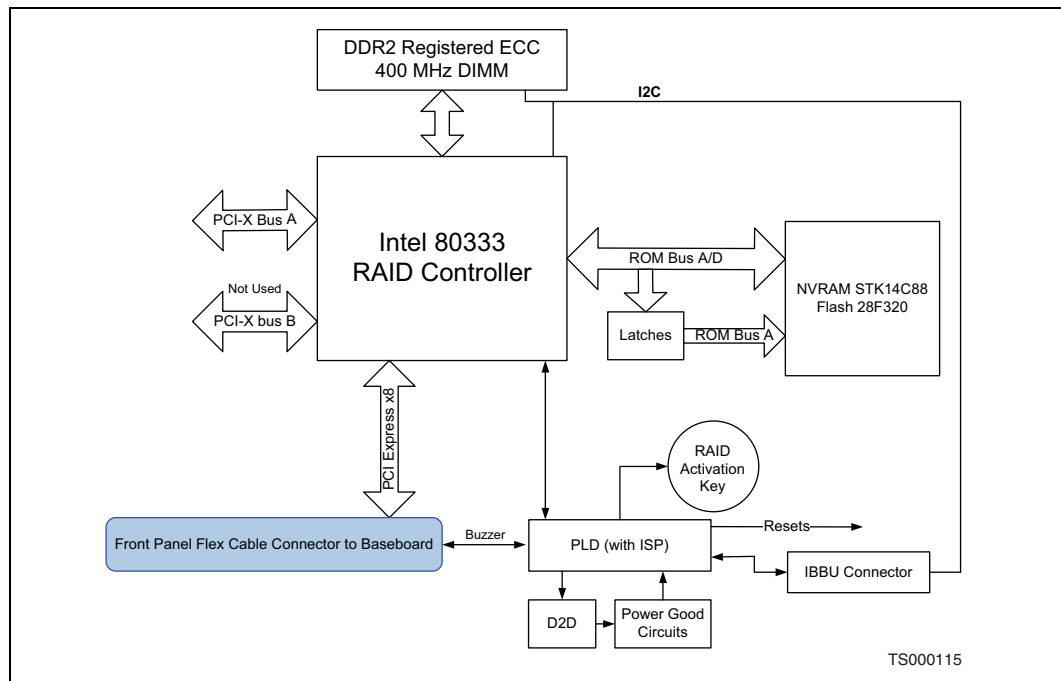
When in hardware RAID mode, the following parts of the I/O processor subsystem interact:

- DDR2
- 80333 device
- Flash memory
- RAID activation key
- PCI buses

The following topics describe each part and its role.

4.5.3   I/O Processor

The SFP architecture is based around the Intel® 80333 I/O processor. The 80333 processor 500 MHz core controls two 133 MHz, 64-bit PCI-X buses, a x8 PCI Express bus, a ROM bus, and a DDR2 400 MHz SDRAM bus. The 80333 also provides two UARTs, I^{2}C bus, and GPIOs.

In PCI-X to PCI Express bridge mode the 80333 processor is seen by the system as a bridge. This allows the LSI1068 to provide SAS support and software RAID support for the system.

In hardware RAID mode, the 80333 processor provides transparent hardware support for RAID 0/1/10. The 80333 provides virtual disk arrays for the system to use. These disk arrays can be in any of the supported RAID modes. The 80333 DDR2 connector provides flexible cache support. The cache support can speed up transaction timing, depending on the cache configuration. When in RAID mode the 80333 processor boots from the flash memory and loads configuration information from the NVRAM.

4.5.4   Flash Memory

A 32 megabit flash memory device contains the executable code for the 80333 processor that is used when the processor is in hardware RAID (RAID 5) mode.

4.5.5   NVRAM

The NVRAM is 256 kilobits of accessible static RAM. The NVRAM is used to store 80333' configuration information and disk drive RAID configuration information.

4.5.6   PCI-X Buses

The PCI-X bus interface is 64 bits wide and runs at 133 MHz. Only one of the 80333 PCI-X buses (Bus A) is used. The LSI1068 is the only device on the 80333 PCI-X bus.

4.5.7   PCI Express Bus

The PCI Express bus interfaces the 80333 processor to the system via the SFP flex connector.   The PCI Express bus is an x8 configuration, although the 80333 processor also supports x1 and x4 modes.

4.5.8   DDR2 Bus

The 80333 DDR2 bus runs at 400 MHz and supports 256 Mbyte, 512 Mbyte, and 1 Gbyte registered ECC mini-DIMMs. The DDR2 memory is used to provide data caching when the 80333 processor is operating in hardware RAID (ROMB) mode.

4.5.9   RAID Smart Battery

The Intel® RAID Smart Battery allows the contents of the RAID DIMM to be preserved if power drops below specifications. VBAT_RAID is the 1.8 V used by the DIMM and is supplied by the either the P1V8, P3V3_STBY to 1.8 V linear, or the RAID battery (battery backup module).

Under normal operation, full power (P1V8) is applied to VBAT_RAID and is generated from 12 V to 1.8 V by a separate PWM controlled switching regulator. If this rail drops out, VBAT_RAID is powered from the system power supply standby rail (P3V3_STBY) through a SC1565 LDO regulator. If P3V3_STBY_PWRGD is de-asserted, the battery takes over as the VBAT_RAID source if cache data is present in the DIMM.

When the 80333 I/O processor senses power has dropped below 2.96 V (Power Good de-asserts) and its POWER_DELAY signal is asserted, it initiates a power fail sequence that safely puts the ROMB DIMM into self-refresh state. The POWER_DELAY circuit generates enough of a delay to allow the 80333 I/O processor to complete its power fail sequence. After the power fail sequence is completed, additional logic (powered by VBAT_RAID) holds the DIMM's clock enable signals low to keep the DIMM in self-refresh mode. Once power is restored, data from the DIMM can be written to the disk array.

4.5.10   GPIOs

The 80333 processor has eight GPIOs that handle various input and output functions. The GPIOs are used to control the RAID smart battery, system indicators, and debug support.

4.5.11 RAID Activation Key

The Intel$^®$ RAID Activation Key is a pre-programmed serial device. This device is required to enable hardware RAID (for RAID 5 operation, for example).

4.5.12 I^{2}C

The 80333 I^{2}C bus allows the device to communicate with the system BMC and to the RAID smart battery. The I^{2}C bus going to the system BMC is isolated when power is not provided to the 80333 processor.

4.5.13 Indicator Buzzer

When the the optional RAID components are installed, the 80333 processor generates a series of beep codes to indicate failure modes. The 80333 indicates buzzer state via a GPIO. The SFP board PLD takes the GPIO input and creates a square wave to activate a buzzer on the server board.

4.6 SAS Controller (LSI1068)

The LSI Logic* LSI 1068 is a PCI-X SAS controller. The LSI1068 provides seven, 3 Gbps SAS links.

During normal SAS mode or software RAID operation, the LSI1068 boots from its dedicated flash device. The LSI1068 has an assigned SAS ID on the SFP board.

Figure 36. SAS Controller I/O Subsystem Block Diagram
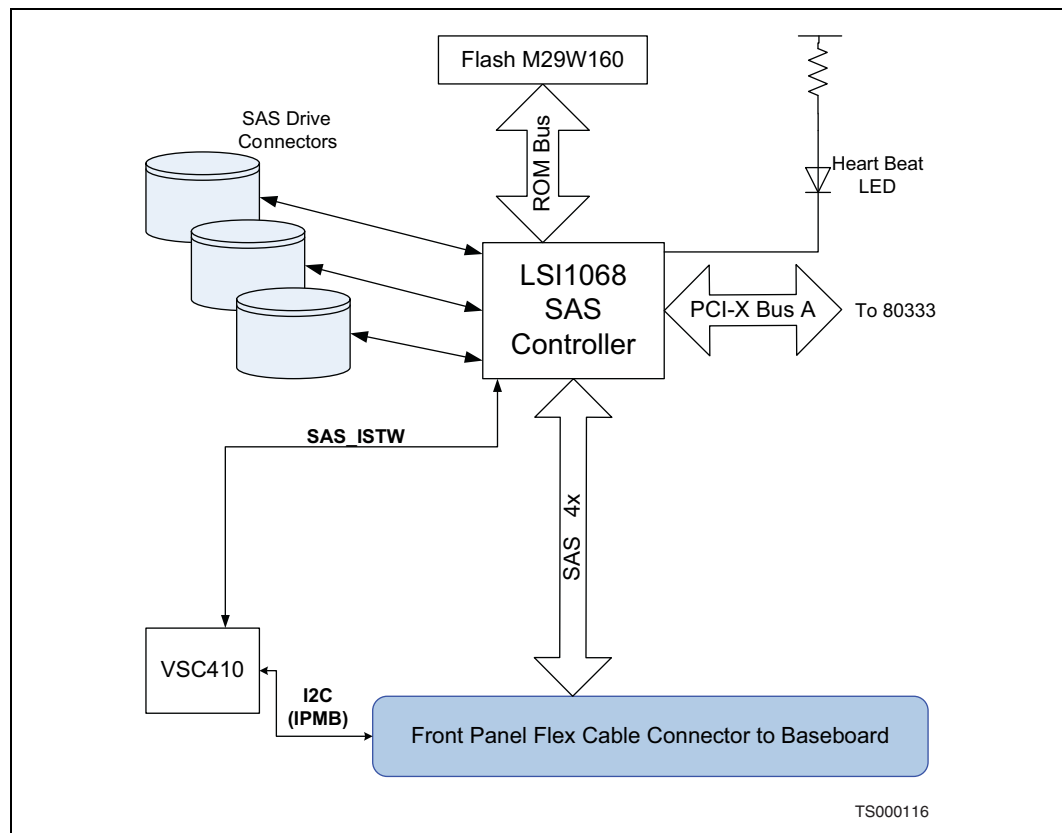
4.6.1   PCI-X Interface

The LSI1068 communicates to the 80333 over a 133 MHz, 64-bit PCI-X bus. The 80333 Bus A is used for this interface and Bus B is left unused.

4.6.2   SAS Interface

The SFP LSI1068 internal SAS interface consists of seven, 3 Gbps links. Three of the SAS ports are routed directly to internal 2.5-inch SAS drive connectors. Four ports are routed to the system baseboard's repeater for re-formation to the baseboard external SAS connector. (The eighth SAS interface on the LSI1068 is unused on the SFP.) All supported hardware and software RAID modes are available on the SAS interface.

4.6.3   Flash Memory

A 16 Mbit flash memory contains the LSI1068 executable code. The LSI1068 boots from the flash when the Carrier Grade Server TIGW1U SFP card is operating in normal SAS mode.

4.6.4   I^{2}C

The LSI1068 I^{2}C bus allows the system's BMC to communicate with the LSI1068. This ISTW I^{2}C bus is provided via the SFP VSC410 enclosure management controller.

4.6.5   LSI1068 Heart Beat LED Indicator

The HB_LED_N signal from the LSI1068 drives a LED on the SFP board that indicates SAS controller health. A blinking green LED indicates the LSI1068 IOP (I/O processor) is up and running. This LED is specifically for debug purposes and is only viewable by removing the system top cover.

4.7   VSC410 Enclosure Management Controller

The VSC410 supports baseboard management controller applications using the intelligent platform management bus (IPMB). The VSC410 provides four IPMB two-wire serial interfaces and three GPIO ports used to detect drive presence and to generate drive fault LED signals. A dedicated SPI flash bus is also provided for connection to serial flash ROM (code store) for system applications. The SFP enclosure management block diagram is shown in Figure 37.

Figure 37. Enclosure Management Block Diagram
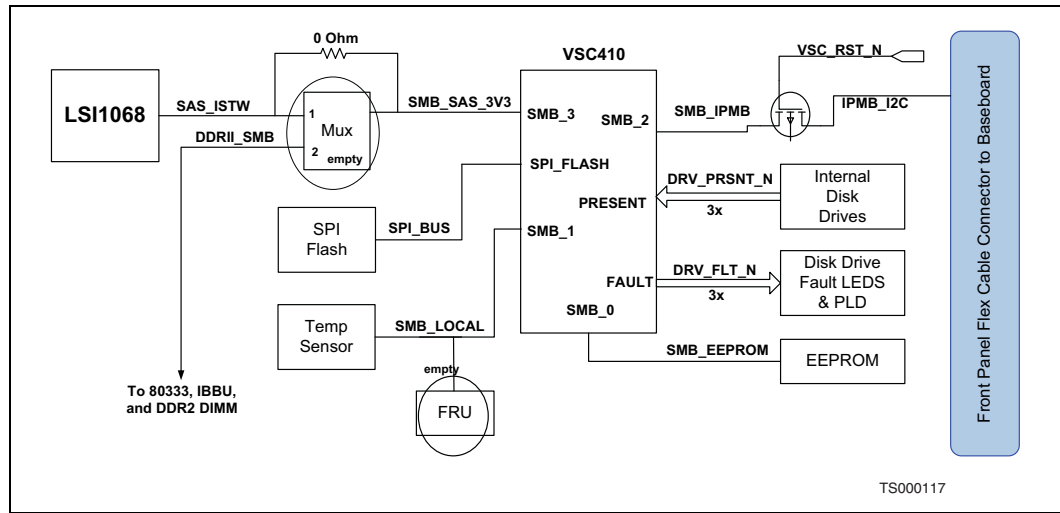
4.7.1 Drive Presence

The VSC410 provides GPIO inputs that are connected directly to the internal hard drives presence pins. These pins are communicate drive presence to the BMC.

4.7.2 Drive Fault

Internal hard drive faults are communicated from the BMC to the VSC410 over the IPMB. GPIO outputs from the VSC410 are connected directly to drive fault LED circuits to alert the user about which drive is at fault.

4.7.3 IPMB Buses

The VSC410 provides four, two-wire IPMB serial interfaces, SMB0-SMB3. SMB0 serves as the FRU interface. SMB1 monitors a temperature sensor that records temperature data around the VSC410. SMB2 is connected directly to the baseboard ESB. SMB3 connects to the LSI1068 ISTW I^{2}C to output debug information to the enclosure management processor.

4.7.4 SPI Bus

The VSC410 provides an SPI-compatible interface to attach a serial flash memory device. This flash device stores the server management application code necessary for the VSC410 functionality.

4.8 Clock Generation/Distribution

The SFP uses several on-board clock sources and a system-generated 100 MHz clock (PCI Express).

Figure 38. SFP Clock Diagram

TS000118
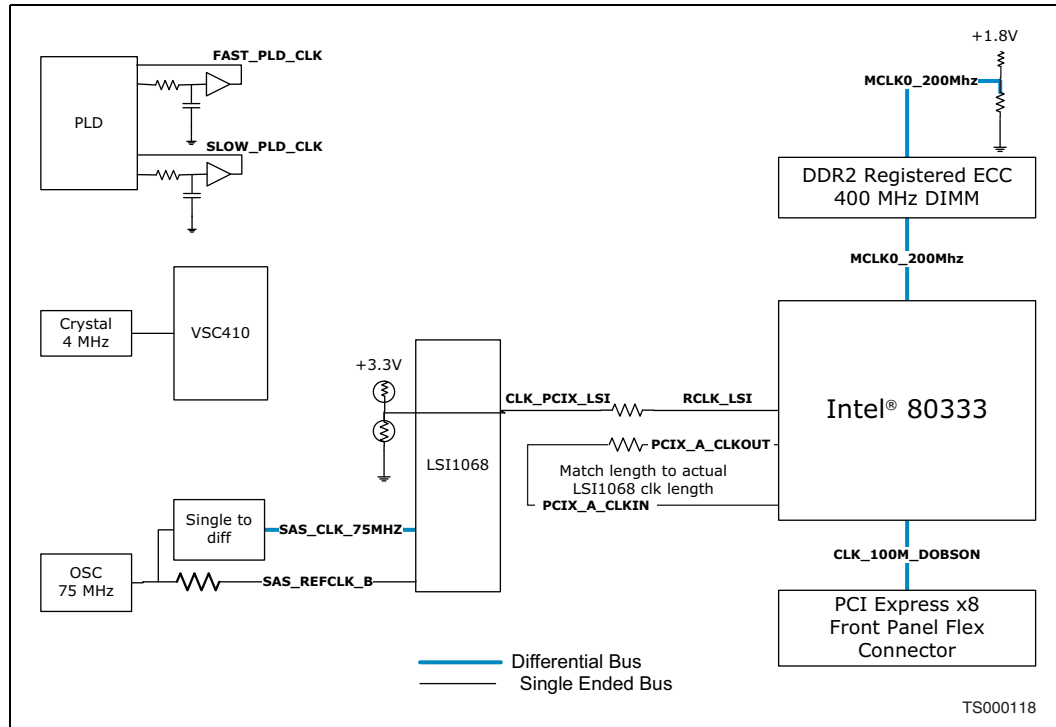
4.8.1 75 MHz Sourced Clock

The LSI1068 uses a differential 75 MHz clock sourced from the 75 MHz oscillator.

4.8.2 133 MHz Sourced Clock

The 80333 processor generates a 133 MHz clock for the PCI-X bus. Skew is controlled to the LSI1068 via a feedback circuit.

4.8.3 200 MHz Sourced Clock

The 80333 processor generates a 200 MHz clock for the DDRII interface.

4.8.4 100 MHz Sourced Clock

The S5000PHB server board provides a 100 MHz clock for the 80333 processor.

4.8.5 PLD Sourced Clock

Two separate external RC circuits and Schmitt* triggers generate a slow CLK and fast CLK for the PLD. The fast CLK is used for critical IBBU strobe timing and the slow CLK provides buzzer frequency and to hold the 80333 in reset for at least 1.5 ms after brock_reset_n.

4.8.6   VSC410 Clock

An external 4.0 MHz crystal provides the clock required for the VSC410 internal PLL.

4.9   Programmable Logic Device (PLD)

The Lattice* programmable logic device on the SFP is used for board power/reset control, board interlock control, buzzer control, Intel® RAID Smart Battery control, and various miscellaneous signals. The PLD can only be updated via a header (unpopulated) on the SFP. Further understanding can be obtained by reviewing the VHDL code and comments.

4.9.1   Power On/Reset

A state machine ensures the voltage sequencing and reset logic comes up as expected.

4.9.2   Buzzer Control

The PLD uses the PLD clock and the AUDIOTRIG signal to generate a 2.4 kHz signal to drive the server board buzzer. AUDIOTRIG is generated from GPIO3 on the 80333.

4.9.3   Intel® RAID Smart Battery Control

The PLD uses the PLD clock to generate the smart battery control signals BBE and IBBU_BBSTROBE. These signals are used to notify the Smart Battery that critical data (dirty) is in the DIMM and that the Smart Battery will have to supply VBAT_RAID if power fails.

4.9.4   Telco Alarm LED Control

The PLD is responsible for selecting the correct color (Red or Yellow) for the Critical and Major dual alarm LEDs according to the TELCO_SELECT_LED signal provided by the S5000PHB server board.

4.9.5   System Drive Status LED Control

The PLD also monitors hard drive presence, hard drive activity, and drive fault signals driven from the VSC410. It uses all of these pins to control the OR'ed internal drive status LED that indicates drive activity and drive faults.

4.10   Hardware RAID

The SFP provides hardware supported RAID 0/1/10/5. The SFP board supports a RAID On MotherBoard (ROMB) solution via the Intel 80333 I/O processor in conjunction with the LSI1068 SCSI controller.

To activate the hardware RAID feature, an optional Intel® RAID Activation Key is available. This pre-programmed serial device contains a configuration code to unlock specific features to support the LSI Logic* MegaRAID solution.

In addition to the activation key, hardware RAID mode requires a DDR-2 mini-DIMM to provide memory for the IOP and to serve as a disk cache to store write data to the drives. If power to the Intel 80333 I/O processor drops below specifications, the RAID smart battery maintains the contents of the ROMB DIMM by keeping the DIMM in self-refresh mode until power is restored. After power is restored, the data can be safely written to the drives, maintaining the integrity of the disk array.

4.10.1   DDR-2 Support

The Carrier Grade Server TIGW1U SFP has a single 244-pin DDR-2 mini-DIMM slot that can be used to add local memory for the I/O processor. This increases performance by allowing the caching of writes to the disk array. See the current supported memory list for compatible DIMMS.

- DDR2 400 MHz SDRAM only.
- Registered DIMMs only (board not routed nor simulated for unbuffered DIMMs).
- 72-bit ECC DIMMs only (64-bit data bus width plus 8-bit ECC).

4.10.2   Intel 80333 I/O Processor NVRAM

A 32 kilobyte NVRAM component is connected to the peripheral bus interface (PBI) of the 80333 I/O processor. This NVRAM contains board and disk drive setup configuration data and other system information.

The SFP uses a 32 Kbyte (32K x 8-bit) Simtek* STK14D88 NVRAM component, which is powered by the system's main 3.3 V rail.

4.10.3   ROMB Battery Backup

The battery backup allows the contents of the ROMB DIMM to be preserved if power drops below specifications. VBAT_RAID is the 1.8 V used by the DIMM and is supplied by the either, P1V8, P3V3_STBY, or the RAID smart battery. Under normal operation, full power (P1V8) is applied to VBAT_RAID and is generated from 12 V to 1.8 V by a separate PWM controlled switching regulator. If this rail drops out, VBAT_RAID is powered from the system power supply standby rail (P3V3_STBY) through a SC1565 LDO regulator. If P3V3_STBY_PWRGD is deasserted, the Smart Battery takes over as the VBAT_RAID source.

When the Intel 80333 I/O processor senses power has dropped below 2.96 V (Power Good deasserts) and its POWER_DELAY signal is asserted, it initiates a power fail sequence that safely puts the ROMB DIMM into self-refresh state. The POWER_DELAY circuit generates enough of a delay to allow the 80333 I/O processor to complete its power fail sequence. After the power fail sequence is completed, additional logic (powered by VBAT_RAID) holds the DIMM's clock enable signals low to keep the DIMM in self-refresh mode. One power is restored, data from the DIMM can be written to the disk array.

4.11   Software RAID

When the Intel® RAID Activation Key is not installed, the Carrier Grade Server TIGW1U provides software-supported RAID 0 and RAID 1 capabilities for the internal drives. When one or more external SAS drives are connected to the rear-panel 4x SAS connector, the system also provides software-supported RAID 10 operation.

Software RAID is enabled by the "Software RAID Enabled" setting in BIOS. This sets the RAID_MODE signal that is necessary to distinguish between straight SAS mode and software RAID mode. The Intel® RAID Activation Key and mini-DIMM should be un-installed to run software RAID.

4.11.1   80333 Processor in Software RAID

The 80333 processor serves as a PCIe to PCI-X bridge supporting transfer rates of up to 3 GB/s. It is connected to the server board's x8 PCI Express link and includes fully functional RAID support. However, the IOP80333 serves only as a bridge in software RAID mode.

4.11.2   LSI1068 Controller in Software RAID

The LSI1068 controller resides on the Channel A PCI-X bus of the 80333 processor, supporting transfer rates of up to 3 GB/s. It includes an Address Translation Unit (ATU) supporting transactions between PCI address space and IOP80333 address space. Address translation for the ATU is controlled through programmable registers accessible from both the PCI interface and the Intel XScale® core. The LSI1068 controller includes its own Flash ROM to support SAS-only software RAID. Software RAID levels supported include 0, 1, and 10.

4.12   Power Good and Reset Control

Power Good are positive logic signals reflecting the status of various power rails.

4.12.1   Power Good Circuit

Power Good outputs allow the SFP board to know when to come out of reset. The worst-case ranges take into account component tolerances and the range represents the smallest expected range.

Table 25.   Power Good Specifications

Voltage	Signal Name	Voltage Range for Good Voltage
+3.3 V	P3V3_STBY_PWRGD	±10% (2.97 V to 3.63 V)
+1.8 V	P1V8_PWRGOOD	+12% / -11% (1.62 V to 1.98 V)
+1.5 V	P1V5_PWRGOOD	±10% (1.35 V to 1.64 V)
+1.35 V	P1V35_PWRGOOD	+9% / -10% (1.21 V to 1.48 V)
+1.2 V	P1V2_PWRGOOD	+13% / -12% (1.06 V to 1.35 V)

4.12.2   Power Good Inputs

The FP_SYS_RESET_N signal indicates the P3V3 power rail supplied by the server board is good. This signal serves as the same function as the system PERST_N.

4.12.3   Reset Control

The board resets are controlled by the PLD and are generated off of the Voltage Power-Good signals and the FP_SYS_RESET_N.

The BROCK_RST_N signal must be held off for 1 ms after the 80333 Power Good signal goes active.

Figure 39. SFP Reset Block Diagram

TS000119
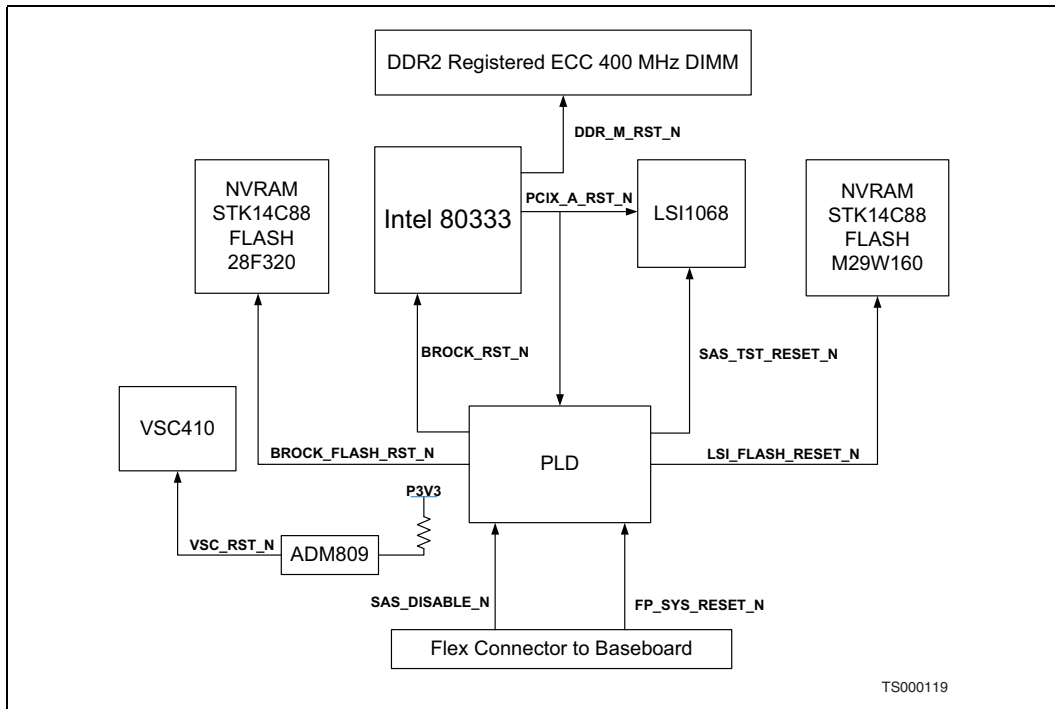
4.13 Front Panel Switches and Status Indicators

Figure 40 shows the locations of the SFP board's front panel switches and LED indicators.

Figure 40. SAS Front Panel Board LED Indicators and Switches

TS000228
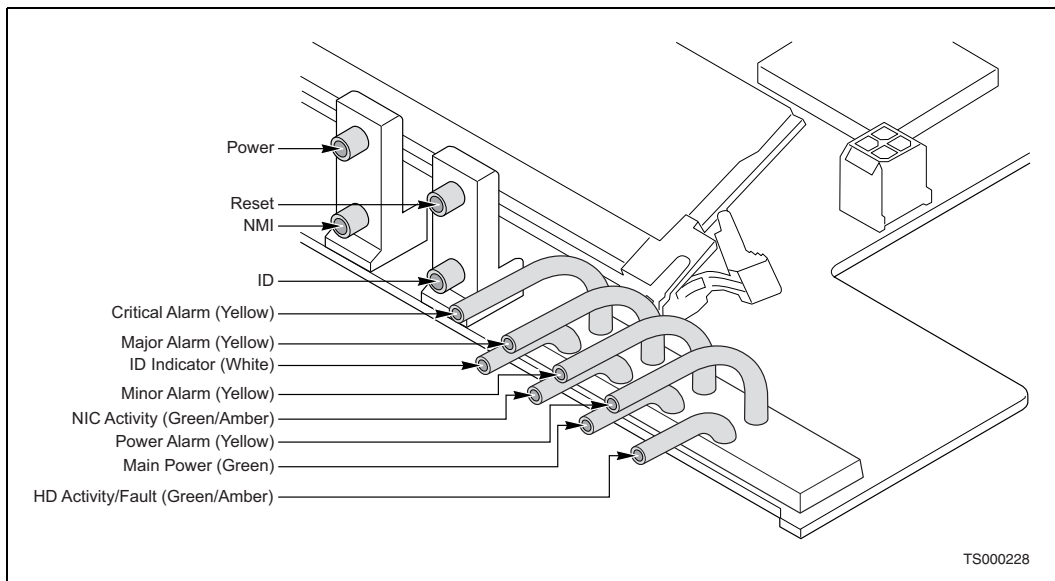
4.13.1   Front Panel Switches

The front panel has a power switch, a reset switch, an NMI switch, and a system ID switch. The function of these switches is described in the following table.

Table 26.   Front Panel Switches Description

Switch	Function
Power Switch	Toggles system power on/off. Also functions as a Sleep Button if enabled by an ACPI-compliant operating system
Reset Switch	Resets the system when it is in the power-on state
NMI Switch	Instructs the processor to copy system memory to hard disk
System ID Switch	Instructs the processor to toggle the state of the system ID LED

4.13.2   Front Panel LEDs

Table 27 lists the front panel LED specifications

Table 27.   SFP LED Specifications

LED Function	LED Color	Peak Wavelength (nm)	Luminous Intensity Typ @20mA (mcd)	Luminous Intensity Min @20mA (mcd)
Critical Alarm†	Yellow (Red)	590 (627)	15 (20)	4 (7)
Major Alarm†	Yellow (Red)	590 (627)	15 (20)	4 (7)
Minor Alarm	Yellow	580	6	3
Power Alarm	Yellow	580	6	3
System ID	White	n/a	75	36
NIC Activity	Green	560	12	6
Power On	Green	567	12	6
HDD Activity/Status	Green/Amber	560/605	7.5/9	3/5

† Critical and Major alarm indicators are bi-color LEDs that can be configured to be yellow or red by means of an SDR TAM setting. Yellow is the default color.

4.13.3   System Status LEDs

There are four front panel system status LEDs. The functions of these system status LEDs are described in Table 28.

Table 28.   SFP System Status LEDs

Status LED	Function
Power On	The green *Power On* LED indicates that system power is on when it is illuminated continuously. When blinking green, it indicates that the system is in ACPI sleep mode.
NIC Activity	The green *NIC activity* LED indicates network link presence and activity on either NIC 0 or NIC 1.
System ID	The white *ID* LED identifies a system. The LED can be toggled remotely or with the System ID Switch.
HDD Activity/Fault	The green/amber *hard drive activity/fault LED* displays activity (green indication) or fault status (amber indication) for any of the three internal SAS drives. This is an OR'ed LED function; the SFP board also provides individual activity and status LEDs for each internal drive, which can be seen when the bezel is removed.

4.13.4   System Fault LEDs (Telco Alarms)

There are four front panel system fault LEDs. The functions of these system fault LEDs are described in Table 29.

Table 29.   Telco Alarm LED Description

Fault LED	Function
Critical†	The yellow (or red) LED alarm is illuminated via BMC private I^{2}C bus and may only be turned off via BMC private I^{2}C control. When continuously lit, it indicates the presence of a Critical System Fault, which is an error or event that has a fatal impact to the system. In this case, the system cannot continue to operate. An example is the loss of a large section of memory, or other corruption that renders the system not operational. The critical alarm relay is also engaged when the LED is illuminated.
Major†	The yellow (or red) major alarm is illuminated via BMC private I^{2}C bus and may be turned off via BMC private I^{2}C control or alarm connector reset. When continuously lit, it indicates the presence of a Major System Fault, which is an error or event that that has discernible impact to system operation. In this case, the system can continue to operate, but in a "degraded" fashion (reduced performance or a non-fatal feature reduction). An example is the loss of one of two mirrored disks. The major alarm relay is also engaged when the LED is illuminated.
Minor	The yellow minor alarm LED is illuminated via BMC private I^{2}C bus and may be turned off via BMC private I^{2}C control or alarm connector reset. When continuously lit, it indicates the presence of a Minor System Fault, which is an error or event that that has little impact to actual system operation. An example would be a correctable ECC error. The minor alarm relay is also engaged when the LED is illuminated.
Power	The yellow power alarm LED is illuminated via BMC private I^{2}C bus or SYS_FLT_LED_L signal and may only be turned off via BMC private I^{2}C control. When continuously lit, it indicates the presence of a Power System Fault. The power alarm relay is also engaged when the LED is illuminated.
†	Critical and Major alarm indicators are bi-color LEDs that can be configured to be yellow or red by an SDR TAM setting. Yellow is the default.

4.13.5   Fan Fault LEDs

The SFP board contains an 8-bit, serial-in, parallel-out shift register to control the on-board fan fault LEDs. Each of the five fan LEDs is mapped to the following bits of the shift register.

Table 30.   Fan Fault LED Bit Mapping

Fan ID	Shift Register Bit Location
FAN1 (in front of CPU1 & DIMMS)	Bit 0
FAN2 (in front of CPU1)	Bit 1
FAN3 (in front of CPU0)	Bit 2
FAN4 (in front of CPU0)	Bit 3
FAN9 (in front of PCI CONN)	Bit 4

4.13.6   Hard Drive LEDs

The SFP provides individual light-piped activity and fault LEDs for each internal disk drive. Activity and fault conditions can be observed on the OR'ed front-panel disk drive LED indicator described in Section 4.13.3, "System Status LEDs". If a fault is seen, the user can remove the front bezel to observe the individual hard drive LEDs and identify the faulty drive.

4.13.7   Temperature Sensor

The SFP board provides an LM95010 single-wire interface temperature sensor that can be read by the server board. The temperature sensor address pins are strapped to ground, which corresponds to the assignment of device number 001. The temperature sensor has an accuracy of ±2º C and provides a temperature reading range of -20º C to +125º C. This temperature sensor is placed to measure ambient air coming into the chassis.

5.0   SMART Embedded USB Solid-State Drive

This chapter describes the basic functions and interface requirements of the SMART Embedded USB Solid-State Drive. The information contained in this chapter is organized into the following sections:

- Functional Description
- SFP Board Connector
- Architecture
- Installation

5.1   Functional Description

Key features of the eUSB solid-state drive are:

- Capacity of 1, 2, or 4 Gbyte
- Sequential read performance of 28 Mbyte per second
- Sequential write performance of 20 Mbyte per second
- Supports the USB 2.0 / 1.1 specification

The eUSB solid-state drive attaches to an interposer board and is used with the Ethernet front panel (EFP) board to provide local memory storage for various options including, but not limited to, operating system, system information, diagnostic partitions, and configuration data.

Figure 41 shows the eUSB solid-state drive board as it attaches to the interposer board and Figure 42 gives the dimensions of the Solid State Drive.

Figure 41.   eUSB Solid-State Drive Connection to Interposer Board
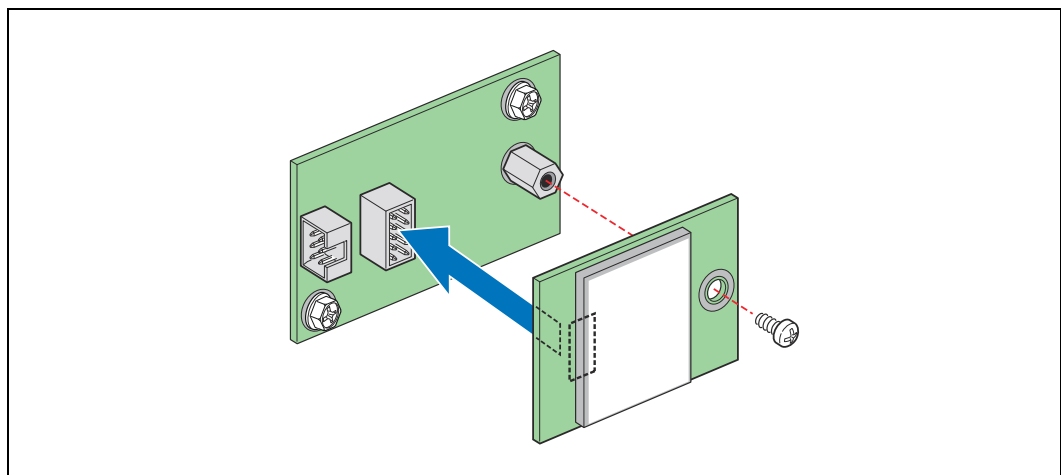
Figure 42.   eUSB Solid-State Drive Dimensions
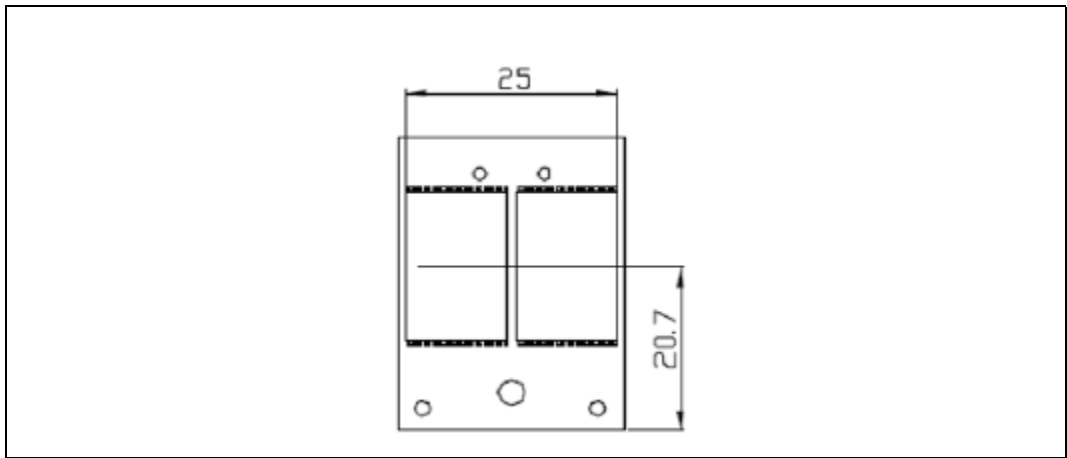
Because this is a removable media device, it can be moved with the data intact from one system to another. This is useful for cloning system configurations and system options, and for other operations. The connection for the eUSB SSD is made by a USB channel provided by the SFP board.

5.2   SFP Board Connector

Table 31 lists the pinout of the 2 x 3 connector that interfaces to the SFP board.

Table 31.   2 x 3 Connector Pinout

Pin	Blind Mate Signal	Pin	Blind Mate Signal
1	GND	2	N/C (Pin Pulled)
3	USB_Data_Plus (D+)	4	VBUS (+5V)
5	USB_Data_Minus (D-)	6	GND

5.3   Architecture

The eUSB solid-state drive combines Intel® NAND Flash memory and a USB controller to deliver a solution for embedded and thin client markets. The system is based on a single level cell (SLC) flash technology. Each capacity option (1, 2, or 4 Gbyte) contain two NAND flash devices. The high-speed USB 2.0 controller includes 4 symbol error correction capability and wear-leveling algorithms for enhanced NAND management. The controller is backward-compatible to the USB 1.1 specification and complies with USB Mass Storage Class Specification v1.0.

5.4 Installation

The SMART Embedded USB Solid-State Drive is installed onto an interposer board. The interposer board attaches to the top of the drive bay. The cable connects between the Solid State Drive interposer board and the SFP board. See the following figure.

Figure 43. eUSB Solid-State Drive Installation
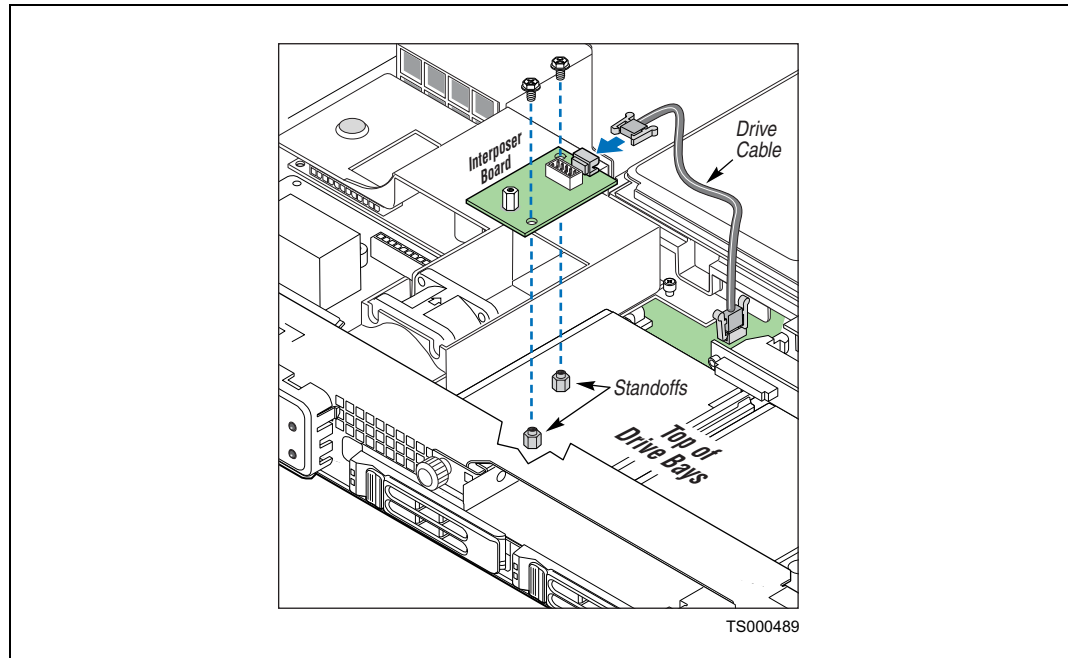
6.0 PCI/PCI-X* Riser Card

This chapter describes the design and external interface PCI/PCI-X* riser card, which is standard on the Kontron Carrier Grade Server TIGW1U. The riser card implements one 3.3 V, 64-bit PCI/PCI-X slot, with access to the I/O bracket through the server's rear panel.

The information in this chapter is organized into the following sections:

- Introduction
- Functional Description
- PCI-X Riser Card Connector Interface
- Electrical Specification

6.1 Introduction

The PCI/PCI-X riser card supports one 3.3 V, 64-bit slot. The bus speed varies from 33 MHz to 133 MHz depending on the PCI or PCI-X adapter card installed in the riser card. For a detailed description of this card, see the *Intel® Server Board S5000PHB Technical Product Specification*.

Figure 44 illustrates the riser board assembly (upside down from its installed orientation).

Figure 44.   PCI-X Riser Card Assembly

TS000109
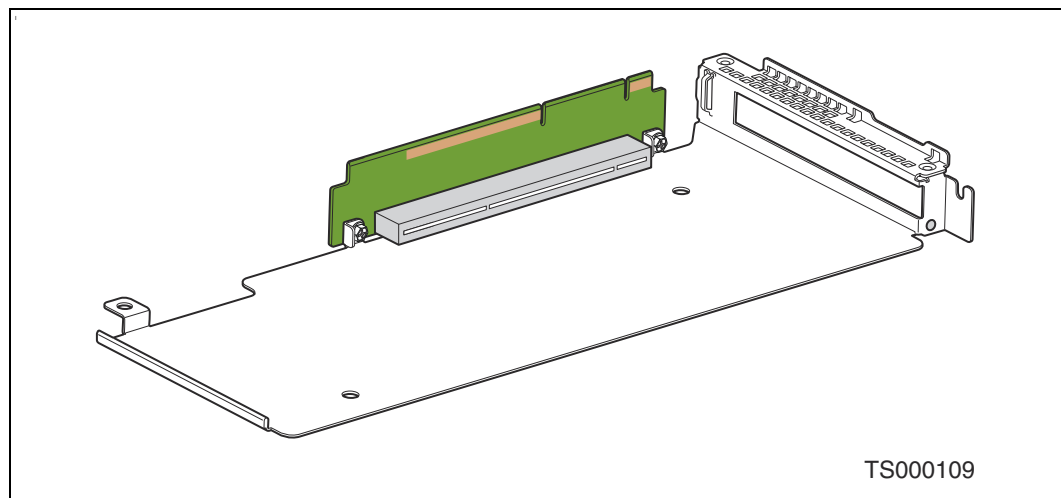
6.2 Functional Description

The PCI/PCI-X riser card has one 64-bit slot that supports bus speeds of 33 MHz and 66 MHz for PCI add-in cards and 66 MHz, 100 MHz, and 133 MHz for PCI-X cards.

IDSELs are AD24 for slot 1.

6.3 PCI-X Riser Card Connector Interface

Table 32 lists the signals available on the PCI/PCI-X card slot.

Table 32.   PCI/PCI-X Riser Card Slot Pin-Out (Sheet 1 of 3)

Pin #	Signal	Pin #	Signal
B1	-12V	A1	TRST#
B2	TCK	A2	+12V
B3	GND	A3	TMS
B4	Reserved	A4	TDI
B5	+5V	A5	+5V
B6	+5V	A6	P64IRQ0
B7	P64IRQ1	A7	P64IRQ2
B8	P64IRQ3	A8	+5V
B9	Reserved	A9	Reserved
B10	Reserved	A10	+3.3V
B11	Reserved	A11	Reserved
KEY			
B14	Reserved	A14	+3.3VAUX
B15	GND	A15	RST#
B16	CLK	A16	+3.3V
B17	GND	A17	GNT#
B18	REQ#	A18	GND
B19	+3.3V	A19	PME#
B20	AD31	A20	AD30
B21	AD29	A21	+3.3V
B22	GND	A22	AD28
B23	AD27	A23	AD26
B24	AD25	A24	GND
B25	+3.3V	A25	AD24
B26	C/BE3#	A26	IDSEL
B27	AD23	A27	+3.3V
B28	GND	A28	AD22
B29	AD21	A29	AD20
B30	AD19	A30	GND
B31	+3.3V	A31	AD18
B32	AD17	A32	AD16
B33	C/BE2#	A33	+3.3V

Table 32.   **PCI/PCI-X Riser Card Slot Pin-Out (Sheet 2 of 3)**

Pin #	Signal		Pin #	Signal
B34	GND		A34	FRAME#
B35	IRDY#		A35	GND
B36	+3.3V		A36	TRDY#
B37	DEVSEL#		A37	GND
B38	GND		A38	STOP#
B39	LOCK#		A39	+3.3V
B40	PERR#		A40	SMCLK
B41	+3.3V		A41	SMDATA
B42	SERR#		A42	GND
B43	+3.3V		A43	PAR
B44	C/BE1#		A44	AD15
B45	AD14		A45	+3.3V
B46	GND		A46	AD13
B47	AD12		A47	AD11
B48	AD10		A48	GND
B49	M66EN		A49	AD9
B50	GND		A50	GND
B51	GND		A51	GND
B52	AD8		A52	C/BE0#
B53	AD7		A53	+3.3V
B54	+3.3V		A54	AD6
B55	AD5		A55	AD4
B56	AD3		A56	GND
B57	GND		A57	AD2
B58	AD1		A58	AD0
B59	+3.3V		A59	+3.3V
B60	ACK64#		A60	REQ64#
B61	+5V		A61	+5V
B62	+5V		A62	+5V
		KEY		
B63	Reserved		A63	GND
B64	GND		A64	C/BE7#
B65	C/BE6#		A65	C/BE5#
B66	C/BE4#		A66	+3.3V
B67	GND		A67	PAR64
B68	AD63		A68	AD62
B69	AD61		A69	GND
B70	+3.3V		A70	AD60
B71	AD59		A71	AD58
B72	AD57		A72	GND

Table 32. **PCI/PCI-X Riser Card Slot Pin-Out (Sheet 3 of 3)**

Pin #	Signal	Pin #	Signal
B73	GND	A73	AD56
B74	AD55	A74	AD54
B75	AD53	A75	+3.3V
B76	GND	A76	AD52
B77	AD51	A77	AD50
B78	AD49	A78	GND
B79	+3.3V	A79	AD48
B80	AD47	A80	AD46
B81	AD45	A81	GND
B82	GND	A82	AD44
B83	AD43	A83	AD42
B84	AD41	A84	+3.3V
B85	GND	A85	AD40
B86	AD39	A86	AD38
B87	AD37	A87	GND
B88	+3.3V	A88	AD36
B89	AD35	A89	AD34
B90	AD33	A90	GND
B91	GND	A91	AD32
B92	Reserved	A92	Reserved
B93	Reserved	A93	GND
B94	GND	A94	Reserved

6.4   Electrical Specification

The maximum power per slot is 25 W. This conforms to *PCI Specification 2.2*.

7.0 PCI Express* Riser Card

This chapter describes the design and external interface of the PCI Express* (PCIe*) riser card, an optional accessory for the Kontron Carrier Grade Server TIGW1U. The PCIe riser board implements one x8 PCI Express slot compatible with full-height, full-length x1, x4, and x8 PCI Express boards. The I/O bracket of the PCIe board is accessible through the server's rear panel.

The information contained in this chapter is organized into the following sections:

- Introduction
- Functional Description
- PCI Express Riser Card Connector Interface
- Electrical Specification

7.1 Introduction

The PCIe riser card supports one x8 PCIe slot. This is described in the *Intel® Server Board S5000PHB Technical Product Specification*.

Figure 45 shows the FH/FL PCIe riser card layout (upside down from its installed orientation).

Figure 45. PCI Express Riser Card Assembly

TS000110
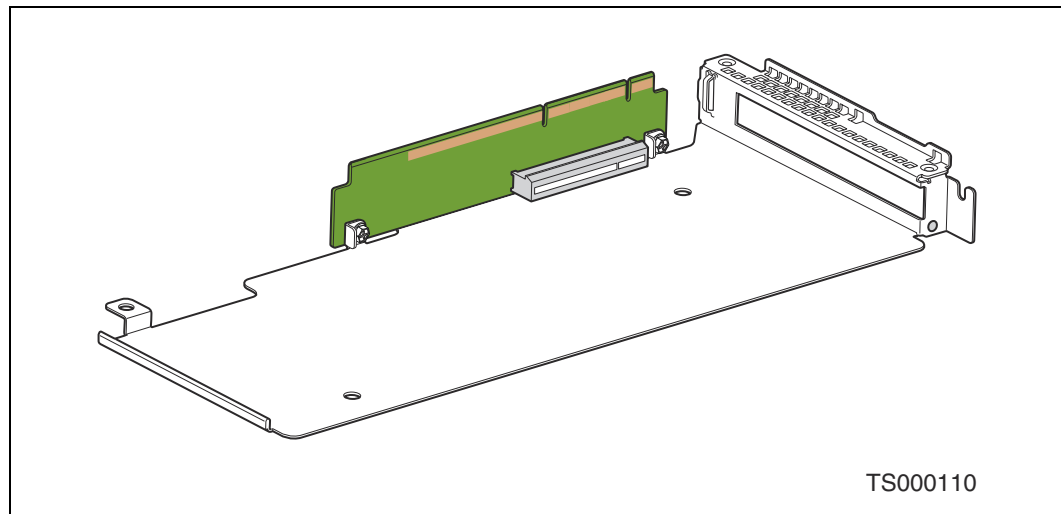
7.2 Functional Description

The FH/FL PCIe riser card has one x8 PCIe slot, which can accept x1, x4, or x8 PCI Express boards.

IDSELs are device ID 17 for slot 1.

7.3 PCI Express Riser Card Connector Interface

Table 33 provides the pin-out for the adapter card connector on the PCIe riser card.

Table 33. PCI Express Riser Slot Pin-Out (Sheet 1 of 2)

Pin #	Signal	Pin #	Signal
B1	+12V	A1	Reserved
B2	+12V	A2	+12V
B3	Reserved	A3	+12V
B4	GND	A4	GND
B5	SMCLK	A5	Reserved
B6	SMDATA	A6	Reserved
B7	GND	A7	Reserved
B8	+3.3V	A8	Reserved
B9	Reserved	A9	+3.3V
B10	+3.3VAUX	A10	+3.3V
B11	WAKE_N	A11	PWRGD
KEY			
B12	Reserved	A12	GND
B13	GND	A13	REFCLK+
B14	HSOP0+	A14	REFCLK-
B15	HSOP0-	A15	GND
B16	GND	A16	HSIP0+
B17	Reserved	A17	HSIP0-
B18	GND	A18	GND
B19	HSOP1+	A19	Reserved
B20	HSOP1-	A20	GND
B21	GND	A21	HSIP1+
B22	GND	A22	HSIP1-
B23	HSOP2+	A23	GND
B24	HSOP2-	A24	GND
B25	GND	A25	HSIP2+
B26	GND	A26	HSIP2-
B27	HSOP3+	A27	GND
B28	HSOP3-	A28	GND
B29	GND	A29	HSIP3+
B30	Reserved	A30	HSIP3-
B31	Reserved	A31	GND

Table 33.   PCI Express Riser Slot Pin-Out (Sheet 2 of 2)

Pin #	Signal	Pin #	Signal
B32	GND	A32	Reserved
B33	HSOP4+	A33	Reserved
B34	HSOP4-	A34	GND
B35	GND	A35	HSIP4+
B36	GND	A36	HSIP4-
B37	HSOP5+	A37	GND
B38	HSOP5-	A38	GND
B39	GND	A39	HSIP5+
B40	GND	A40	HSIP5-
B41	HSOP6+	A41	GND
B42	HSOP6-	A42	GND
B43	GND	A43	HSIP6+
B44	GND	A44	HSIP6-
B45	HSOP7+	A45	GND
B46	HSOP7-	A46	GND
B47	GND	A47	HSIP7+
B48	Reserved	A48	HSIP7-
B49	GND	A49	GND

7.4   Electrical Specification

The maximum power per slot is 25 W. This conforms to *PCI Express Specification 2.0*.

8.0   AC Power Subsystem

This chapter defines the features and functionality of the AC-input switching power subsystem of the Kontron Carrier Grade Server TIGW1U. The AC power subsystem has up to two AC-input power supply modules that can operate in redundant mode, and a power distribution board (PDB).

The AC power supply module is not NEBS hardened, so NEBS certification of the TIGW1U carrier grade server system will not be performed with the server system configured with an AC power subsystem. However, the Carrier Grade Server TIGW1U configured with an AC power supply subsystem is NEBS Level 1 compliant.

The information contained in this chapter is organized into the following sections:

- Features
- Power Distribution Board
- AC-input Power Supply Module

8.1   Features

- 450 W output capability over full AC input voltage range
- Power good indication LEDs
- Predictive failure warning
- External cooling fans with multi-speed capability
- Remote sense of 3.3 V, 5 V, and 12 V DC outputs (on the PDB)
- Brown-out protection and recovery
- Built-in overloading protection capability
- Onboard field replaceable unit (FRU) information
- I^2C interface for server management functions
- Mechanical module latching feature
- Integral handle for insertion/extraction

8.2 Power Distribution Board

8.2.1 PDB Mechanical Specification

The AC-input PDB can support up to two 450 W PSUs in a 1+1 configuration or a 1+0 configuration. A mechanical drawing for the power distribution board is shown in Figure 46.

Figure 46. Power Distribution Board Mechanical Drawing
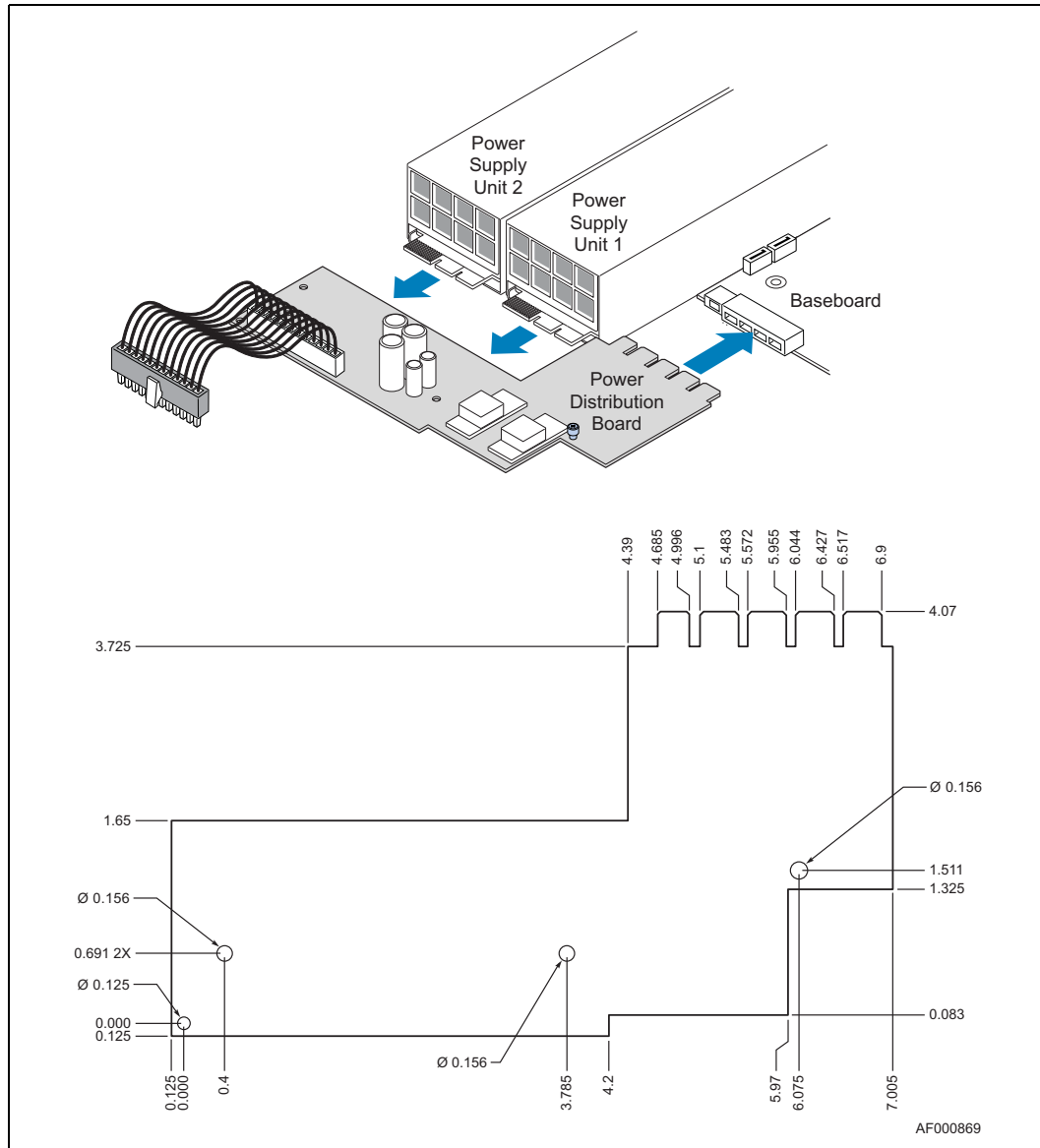
8.2.2　PDB System Interface

The power distribution board has three interconnections with other system components:

- The PDB has edge fingers that connects to the server board via a five-section blind-mate connector.
- The PDB has two, three-section blind-mate connectors that accept edge finger contacts on the hot-swappable power-supply units.
- The PDB has a discrete conductor wiring harness that connects to the front panel board via a single-row 12-pin connector.

All output wiring uses listed or recognized component appliance wiring material (AVLV2), VW-1 flame rating, rated 105° C min, 300 Vdc min.

8.2.2.1　PDB Interface to Server Board

Figure 47 and Figure 48 show the connection between the PDB and the S5000PHB server board.

Figure 47.　PDB Server Board Edge Finger Layout
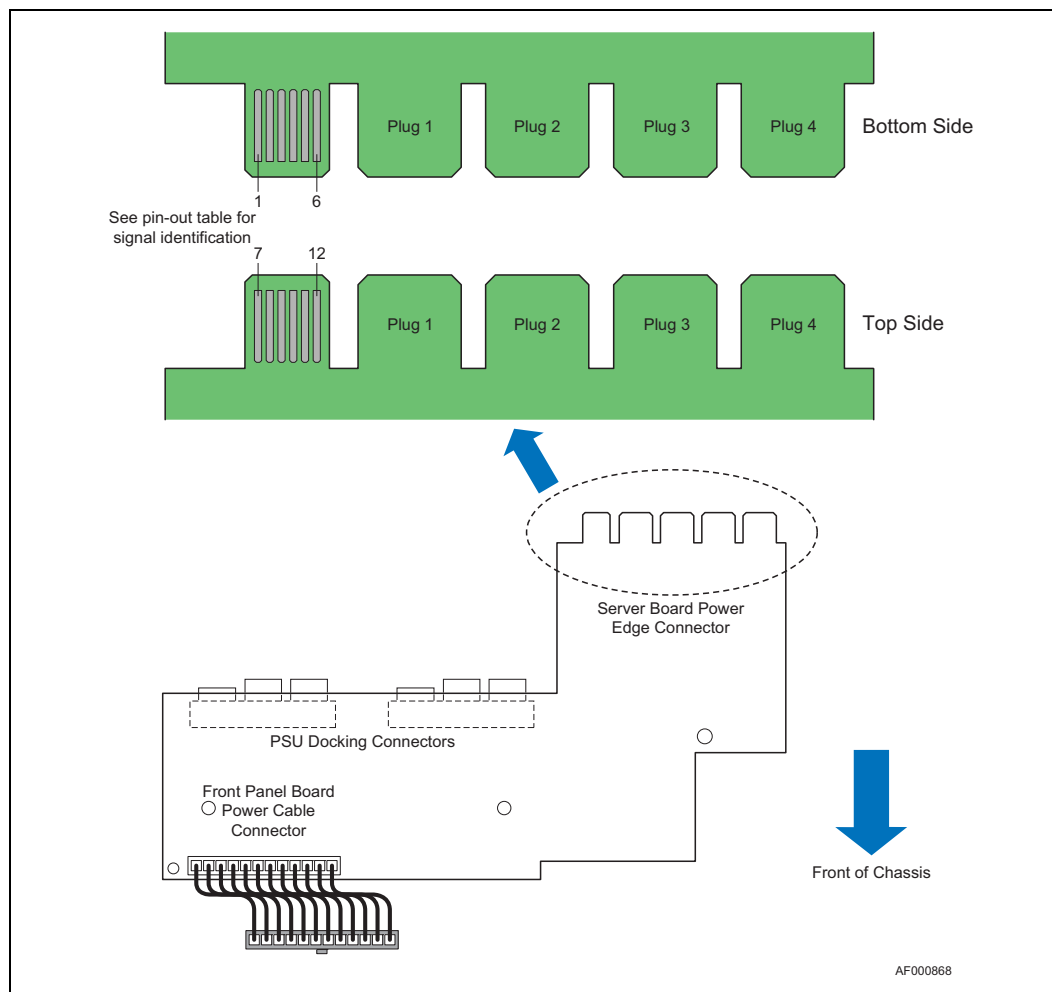
Figure 48.   Server Board Power Docking Connector
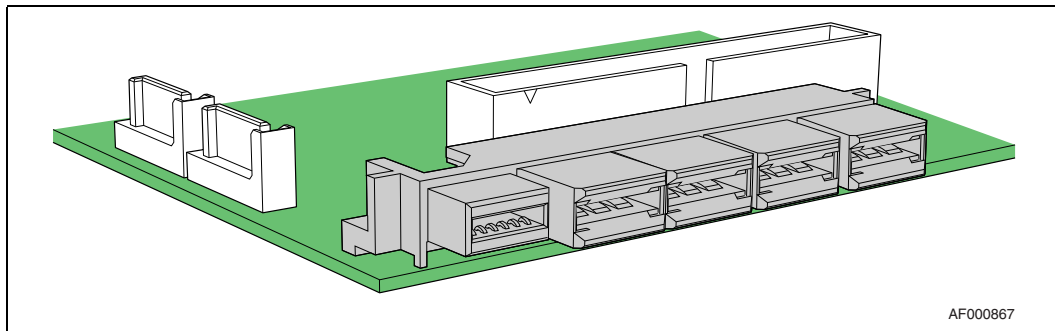
AF000867

Table 34.   PDB Server Board Edge Finger Pin-Out

Pin #	Pin Assignment	Pin #	Pin Assignment
1	PWR OK	7	ReturnS
2	PSON#	8	+3.3RS
3	-12V (0.1 A)	9	+5VSB (1.33 A)
4	I2C Clock	10	+5VSB (1.33 A)
5	I2C Data	11	+5V RS*
6	SMBAlert#	12	+5VSB (1.33 A)
P1 Bottom	COMM (19.61 A)	P1 Top	+12V3 (15.42 A)
P2 Bottom	COMM* (19.61 A)	P2 Top	+5VDC* (6.35 A)
P3 Bottom	COMM (19.61 A)	P3 Top	+3.3VDC* (18.146 A)
P4 Bottom	+12V2 (7.41 A)	P4 Top	+12V1 (7.41 A)

8.2.2.2   PDB Interface to PSUs

Figure 49, Figure 50, and Table 35 document the connection between each PSU module and the PDB.

Figure 49.   PSU Docking Connector
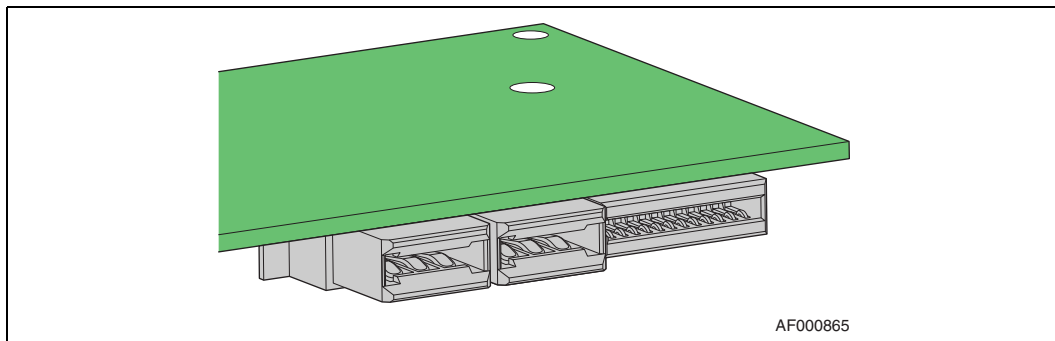
AF000865

Figure 50.   PSU Output Finger Layout

AF000870
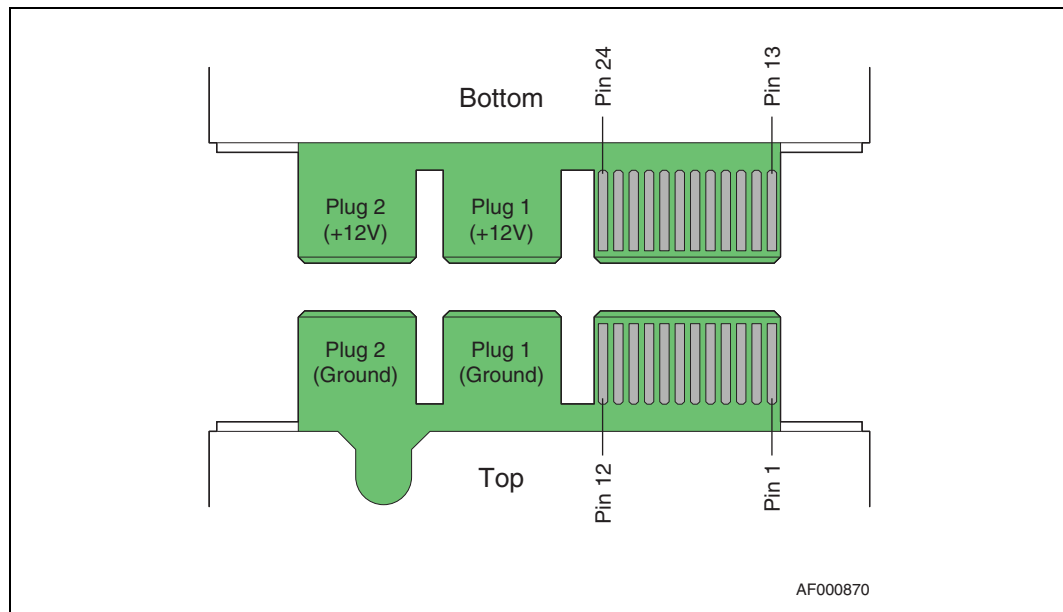
Table 35.   PSU Docking Connector Pin-Out

Pin #	Pin Assignment	Pin #	Pin Assignment
1	n/c	13	12V RS+
2	n/c	14	12V RS-
3	A0	15	12LS
4	n/c	16	SMB Alert
5	n/c	17	SDA
6	n/c	18	SCL
7	n/c	19	PS Kill
8	n/c	20	PS_ON
9	n/c	21	PWOK
10	n/c	22	A1
11	5VSB	23	5VSB
12	5VSB	24	5VSB
P1 Top	COMM	P1 Bottom	+12V
P2 Top	COMM	P2 Bottom	+12V

8.2.2.3   PDB to Front-Panel Board Interface

The power distribution board uses a 12-conductor, 20 AWG discrete wire harness to connect to the front panel board. Table 36 shows the 1 × 12 connector pin-out.

Table 36.   **Front Panel Board Power Harness Connector Pin-Out**

Pin #	Signal
1	P3V3
2	P5V_STBY
3	GND
4	GND
5	P12V
6	P12V
7	P12V
8	GND
9	GND
10	P5V
11	P5V
12	GND

8.2.3   Output Current Requirements

This describes the +12 V output power requirements from the power distribution board with one or two 450 W PSUs plugged into the input of the power distribution board.

Table 37.   **+12 V Outputs Load Ratings**

	+12V1	+12V2	+12V3	+12V4
MAX Load	16 A	16 A	16 A	16 A
MIN Static / Dynamic Load	0 A	0 A	0 A	0 A
Peak load (12 seconds)	18 A	18 A	18 A	18 A
Max Output Power	12 V x 16 A =192 W	12 V x 16 A =192 W	12 V x 16 A =192 W	12 V x 16 A =192 W
Notes: 1. The combined total power limit for all outputs is 450 W max. 2. +12V1/+12V2/+12V3/+12V4 combined output limit = 46.2 A / 63 A pk max.				

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

Table 38.   **DC/DC Converters Load Ratings**

	+12 VDC Input DC/DC Converters	
	+3.3 V Converter	+5 V Converter
MAX Load	15 A	12 A
MIN Static / **Dynamic** Load	0.0 A	0.0 A
Max Output Power	3.3 V x15 A =45 W	5 V x12 A =60 W
Note: 3.3 V / 5 V combined power limit: 95 W max.		

8.2.4 Hot-Swapping Power Modules

Hot swapping a power supply module is the process of extracting and inserting a PSU from a system that is powered on. The power subsystem is capable of supporting hot swapping of power supply modules in a 1 + 1 configuration.

8.2.5 Intelligent Power Subsystem Functions

The PSU and power distribution board (PDB) combination provides a monitoring interface over a server management bus. The device is compatible with both SMBus 2.0 "high power" and I^2C Vdd based power and drive. This bus may operate inside the PSU and PDB at 5 V (powered from stand-by voltage) but, looking from the system server management into the PSU and PDB combination, it is compatible with the 3.3 V bus. A bi-directional I^2C voltage translator IC, such as GTL2002 or similar, is employed on the PDB. The SMBus pull-ups are located on the server board.

The power distribution board's I^2C bus will have a dual function: to provide PSU and PDB monitoring features and to convey the stored FRU data in the PSU and PDB EEPROM.

8.2.6 FRU Data

The PDB contains a 2 Kbyte EEPROM device that contains FRU data for the power subsystem according to the IPMI spec. Each separate output is given a different number for identification purposes.

8.3 AC-input Power Supply Module

The AC-input power system supports one 450 W SSI TPS (Thin Power Supply) module for a non redundant configuration, or two in a 1 + 1 redundant configuration.

8.3.1 AC-input PSU Mechanical Specification

The power supply module contains one 40 mm fan. The module provides a handle to assist in insertion and extraction and can be inserted and extracted without the assistance of tools.

8.3.2 PSU to PDB Interconnect

The PSU's PCB extends beyond the PSU enclosure with edge finger contacts and blind mates to a Molex* LPH 45984-005 connector, or equivalent, located on the PDB (power distribution board). This connects the PSU's output voltages and signals to the PDB. This connection is documented in Figure 49, Figure 50, and Table 35, above.

The PSU is provided with a reliable protective earth ground. All secondary circuits are connected to protective earth ground. Resistance of the ground returns to chassis can not exceed 1.0 mΩ. This path can be used to carry DC current.

8.3.3 AC Input Voltage Requirements

The power supply must operate within all specified limits over the following input voltage range, shown in Table 39. Harmonic distortion of up to 10% THD must not cause the power supply to go out of specified limits. Application of an input voltage below 85 VAC shall not cause damage to the power supply, including a fuse blow.

Table 39.   AC Input Voltage Requirements

Parameter	MIN	Rated	Max	Max Input AC Current	Max Rated Input AC Current
Voltage (110)	90 V_{rms}	100-127 V_{rms}	140 V_{rms}	7.0 A_{rms} (See Notes 1 and 3)	6.3 A_{rms} (See Note 4)
Voltage (220)	180 V_{rms}	200-240 V_{rms}	264 V_{rms}	3.5 A_{rms} (See Notes 2 and 3)	3.2 A_{rms} (See Note 4)
Frequency	47 Hz		63 Hz		

1. Maximum input current at low input voltage range shall be measured at 90 VAC, at max load.
2. Maximum input current at high input voltage range shall be measured at 180 VAC, at max load.
3. This is not to be used for determining agency input current markings.
4. Maximum rated input current is measured at 100 VAC and 200 VAC.

8.3.4   Air Flow

Each power supply module incorporates fans for self-cooling, which also contribute to overall system cooling. The cooling air enters the power module from the PDB side (pre-heated air from the system). The fan's variable speed is based on output load and ambient temperature. Under standby mode, the fans run at minimum RPM and provide 3.5 CFM of airflow per PSU module.

8.3.5   Thermal Protection

The PSU incorporates thermal protection that causes a shut-down if airflow through the PSU is insufficient. Thermal protection activates shutdown before the temperature of any PSU component passes the maximum rated temperature. This shutdown takes place before over-temperature-induced damage to the PSU.

9.0　　DC Power Subsystem

This chapter defines the features and functionality of the DC-input switching power subsystem of the Kontron Carrier Grade Server TIGW1U. The DC power subsystem has up to two DC power supply modules capable of operating in redundant mode and a power distribution board (PDB).

The power subsystem with DC power supply module is NEBS hardened. NEBS certification of the TIGW1U carrier grade server system is performed with the TIGW1U system configured with a DC power subsystem.

The information contained in this chapter is organized into the following sections:

- Features
- DC-Input Power Distribution Board
- DC-Input Power Supply Module

9.1　　Features

- 450 W power module output capability over full DC input voltage range
- 450 W subsystem output capability over full DC input voltage range
- Power good indication LEDs
- Predictive failure warning
- Internal cooling fans with multi-speed capability
- Remote sense of 3.3 V, 5 V, and 12 V DC outputs (on the PDB)
- DC_OK circuitry for brown out protection and recovery
- Built-in load sharing capability
- Built-in overloading protection capability
- Onboard field replaceable unit (FRU) information
- I^2C interface for server management functions
- Integral handle for insertion/extraction
- Mechanical module latching feature

9.2　　DC-Input Power Distribution Board

The DC-input power subsystem uses the same PDB as the AC-input subsystem. See Section 8.2, "Power Distribution Board".

9.3   DC-Input Power Supply Module

9.3.1   PSU Enclosure

A mechanical drawing of the enclosure for the 450 W DC-input power supply module is shown in Figure 51.

Figure 51.   DC PSU Mechanical Drawing
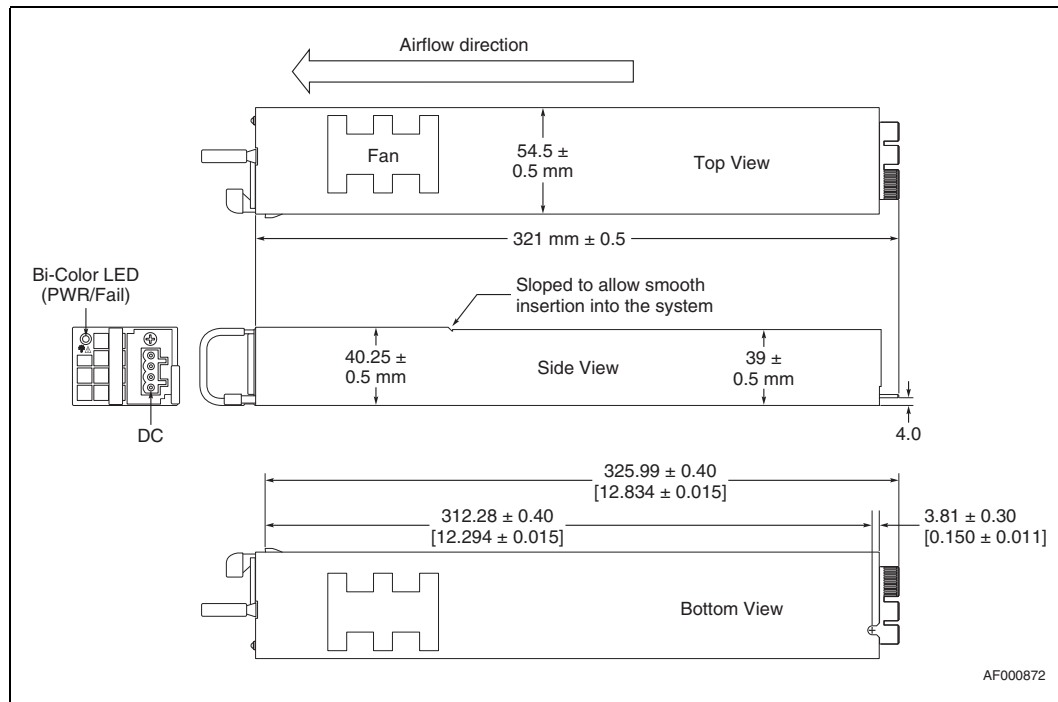
9.3.2   DC Power Supply Unit Input Connector

The DC input power is delivered to the PSU through a 4-pin connector (Molex* MTC 55757-0420 or equivalent) as shown in Figure 51.

Figure 52.   DC Power Supply Module Input Connector
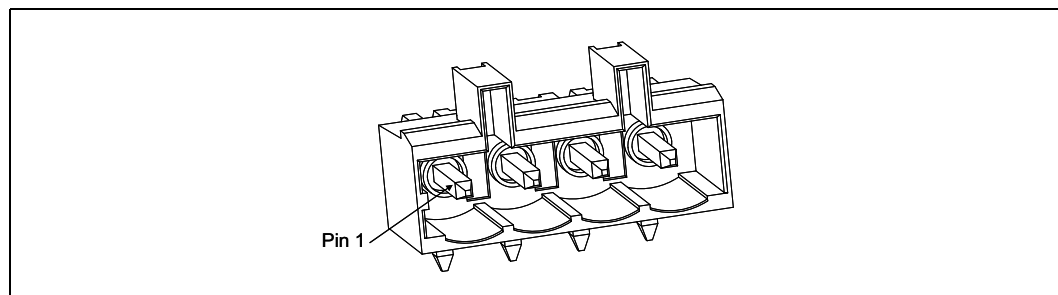
The mating connector for customer cable termination is a Molex 54927-0420 or equivalent, as shown in Figure 53.

Figure 53. DC Power Supply Module Power Input Mating Connector
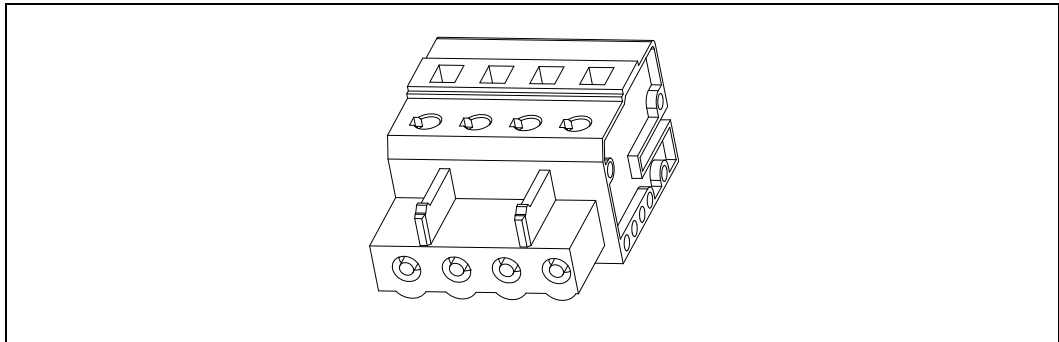
The pin-out of the DC input connector is given in Table 40.

Table 40. DC Power Supply Module Input Pin Assignments

Pin#	Description
1	RTN
2	RTN
3	−48V
4	−48V

9.3.3 DC PSU to PDB Interconnect

The PSU's PCB extends beyond the PSU enclosure with edge finger contacts and blind mates to a Molex LPH 45984-005 connector, or equivalent, located on the PDB (power distribution board). This connects the PSU's output voltages and signals to the PDB.

The PSU is provided with a reliable protective earth ground. All secondary circuits are connected to protective earth ground. Resistance of the ground returns to chassis can not exceed 1.0 mΩ. This path can be used to carry DC current.

Figure 54, Figure 55, and Table 41 document the connection between each PSU module and the PDB.

Figure 54. PSU Docking Connector

AF000865
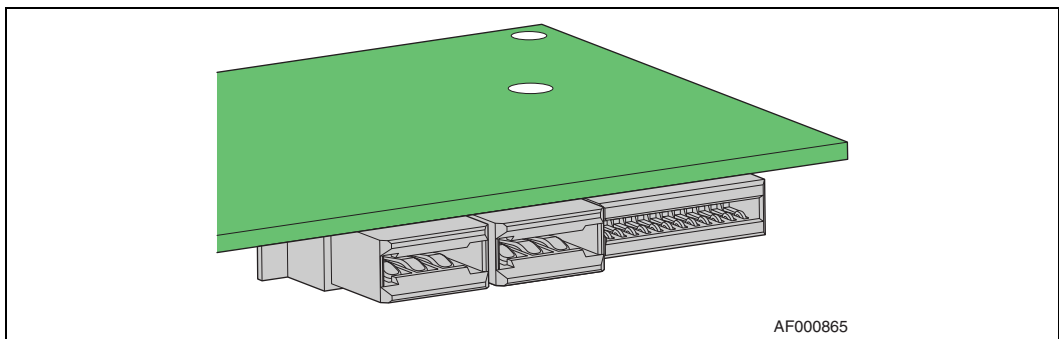
Figure 55. **PSU Output Finger Layout**
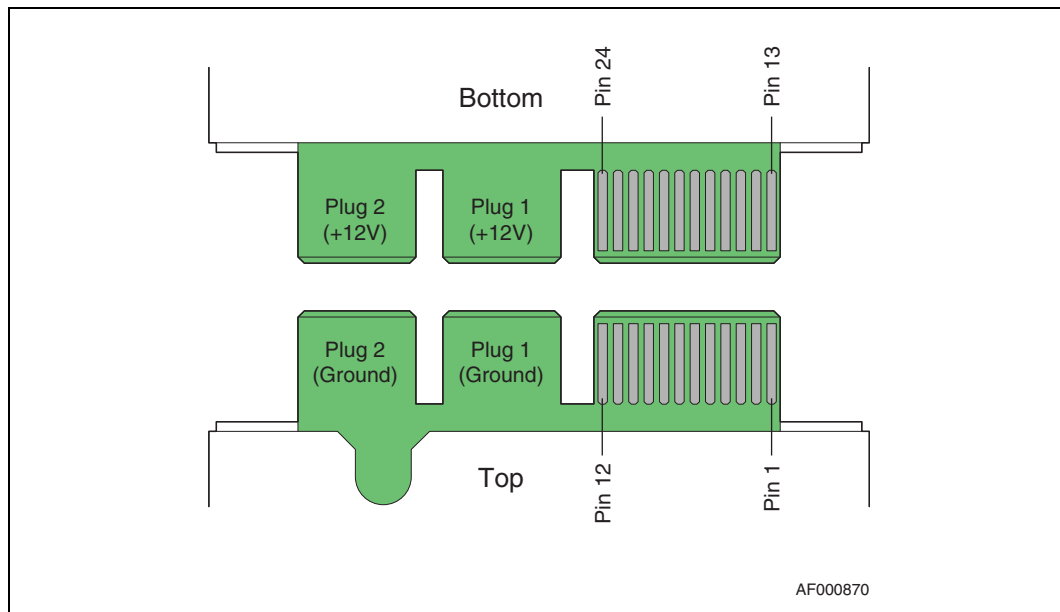
Table 41. **PSU Docking Connector Pin Out**

Pin #	Pin Assignment	Pin #	Pin Assignment
1	n/c	13	12V RS+
2	n/c	14	12V RS-
3	A0	15	12LS
4	n/c	16	SMB Alert
5	n/c	17	SDA
6	n/c	18	SCL
7	n/c	19	PS Kill
8	n/c	20	PS_ON
9	n/c	21	PWOK
10	n/c	22	A1
11	5VSB	23	5VSB
12	5VSB	24	5VSB
P1 Top	COMM	P1 Bottom	+12V
P2 Top	COMM	P2 Bottom	+12V

9.3.4 DC Input Voltage

The power supply must operate within all specified limits over the following input voltage range, shown in Table 42.

Table 42. **DC Input Rating**

Parameter	MIN	Rated	MAX
DC Voltage	-38 VDC	-48 VDC/-60 VDC	-75 VDC

Note: There are two rated input voltages. One is for 48 VDC battery plants, the other is for 60 VDC battery plants.

9.3.5 Output Current Ratings

The PSU provides two outputs, +12 V and +5 V standby voltage. The combined maximum output power of all outputs is 450 W (680 W peak). Each output has a maximum and minimum current rating as shown in Table 43.

Table 43. **DC PSU Load Ratings**

	+12V	+5V standby
MAX Load	37.0 A	3.0 A
MIN DYNAMIC Load	0.0 A	0.1 A
MIN STATIC Load	0.0 A	0.1 A
PEAK Load (12 seconds minimum)	42.0 A	3.5 A
Max Output Power (continuous), see note 1	12 V x 37 A = 444 W max	5 V x 3 A = 15 W max
Peak Output Power (12 sec. min.), see note 2	12 V x 42 A = 504 W pk	5 V x 3.5 A = 17.5 W pk

Notes:
1. At maximum load the output voltages are allowed to sag to -4%. For the 12 V output, this results in 11.52 V, so the actual max power will then be 11.52 V x 37 A = 426.2 W. For the 5 V standby output, the max load voltage can sag to 4.80 V so the actual max power is 4.80 V x 3 A = 14.4 W. The total max continuous power is therefore 426.2 + 14.4 = 440.6 W.
2. At peak load the output voltages are allowed to sag to -4%. For the 12 V output, this results in 11.52 V, so the actual max power will then be 11.52 V x 42 A = 483.8 W. For the 5 V standby output, the max load voltage can sag to 4.80 V so the actual max power is 4.80 V x 3.5 A = 16.8 W. The total max continuous power is therefore 483.8 + 16.8 = 500.6 W.

9.3.6 DC PSU LED Indicators

The PSU provides a single, external, bi-color LED to indicate the status of the power supply.

The LED blinks green when DC is applied to the PSU and standby voltages are available. The LED displays solid green when all the power outputs are available.

The LED displays solid amber when the PSU has failed or shut down due to over-current or over-temperature.

See the following table for LED conditions.

Table 44. **DC PSU LED Indicators**

Power Supply Condition	Bi-color LED Indication
No DC power to all power supplies	OFF
No DC power to this PSU only (for 1+1 configuration) or Power supply **critical event** causing a shutdown: failure, fuse blown (1+1 only), OCP(12V), OVP(12V), fan failed	Amber

Table 44.   DC PSU LED Indicators

Power Supply Condition	Bi-color LED Indication
Power supply **warning events** where the power supply **continues to operate**: high temp, high power/high current, slow fan.	1 Hz Blinking Amber
DC present / Only 5 Vsb on (PS Off)	1 Hz Blinking Green
Output ON and OK	Green

9.3.7   Air Flow

The power supply module incorporates fans for self-cooling, which also contribute to overall system cooling. The cooling air enters the power module from the PDB side (pre-heated air from the system). The fan's variable speed is based on output load and ambient temperature. Under standby mode, the fans run at minimum RPM and provide 3.5 CFM of airflow per PSU module.

9.3.8   Thermal Protection

The PSU incorporates thermal protection that causes a shut down if airflow through the PSU is insufficient. Thermal protection activates shutdown before the temperature of any PSU component passes the maximum rated temperature. This shutdown takes place before over-temperature induced damage to the PSU.

10.0   Regulatory Specifications

The Kontron Carrier Grade Server TIGW1U meets the specifications and regulations for safety and EMC defined in this chapter.

10.1   Safety Compliance

USA/Canada	UL 60950-1, 1st Edition/CSA 22.2
Europe	Low Voltage Directive, 73/23/EEC TUV/GS to EN60950-1, 1st Edition
International	CB Certificate and Report to IEC60950-1, 1St Edition and all international deviations

10.2   Electromagnetic Compatibility

USA	FCC 47 CFR Parts 2 and 15, Verified Class A Limit
Canada	IC ICES-003 Class A Limit
Europe	EMC Directive, 89/336/EEC EN55022, Class A Limit, Radiated & Conducted Emissions EN55024 Immunity Characteristics for ITE EN61000-4-2 ESD Immunity (level 2 contact discharge, level 3 air discharge) EN61000-4-3 Radiated Immunity (level 2) EN61000-4-4 Electrical Fast Transient (level 2) EN61000-4-5 Surge EN61000-4-6 Conducted RF EN61000-4-8 Power Frequency Magnetic Fields EN61000-4-11 Voltage Fluctuations and Short Interrupts EN61000-3-2 Harmonic Currents EN61000-3-3 Voltage Flicker
Australia/New Zealand	EN55022, Class A Limit
Japan	VCCI Class A ITE (CISPR 22, Class A Limit)
Taiwan	BSMI Approval, CNS 13438, Class A and CNS13436 Safety
Korea	RRL Approval, Class A
China	CCC Approval, Class A (EMC and Safety)
Russia	Gost Approval (EMC and safety)
International	CISPR 22, Class A Limit, CISPR 24 Immunity

10.3   CE Mark

The CE marking on this product indicates that the Carrier Grade Server TIGW1U system is in compliance with the European Union's EMC Directive 89/336/EEC, and Low Voltage Directive 73/23/EEC.

10.4   NEBS Compliance

The Carrier Grade Server TIGW1U with DC input is compliant with the NEBS Level 3 criteria from the following NEBS specifications:

- NEBS GR-63-CORE, Issue 3 — Physical Protection
- NEBS GR-1089-CORE, Issue 4 — Electromagnetic Compatibility and Electrical Safety

10.5   ETSI Standards Compliance (DC Input Only)

The Carrier Grade Server TIGW1U with DC input is compliant with the following ETSI specifications:

- ETSI EN 300 386 — EMC requirements for Telecom Equip.
- ETS 300-019-2-1 — Storage Tests, Class T1.2
- ETS 300-019-2-2 — Transportation Tests, Class T2.3
- ETS 300-019-2-3 — Operational Tests, Class T3.2
- ETS 753 — Acoustic Noise

Appendix A Glossary

This appendix contains important acronyms and terms used in the preceding chapters.

Term	Definition
A, Amp	Ampere
A/μs	Amps per microsecond
AC	Alternating current
ACPI	Advanced Configuration and Power Interface
ANSI	American National Standards Institute
APIC	Advanced Programmable Interrupt Controller
ASIC	Application specific integrated circuit
AWG	American wire gauge
BIOS	Basic input/output system
BMC	Bus management controller
Bridge	Circuitry that connects one computer bus to another
Byte	8-bit quantity
C	Centigrade
CE	Community European
CFM	Cubic feet per minute
CISPR	International Special Committee on Radio Interference
CSA	Canadian Standards Organization
CTS	Clear to send
DAT	Digital audio tape
dB	Decibel
dBA	Acoustic decibel
DC	Direct current
DIMM	Dual inline memory module
DMI	Desktop management interface
DOS	Disk operating system
DRAM	Dynamic random access memory
DSR	Data set ready
DTR	Data terminal ready
DWORD	Double word – 32-bit quantity
ECC	Error checking and correcting
EEPROM	Electrically erasable programmable read-only memory
EFP	Ethernet Front Panel

Term	Definition
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
EMP	Emergency management port
EN	European Standard (Norme Européenne or Europäische Norm)
EPS	External product specification
ESCD	Extended system configuration data
ESD	Electrostatic discharge
ESR	Equivalent series resistance
eUSB	Embedded USB
F	Fahrenheit
FCC	Federal Communications Commission
FFC	Flexible flat connector
Flash ROM	EEPROM
FPC	Front panel controller
FRB	Fault resilient booting
FRU	Field replaceable unit
G	Acceleration in gravity units, 1 G = 9.8 m/s^2
Gbyte or GB	Gigabyte – 1024 Mbytes
GND	Ground
GPIO	General purpose input/output
Grms	Root mean square of acceleration in gravity units
GUI	Graphical user interface
HDD	Hard disk drive
HPIB	Hot-plug indicator board
HSC	Hot-swap controller
Hz	Hertz – 1 cycle/second
I/O	Input/output
I^{2}C*	Inter-integrated circuit bus
ICMB	Intelligent Chassis Management Bus
IDE	Integrated drive electronics
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFLASH	Utility to update Flash EEPROM
IMB	Intelligent management bus
IPMB	Intelligent Platform Management Bus
IPMI	Intelligent Platform Management Initiative
IRQ	Interrupt request line
ITE	Information technology equipment
ITP	In-target probe
JAE	Japan Aviation Electronics
KB	Kilobyte – 1024 bytes

Term	Definition
kV	Kilovolt – 1,000 volts
L2	Second-level cache
LAN	Local area network
LED	Light-emitting diode
LVDS	Low voltage differential SCSI
mA	Milliampere
Mbyte or MB	Megabyte – 1024 Kbytes
MEC	Memory expansion card
mm	Millimeter
MPS	Multiprocessor specification
MTTR	Mean time to repair
mΩ	Milliohm
NEMKO	Norges Elektriske Materiellkontroll (Norwegian Board of Testing and Approval of Electrical Equipment)
NIC	Network interface card
NMI	Nonmaskable interrupt
NWPA	NetWare* Peripheral Architecture
ODI	Open data-link interface
OEM	Original equipment manufacturer
OPROM	Option ROM (expansion BIOS for a peripheral)
OS	Operating system
OTP	Over-temperature protection
OVP	Over-voltage protection
PC-100	Collection of specifications for 100 MHz memory modules
PCB	Printed circuit board
PCI	Peripheral component interconnect
PCI-E	PCI Express peripheral component interconnect
PHP	PCI hot-plug
PID	Programmable interrupt device
PIRQ	PCI interrupt request line
PMM	POST memory manager
PnP	Plug and play
POST	Power-on Self Test
PSU	Power supply unit
PVC	Polyvinyl chloride
PWM	Pulse width modulation
RAS	Reliability, availability, and serviceability
RIA	Ring indicator
RPM	Revolutions per minute
RTS	Request to send
SAF-TE	SCSI Accessed Fault-Tolerant Enclosures
SCA	Single connector attachment

Term	Definition
SCL	Serial clock
SCSI	Small Computer Systems Interface
SDR	Sensor data records
SDRAM	Synchronous dynamic RAM
SEC	Single edge connector
SEL	System event log
SELV	Safety extra low voltage
SEMKO	Sverge Elektriske Materiellkontroll (Swedish Board of Testing and Approval of Electrical Equipment)
SFP	SAS Front Panel
SGRAM	Synchronous graphics RAM
SM	Server management
SMBIOS	System management BIOS
SMBus	Subset of I^2C bus/protocol (developed by Intel)
SMI	System management interrupt
SMM	Server management mode
SMP	Symmetric multiprocessing
SMRAM	System management RAM
SMS	Server management software
SPD	Serial presence detect
SSD	Solid-state drive
SSI	Server system infrastructure
TUV	Technischer Uberwachungs-Verein (A safety testing laboratory with headquarters in Germany)
UL	Underwriters Laboratories, Inc.
USB	Universal Serial Bus
UV	Under-voltage
V	Volt
VA	Volt-amps (volts multiplied by amps)
Vac	Volts alternating current
VCCI	Voluntary Control Council for Interference
Vdc	Volts direct current
VDE	Verband Deutscher Electrotechniker (German Institute of Electrical Engineers)
VGA	Video graphics array
VRM	Voltage regulator module
VSB	Voltage standby
W	Watt
WfM	Wired for Management
Ω	Ohm
μF	Microfarad
μS	Microsecond

Appendix B Additional References

This appendix contains information on additional reference documents that contain useful information on the indicated subjects:

Ethernet

- Intel® 82563EB and Intel® 82571EB Gigabit Ethernet Controller datasheets

    http://developer.intel.com/design/network/datashts/82563_datasheet.htm

    http://developer.intel.com/design/network/datashts/82571eb_82572ei.htm

MPS

- MultiProcessor Specification, Version 1.4, Intel Corporation
  http://www-techdoc.intel.com/design/intarch/manuals/242016.htm

PCI

- PCI Bus Power Management Interface Specification, Revision 1.1, PCI Special Interest Group
  http://www.pcisig.com/specifications/conventional/
  pci_bus_power_management_interface
- PCI Local Bus Specification Revision 3.0, PCI Special Interest Group
  http://www.pcisig.com/specifications/conventional/pci_30

Plug and Play

- Plug and Play ISA Specification, Version 1.0a, Microsoft Corp.
  http://www.microsoft.com/hwdev/respec/PNPSPECS.HTM
- Clarification to Plug and Play ISA Specification, Version 1.0a, Microsoft Corp.
  http://www.microsoft.com/hwdev/respec/PNPSPECS.HTM

Power Supply

- AC ERP1U 450 W Power Supply Module Specification, Intel Corporation.
- DC ERP1U 450 W Power Supply Module Specification, Intel Corporation.
- AC / DC ERP1U 450 W Power Supply Power Distribution Board Specification, Intel Corporation.

Server Management

- Emergency Management Port v1.0 Interface External Product Specification, Revision 0.83, Intel Corporation.
- Intelligent Platform Management Interface (IPMI) Specification, Version 2.0, Intel Corporation.
  http://developer.intel.com/design/servers/ipmi/spec.htm