Enterprise Server Group

Intel® Balboa II Chassis
Technical Product Specification

Version 1.0
Order Number: 243843-001

June, 1998

The Balboa II chassis may contain design defects or errors known as errata. Characterized errata that may cause the Balboa II chassis's behavior to deviate from published specifications are documented in the MB440LX DP Server Specification Update.

Revision History

Revision	Revision History	Date
Rev 1.0	Initial release version of the Balboa II Chassis Technical Product Specification.	6/98

Table of Contents

1 Introduction

The Balboa II chassis technical product specification details the functional hardware features of the Balboa II mid-size desk side chassis. Low cost, time to market, and utilization for multiple platforms and multiple configurations are primary considerations in the design. This chassis must also have user friendly features, be accessible and be serviceable.

The Balboa II chassis also incorporates features for high availability servers. This includes a power system with optional redundancy, a cooling system with optional redundancy, and a mass storage system with hot swap hard drives. These are key components for increasing the availability of the server. Since typically, the fans and the power supplies have the lowest MTBF specifications, the optional redundancy in these components will permit the system to continue to operate with a failed fan or power supply. With the use of RAID technology, the system can continue to operate with a hard drive failure. The hot plug-ability allows for the failed hard drive to be replaced while the system continues to operate.

The chassis is designed for a modular processing system. This includes a baseboard containing the I/O system with two processor sockets and one memory board socket. This product specification details the following: Chassis, Power system, Chassis cooling, Peripheral bays, Baseboards, I/O and interconnects, System configuration, System certifications, Environmental limits, Reliability, serviceability, and availability

Reference Documents

M440LX DP Server Technical Product Specification, Order Number 282994-002

MB440LX DP Server System Product Guide, Order Number 668895-004

2 Chassis

The chassis is approximately 17" wide, 20 " high and 20 " deep. A vertical bulkhead divides the chassis with the baseboard and processor/memory module on the left side of the chassis and the power system and peripheral systems on the right side. The two sides of the chassis are accessed with two removable covers that are interchangeable. There are nine I/O filler panels on the rear of the chassis for nine full-length expansion cards. Three bays are supplied in the back of the chassis for power supplies or fans. The first power supply will be installed in the upper bay. Additional power supplies or fans or a blank filler panel will be installed in the other bays.

System Color

The primary exterior system color will match Intel Color Standard 513505.

The chassis color is "Intel Pearl White."

- Plastic: Standard Intel Pearl White, GE Plastics C2800 - #H86204
- Paint: Standard Intel Pearl White, Sherwin Williams - Polane T #F99WX119

The bottom and back of the chassis are not painted.

OEM color matching is available for all painted exterior sheet metal components

Front Bezel Features

The front bezel will be molded plastic in three parts. The main portion of the bezel is easily installed on the chassis and covers the left half of the chassis front. It also provides the support to hold the bezel for the upper drive bay area on the right side. An EMI shield and a plastic door cover the lower right side where the hard drives are located.

Customized bezels for OEM customers can be easily designed from the standard bezel design.

Security

At the system level a variety of security options are provided. Padlock loops on the system side covers and a lock on the hard drive inner cover can be used to prevent access to add-in cards and to peripherals. Optional cover alarm switches are provided for the side covers and hot swap bay door. The alarm is transmitted to the baseboard where the user software can process it as desired.

Software and BIOS security features are described in the M440LX DP Server Board set Technical Product Specification.

I/O Panel

All input/output connectors are accessible at the back of the chassis. The built-in interfaces on the baseboard are mapped in the figure below.

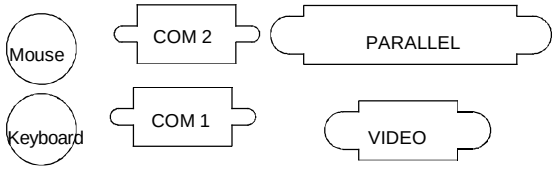

Figure 2-1 I/O Connector Map

Chassis Views

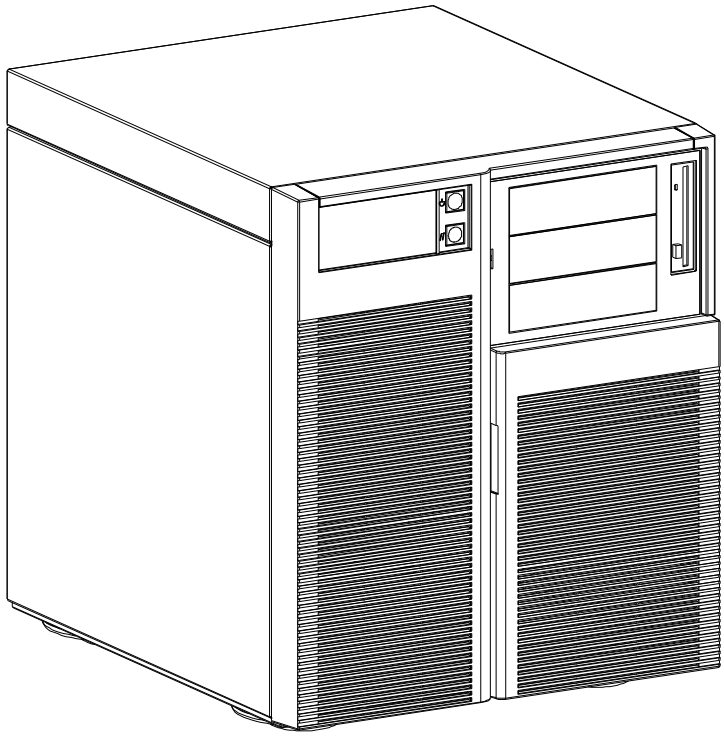

Figure 2-2 Balboa II Front Bezel view

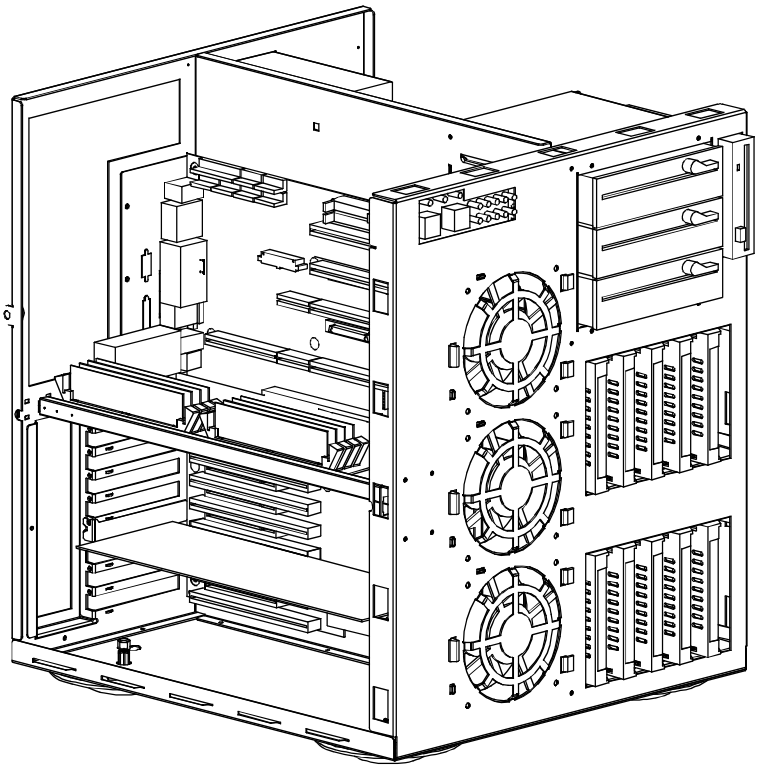

Figure 2-3 Balboa II Open Side view

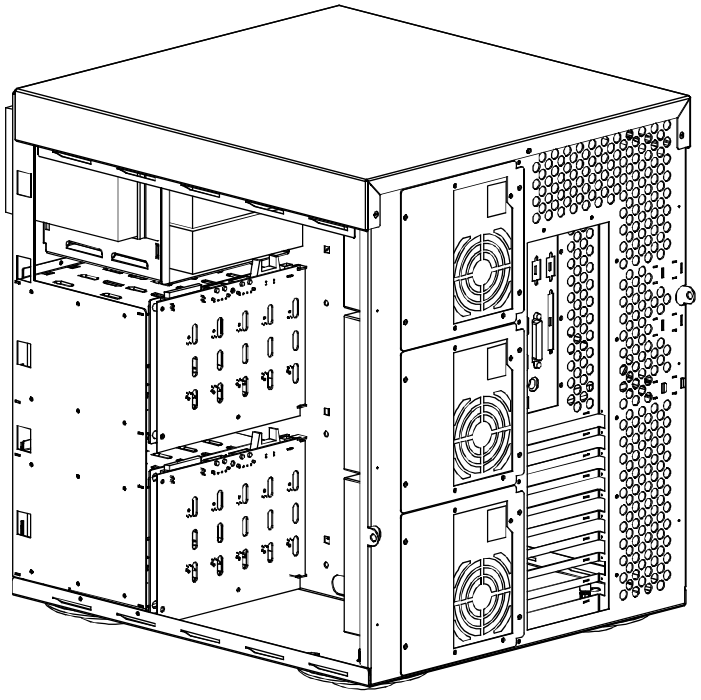

Figure 2-4 Balboa II Rear view

Chassis Dimensions

Table 2-1 System Dimensions

Height	20.25"
Width	17.15"
Depth	19.9"
Clearance Front	8.5"
Clearance Rear	5"
Clearance Side	0" (additional side clearance required for service)
Weight	93 lb. maximum configuration

3 System Baseboards

The Intel M440LX DP Server board set is a modular, dual Pentium® II processor-based server system that combines the latest technology and integrated features to provide a high-performance platform at mid-range cost efficiency.

The M440LX DP Server board set utilizes the Intel 440LX AGPset, the latest in chipset technology from Intel, to maximize system performance for 32-bit application software and operating systems. Additionally, by incorporating the i960 ® RD processor in the board set design an Intelligent I/O subsystem can be formed. The reduced the demands placed on the host processor further enhancing system performance and scalability. The i960 RD processor fully supports the Intelligent I/O industry specification, also known as I20.

The M440LX DP Server design is complemented with an array of features. These include:

- Intel 440LX AGPset (82440LX, 82443LX PAC controller, PIIX4)
- i960 RD I/O processor
- Symbios* SCSI controllers (1 narrow, 2 ultra-wide)
- AMI MegaRAID*
- Ten I/O expansion slots (3 PCI on PCI-P, 4 PCI on PCI-S, 3 ISA, 1 shared)
- National SuperI/O* 97307 PCI/IDE controller
- Two Single Edge Contact (SEC) cartridge connectors (to accommodate dual Pentium II processors and future processor upgrades)
- Support for up to 1MB EDO or 512MB SDRAM ECC memory (modular)
- Cirrus Logic GD54M40* SVGA video
- Server Management

The M440LX DP Server board set supports dual 266 MHz or 300 MHz Pentium II processors contained on Single Edge Contact (SEC) cartridges. These cartridges enclose the processor with 512 KB of integrated ECC L2 cache to enable high-frequency operation. There are two SEC connectors on the baseboard, with an embedded VRM 8.1-compliant voltage regulator (DC-to-DC converter) for connector 0, and plug-in VRM support for connector 1. The M440LX DP Server board set design will accommodate upgrades to future processing technology.

4 System Power

The power system is a modular design. The system may be configured with one, two, or three power supplies. These configurations are referenced as entry-level power, entry-level redundant power, maximum level power, and maximum level redundant power.

Each power supply has it's own power cord. For redundant level powered systems, the loss of a single power supply will not affect the operation of the system. All supplies should be connected to the same AC mains branch circuit (Phase).

When multiple power supplies are utilized, a power share board may be used to implement a redundant power distribution system. This power share board also implements the server power management features which, via I2C, reports the quantity and location, and operational status of power supplies installed. Power sensing in the power share board shuts down the entire power system if any single output from the power distribution back plane exceeds 240VA. The parts of the power share board that have greater than 240VA are protected from operator contact by a shield that cannot be removed with power present. This feature enables the system to meet CSA Level 3 operator accessibility without interlocks.

If a single power supply fails in a redundant system, a Power Supply Failure LED on the front panel will be turned on. With redundant power, a power supply can be changed without shutting down the system. The power supply is inserted into and removed from the chassis from the rear and is held in place with screws. There is an interlock mechanism to prevent removal or insertion while the power cord is plugged into the power supply.

Each power supply will have rear panel indication of good health.

Table 4-1 360W Power Supply Output Summary (per supply)

DC Power		+3.3VDC at 16 A Max. *
		+5 VDC at 33.5 A Max. *
		+12 VDC at 15.5 A with 17.5 peak
		+24 VDC at 50 mA
		-12 VDC at 0.5A
		-5 VDC at 0.25A
		5V Standby 150 mA
	*	Total combined output power of 3.3v and +5v shall not exceed 195W
AC Line voltage		PFC: auto sense
AC Line Frequency		50 / 60 Hz
AC Input Current		6A@ 110 VAC /3A@ 210 VAC

Mechanical Outline

The approximate dimensions are 140mm x 86mm x 150mm with a mounting flange extending 3mm top and bottom and 15mm each side.

The supply is equipped with a handles formed into the rear flange and a floating connector for easy slide in, slide out removal and replacement.

Fan Requirements

The power supply incorporates a 92mm “low acoustic noise” fan to exhaust air from the peripheral bay side. These fans will incorporate a life sense output.

AC Power Line

The system is specified to operate from 100-120VAC, 200-240VAC, at 50 or 60Hz. The power supply is auto selecting. Power Factor Correction (PFC) is standard. The system is tested to meet these line voltages, and has been tested (but not specified) at +10% and -10% of the voltage ranges, and similarly ± 3Hz on the line input frequency.

The system is specified to operate without error with line source interruptions not to exceed 20 milliseconds at nominal line and full load.

The system is not damaged by AC surge ring wave to 3.0kV/500A. This ring wave is a 100kHz damped oscillatory wave with a specified rise-time for the linear portion of the initial half-cycle of 0.5 µsec. Additionally, the system will not be damaged by a unidirectional surge waveform of 2.0kV /3000A, with a 1.2µsec rise time and 50 µsec duration. Further details on these waveforms can be obtained in ANSI/IEEE STD C62.45-1987.

Power Supply/System Configuration

A system may be configured with a single supply (entry-level power). With a single supply the system will typically be limited to dual processors, 512MB memory, five hard drives and a restricted number of add-in cards. This entry-level system configuration nevertheless provides for a wide class of server installations. Power budgets for specific configurations will determine required power configurations.

This system configured with two power supplies provides for fully configurable systems.

An optional power share board provides current sharing between supplies allowing redundant power, “hot swapping” of supplies, and power server management functions.

Table 4-2 System Power Supply Output Summary*

	+3.3V	**+5V**	**+12V**	**-5V**	**-12V**
Entry Level Power No Drives No CD	13A	6.2A	5.8A	0.25A	0.5A
Entry Level Power	13A	9A	8A	0.25A	0.5A
Redundant Level Power 2 Power Supplies	16A	33.5A	15.5A	0.25A	0.5A
Redundant Level Power 3 Power Supplies	28A	50A	25.5A	0.5A	0.5A
Redundant Level Power 3 Power Supplies Drives Starting	28A	50A	30.0	0.5A	0.5A

*Above currents are constrained by 195 watt combined +3.3V and +5V max power and 360 watt total max power per supply.

^Above specifications are preliminary and subject to change.

In addition, two other voltages are available:

A +24V@0.05A for power share board functionality.

A +5V@0.15A for server management functions.

5 System Cooling

One fan and two blowers provide cooling for the processor and the add-in cards in the card cage area. An additional fan may be installed for redundant cooling of the processor and add in-cards. The power supply fan plus an additional fan will supply cooling for the hard drives. Multiple power supplies will provide for redundant cooling in the peripheral side. All system fans provided a fault signal if the fan fails. The baseboard can sense this signal and turn on a Fan Failure LED on the front panel. This signal will also be available for server management functions.

Removal of the side covers allows access to the fans. Failed fans can be easily changed when the system has been shut down.

6 System Peripheral Bays

Drive Bays

3.5" Floppy Drive Bay

The system ships from the factory with a 3.5” inch floppy drive installed in the upper right bay. Access for replacement of the drive is removal of the right side cover.

5.25" Drive Bays

The system design includes three 5.25" half height peripheral bays designed for peripherals with removable media (e.g. floppy disk, CD-ROM or tape drive). The upper bays will have removable filler panels installed.

Any two adjacent 5.25" bays are convertible to a single full height bay. The cable from the on-board narrow SCSI controller allows three 5.25” half-height SCSI devices to be installed in these bays. An additional SCSI or IDE CD-ROM can be installed. The 5.25" peripherals are removable directly from the front of the chassis.

Note: These bays are not recommended for a hard disk drive, due to several factors. These include hard disk drive generated EMI, and increased ESD susceptibility (i.e. less hardened to ESD). The manufacturer/drive model that a customer would select also affects these factors. A hard drive will not be integrated into these bays at the Intel factory.

Internal 3.5" Hard Drive

A 3.5” internal mounting bracket just above the System boards has been provided to mount either an IDE or SCSI HDD. Access to this bracket is by removal of the top system cover.

Internal 3.5" Hard Drive Bays with SCSI Hot Swap Back Plane

The product contains two bays for five 3.5" one inch high hard drives, each are accessible from the lower front bezel. One of the bays will have a hot swap capable back plane installed and the second bay’s back plane is optional. The back planes are designed for Fast-20 SCSI III devices using the Industry Standard 80 pin SCSI II connector.

When the optional second hot swap back plane is installed for a second bay of 5 drives, a second wide SCSI cable will be required.

As part of the hot swap implementation a drive carrier is required. The 3.5" peripherals that are 1.0 inch high can be accommodated in the carrier. The drives are mounted in the carrier via four fasteners. The carrier snaps into the chassis .

These peripheral bays are designed to accept peripherals that consume up to 11 Watts of power, with peripherals that are specified with a maximum ambient temperature of 50 ^{o}C. At this time cooling for these drives supports 7200RPM and testing is needed for 10KRPM drives.

A single metal EMI door and a plastic door will cover the drive bays.

7 System Interconnection

Signal Definitions

The pin out on the connectors referred to in these sections are defined in the Server System User's Guide or listed here.

System Internal Cables

Baseboard to Front Panel

- 2X8 connectors with 16 wire cable

Baseboard to SCSI devices

- Two- 68-pin Wide SCSI cable to the hot swap back planes.
- One 50-pin Narrow SCSI cable to the 5.25" drive bays.

Baseboard to IDE devices - Optional Cables

- 2X20 connector for 18" IDE cable for an optional 3.5" hard drive and an optional 5.25" IDE CD-ROM

Baseboard to Power Share Board

- 2X5 connector with 10 wire cable

Front Panel to Hot Swap SCSI Back Planes

- 2X5 connectors for cabling front panel to hot swap SCSI back plane.
- Second cable is used with optional hot swap back plane

Front Panel Chassis Intrusion Cables

- Three 2 wire cables from chassis intrusion micro-switches to front panel

Fan Connectors

Two 3-pin connectors on baseboard and one 3-pin connector on hot swap back planes.

The fan connectors are pin 1 -ground, pin 2 - fault signal, pin 3 - +12V. This pin-out is different from that used on pervious chassis. The connector is a shrouded-keyed connector to prevent fans from being powered incorrectly.

Blower Connectors

Two 4-pin connectors located on the baseboard.

The blower connectors are pin 1 - +12V, pin 2 – fault signal, pin 3 – GND, pin 4 – high speed.

I/O Panel Connectors

The following I/O panel connectors are included in the Balboa II chassis: a PS/2 keyboard connector, PS/2 mouse connector, two 9-pin serial ports, 25-pin parallel port, and 15 -pin video port

8 Chassis Electronics

Power Share Back plane

This document establishes the physical size and general requirements of the Power Share PBA for the Power Share of two or three power supplies.

Features

Distributed load among 2 or 3 power supplies (Power Share)

Management Features:

- I^2C bus
- Report power supply failure
- Over current report
- Current usage report
- Number of supplies installed
- Redundant mode determination
- 240 VA Limit shutdown to meet CSA Level III requirements
- Visual Power Supply subsystem Fail indictors(s)

Power Share Board Physical Description

The board has dimensions of 15.45" x 4.15". To protect the user from access to circuits capable of delivering over 240VA, a cover will be placed over the entire board except the area of the board where are located. This area is after the 240VA protection circuits.

Power Share Functions - Descriptions

Power Enable/Disable (PON)

The System PON signal is a control signal that originates on the Baseboard and is routed through the Power Share Backplane Microcontroller. The Backplane Microcontroller monitors for the 240VA limit in two zones. If the +5 and +12 power going to the Baseboard or the Peripherals exceeds 90% of the 240VA limit, the Backplane Microcontroller will de-assert the PON control going to each Power Supply (J1, J2, and J3). This signal is used to enable/disable the power supplies

Remote Sense Connections

Remote voltage sense for +5VDC and +3.3VDC is actually done on the Baseboard. The +5.0VDC and +3.3VDC Remote Sense lines are routed through the Backplane and connect to the Current Sense circuitry. The Current Sense circuit conditions the Remote Sense signals. Individual Remote Sense outputs are provided to each of the +5.0VDC and +3.3VDC Power Supply sections.

The +12V is not sensed remotely. Instead, it is sensed on the Power Share Backplane. Regulation is achieved through the Load Share pass transistors.

Load Share Connection

The Power Share Backplane is installed in systems with two or three power supplies. Each of the +5.0VDC, +3.3VDC and +12VDC outputs from each of the supplies is routed through the Power Share Backplane. The loading of each Power Supply is controlled by a series FET.

The current from each Power Supply output is monitored with a zero-drop Saturate-able Reactor current monitoring circuit. The primary of the Saturate-able Reactor consists of a single large conductor passing through the reactors toroidal core. Normal load current through the primary is sufficient to cause the reactor to saturate. A ramp-generator connected to the multi-turn secondary of each reactor creates a counter-magnetic field in the reactor. The point on the ramp at which each reactor under goes a magnetic reversal provides an indication of the current in its primary. The value of this current is then used to adjust the gate voltage on the series FET and thereby adjust the load share of each Power Supply output.

Output Power Connections

Following the Load Share circuit, +12VDC, +5.0VDC, and 3.3VDC power is routed to the Baseboard power connector J5. Following the Peripheral 240VA limit circuit, +12VDC and +5.0VDC are routed to the Peripheral power connector, J7.

For each of the -12VDC, -5VDC, and +5V standby voltages, the outputs are routed together through diode isolation circuits, combined together, and connected to the Baseboard through connector J5 (pin 4, and 3) and J6 (pin 11).

Power Good Circuit

The microcontroller provides the power good function. The microcontroller looks at the levels of the Power Supply good (PGOOD) signals. When a Power Supply PGOOD is sensed by the Backplane PGOOD circuit a System PGOOD is asserted by the microcontroller after an approximately 550mS delay.

The Backplane will not be able to discern whether PGOOD was de-asserted as the result of a power down, AC line failure or a single supply failure. In a non-redundant system, PS_ON must be de-asserted within 200mS to protect the good supply or supplies from overload damage. The 200mS delay allows the Baseboard microprocessor time to log the event.

240VA Monitor Circuit

Current usage is monitored at two points. The first is the Total Supply Currents, which forms part of the Load Sharing circuit and monitors the +3.3VDC as well as the +5VDC and +12VDC. Analog voltages, which represent the Total Supply currents, are fed to the Analog-to-Digital Converter portion of the Backplane microcontroller. The digitized form of these Supply currents is used to report the System Current usage. The second point of monitoring is the current used by the peripherals. The microcontroller can easily determine the current being supplied to the Baseboard by subtracting the Peripheral current from the Total. If either the Baseboard power or Peripheral power exceeds 240VA, the Backplane microcontroller will disable the supply outputs by de-asserting PON. An OFF/ON cycling of the AC line is required to reset the circuit.

I²C Communication Circuit

The Power Share Backplane has a microcontroller, which communicates with a similar device on the Baseboard via an I²C data link. The I²C link is used to report the number of power supplies present, current usage, and Power Supply status. I²C signals are routed through J6 to the System Baseboard.

Power Supply FAULT

Each Power Supply provides a PGOOD signal that is asserted High. In the event of a Power Supply failure, the PGOOD signal goes low. The Power Supply outputs are enabled through assertion of the PON signal. If PGOOD goes low indicating a Power Bad condition while PON is asserted, a FAULT signal is sent to the backplane microcontroller.

Power Supply Presence Detect

The DETECT signal will be used to sense the number of power supplies (operational or not) in the system. Each Power Supply presents a grounding connection to the backplane microcontroller to indicate that a Power Supply is present. If a Power Supply is not present, the backplane microcontroller input will be pulled High though a pull-up resistor to +5V standby.

Backplane Interconnections

DC Power Circuits (Power Supply-to-Backplane Interface)

A Molex 36 position right-angle Mini-Fit Jr. header (Molex part no. 43759-0036), Intel part no. 662739-001, on the Power Share Backplane is used to connect the +12VDC, +5.0VDC, +3.3VDC, -12VDC , -5VDC, +24, +5V Standby, and Ground to the Power Supply. This connector uses 12 Amps per pin rated contacts. The contacts are de-rated to 6A/pin. Table 9 - DC Power Connections shows the pin assignments coming from the Power Supply. Connection is made to the backplane through J1, J2 and J3.

Table 9. DC Power Connections

Connector: Housing: 36-pin Molex SDX -43759-0036, Intel P/N 662739-001

Contacts: Molex 44476-1111

PIN	SIGNAL	PIN	SIGNAL
1	Power Good	19	Power Supply ON
2	+5V Standby	20	Remote Sense Return
3	Predictive Failure	21	+5V Remote Sense
4	+3.3V Remote Sense	22	+12V Remote Sense
5	Supply Present Gnd	23	+24VDC
6	-5VDC	24	-12VDC
7	Ground	25	+5VDC
8	Ground	26	+5VDC
9	Ground	27	+5VDC
10	Ground	28	+5VDC
11	Ground	29	+5VDC
12	Ground	30	+5VDC
13	Ground	31	+12VDC
14	Ground	32	+12VDC
15	Ground	33	+12VDC
16	Ground	34	+3.3VDC
17	Ground	35	+3.3VDC
18	Ground	36	+3.3VDC

Signal and Low Current Circuits (Power Supply-to-Backplane Interface)

The Power Share Backplane provides power to the Baseboard via power connector, J5. Refer to Table 10. Backplane-to-Baseboard Power Connector Pin Definitions for the connector pin-outs to the Baseboard. The connector on the Backplane is a 24-position Molex Mini-Fit Jr. header (Molex# 39-29-9242), Intel part no. 650520-012.

Table 10. Backplane-to-Baseboard Power Connector Pin Definitions

PIN	SIGNAL	18 AWG COLOR	PIN	SIGNAL	18 AWG COLOR
1	+5 Vdc	Red	13	+5 Vdc	Red
2	+5 Vdc	Red	14	+5 Vdc	Red
3	-5 Vdc	White	15	+5 Vdc	Red
4	-12Vdc	Blue	16	+5 Vdc	Red
5	COM	Black	17	COM	Black
6	COM	Black	18	COM	Black
7	COM	Black	19	COM	Black
8	COM	Black	20	COM	Black
9	COM	Black	21	COM	Black
10	+3.3Vdc	Orange	22	+3.3Vdc	Orange
11	+12Vdc	Yellow	23	+3.3Vdc	Orange
12	+12Vdc	Yellow	24	+12V	Yellow

J6 connects the I²C, Remote Sense and Power Supply control of the Backplane to the system. See, *Table 11. Backplane to Baseboard Control Connector,* for connector pin definitions. The connector on the Backplane is a 14-position Amp header (Amp# 111959-2), Intel part no. 653767-003.

Table 11. Backplane to Baseboard Control Connector, J6

PIN	SIGNAL	PIN	SIGNAL
1	Remote Sense Return	8	Power Good
2	5V Remote Sense	9	PS on
3	3.3V remote sense	10	Ground
4	Ground	11	5VSB
5	I²C -SCL	12	KEY
6	I²C -SDA	13	12V Remote Sense
7	Ground	14	12V Remote Sense Return

Backplane-to-Peripheral Interface

J7 supplies +5.0VDC and +12VDC power to the system peripherals. The connector on the backplane is a Molex MiniFit Jr. straight-up header (Molex part no. 39-29-9202) Intel part no. 650520-001.

Table 12. Peripheral Power Pin Definitions

PIN	DESCRIPTION	SIGNAL	PIN	DESCRIPTION	SIGNAL
1	SCSI Bay #1, Ground	GND	11	SCSI Bay #1, Ground	GND
2	SCSI Bay #1, +5V	+5VDC	12	SCSI Bay #1, +12V	+12VDC
3	SCSI Bay #2, Ground	GND	13	SCSI Bay #2, Ground	GND
4	SCSI Bay #2, +5V	+5VDC	14	SCSI Bay #2, +12V	+12VDC
5	Peripheral Bay #1, Ground	GND	15	Peripheral Bay #1, Ground	GND
6	Peripheral Bay #1, +5V	+5VDC	16	Peripheral Bay #1, +12V	+12VDC
7	Peripheral Bay #2, Ground	GND	17	Peripheral Bay #1, Ground	GND
8	Peripheral Bay #2, +5V	+5VDC	18	Peripheral Bay #1, +12V	+12VDC
9	Peripheral Bay #3, Ground	GND	19	Peripheral Bay #1, Ground	GND
10	Peripheral Bay #3, +5V	+5VDC	20	Peripheral Bay #1, +12V	+12VDC

Server Management Architecture - Power Share Subsystem

Microcontroller Circuit - PSBC

The Microcontroller Circuit is used to:

1. Provide control for an orderly turn-on of system power.
2. Monitor the power share circuitry and power supplies, reporting status back to the system baseboard.
3. Shut down power supplies if the 240VA limit is exceeded on +5V or +12V loads.

Power-On

The Power Share Microcontroller (PSM) circuit includes a special voltage monitor device that keeps the microcontroller chip reset for at least 250 msec. after the +5V standby power has stabilized to greater than 4.5 Volts. During this reset interval 1s are written to all port latches by the PSBC's internal reset function. The Power Supplies' power on (PS_PON) output from the PSM is inverted so that the logic 1 from the port bit represents the power-off state.

System Current Monitor

One of the features of the Power Share Board is to provide a power usage report back to the system via the I^2C Communications Bus. The PSM contains 5 built-in Analog-to-Digital Converters which are used to monitor a D.C. voltage level supplied by the Current Sense circuits that represent the current draw on the +3.3V from the baseboard and the +5V, and +12V load at both the baseboard and the peripheral bays.

If either the +5V or +12V load from the baseboard or the peripherals go beyond the CSA Level III requirement of 240VA, the power will be shut off immediately by de-asserting PS_PON. It is not possible to draw 240 VA from the 3.3 Volt power supply even when 3 supplies are installed.

The Current Sense circuits on the Power Share Baseboard generate a voltage level within the range of 0 to 5 Volts that represents the amount of current being used. For Balboa II, the Limit threshold will be set to 44 + 4 Amps for each +5 Volt channel and 16 Amps +4 Amps for each +12 Volt channel.

SCSI Hot-Swap Backplane

This section describes the architecture of the *Balboa II SCSI Backplane*: a SCSI backplane board which supports hot-swapping SCSI drives, and enclosure management and monitoring functions conforming to the SCSI-Accessed Fault-Tolerant Enclosures specification (SAF-TE).

The Balboa II Hot-Swap SCSI Backplane is an embedded application subsystem. During normal operation, the following operations are taking place:

1. Respond to SAF-TE messages (transmitted to the backplane via the SCSI bus)
2. Monitor the state of the power-supply sharing board, and inform the system, via a SAF-TE message, of any changes in the state of that board.
3. Monitor the temperature on the backplane, and report a warning or critical error if the warning or critical error threshold is exceeded.
4. Monitor the speed of the fan (if present), and report a warning or critical error if the warning or critical error threshold is exceeded.

The Balboa II Hot-Swap SCSI Backplane is made up of the following functional blocks:

- SCSI Bus with SCA (Single Connector Attach) drive connectors, and active terminators
- Microcontroller
- I^2C interface
- SCSI drive power control
- Fault indicator LEDs

The Hot-Swap SCSI Backplane resides in the hot-swap drive bay of a server. During normal operation, it periodically polls the power-supply sharing board (if it is present in the server) for status information.

The *Hot-Swap SCSI Backplane* performs the tasks associated with hot-swappable SCSI drives, and enclosure (chassis) monitoring and management, as specified in the SCSI-Accessed Fault-Tolerant Enclosures specification, rev 1.00. These tasks include, but are not limited to, the following:

- Monitoring the SCSI bus for enclosure services messages, and acting on them appropriately. Examples of such messages include:
  - Activate a drive fault indicator.
  - Power down a drive which has failed.
  - Report backplane temperature
- Acting as a proxy for "dumb" I^2C devices during inter-chassis communication
- Monitoring the state of the power-supply-sharing board, if it exists in the system.
- Monitoring the state of other hot-swap SCSI backplanes, if there are others in the same chassis.
- Capable of performing in circuit firmware upgrades.

Board Layout

The following diagram shows the layout of components and connectors on the SCSI backplane printed circuit board.

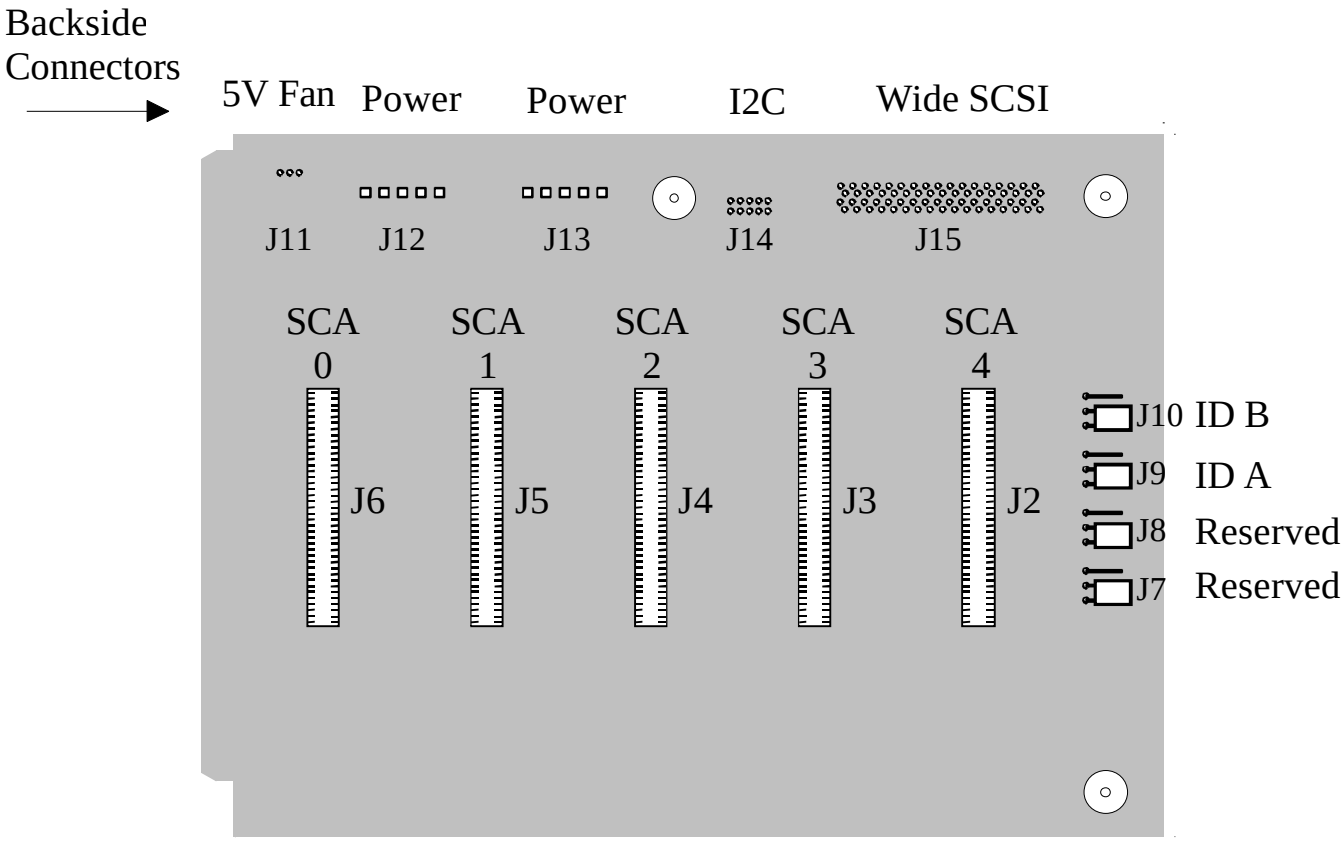

Figure 8-5. Hot-swap SCSI Backplane Component and Connector Layout

Configuration Options

The following table describes the various configuration jumpers on the Balboa II Hot-Swap SCSI Backplane along with their function and intended usage.

Table 8-1 Hot-Swap Backplane Jumpers

J10 ID-B	J9 ID-A	Drive 0 (J6)	Drive 1 (J5)	Drive 2 (J4)	Drive 3 (J3)	Drive 4 (J2)
2-3	2-3	ID8	ID9	ID2	ID11	ID12
1-2	2-3	ID0	ID1	ID2	ID3	ID4
2-3	1-2	ID8	ID9	ID10	ID11	ID12
1-2*	1-2*	ID0	ID1	ID10	ID3	ID4

*Jumper Default Setting

Design Constraints and Assumptions

SCSI bus

The SCSI bus, based on the SCSI-3 specification, was designed to allow any SCSI device to communicate with any other SCSI device. To that end, the SCSI specification requires that all SCSI devices be at least 0.3m (11.81in) apart (draft-Proposed SCSI-3, section 6.4). Since this hot-swap backplane will violate this specification (drives will be 1.3in apart), certain constraints must be placed on the backplane in order for the product to operate correctly.

There is allowed only one initiator on the hot-swap SCSI bus, and that initiator is the SCSI controller located on the system baseboard. All SCSI devices on the backplane are targets. This arrangement allows communication over the SCSI bus to occur only between the two ends of the bus, significantly reducing the signal reflections, and thereby increasing the signal quality at the receiver.

Deviations from SAF-TE Specification

The SAF-TE specification, rev 1.00, requires the use of a “PAIR” signal. The intended use of this signal is to allow inter-backplane processor communication. This signal has not bee used in the designs prior to this one. Therefore, this signal is deemed unnecessary and will not be implemented.

Miscellaneous

Per-drive power and activity indicators are somewhat common for a design such as this. In the interests of cost, these indicators will not be supported or implemented.

Server Management Architecture - SCSI Subsystem

This section defines the architecture of the Server Management subsystem, including descriptions of functional blocks and how they operate. The following figure shows the functional blocks of the Server Manager Subsystem. An overview of each block follows.

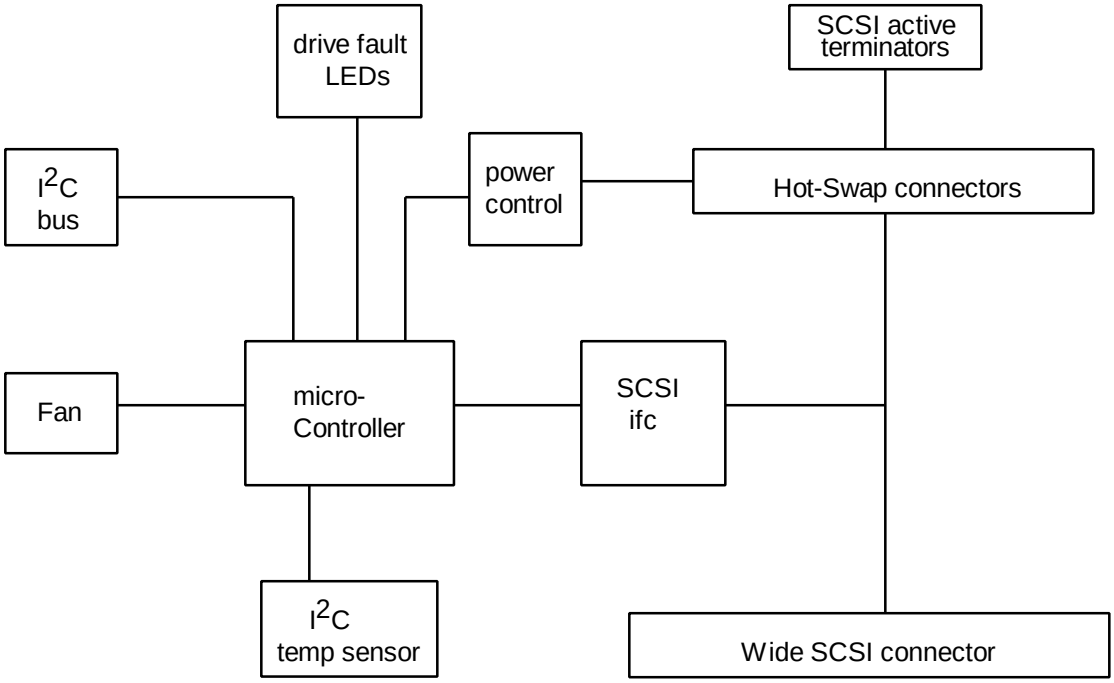

Figure 8-6. Functional Block Diagram

Hot-Swap connectors

The hot-swap connectors are SCA (Single Connector Attachment) connectors. Each of the five SCSI drives attaches to the backplane at this point. The SCA provides connection to both the SCSI bus and power.

SCSI interface

The SCSI interface controller on the hot-swap backplane provides the interface between the SCSI bus and the microcontroller, which contains all the "intelligence" on the board. The SCSI interface is a very simple, 8-bit wide SCSI interface, as it only interfaces to an 8-bit microcontroller, and does not need high-performance functions.

SCSI Active terminators

The SCSI active terminators provide proper termination for the Hot-Swap backplane end of the SCSI bus. It is assumed that the initiator-end of the SCSI bus will also be properly terminated.

Power control

Power control is provided to power-down the drive when a failure is detected and reported (via enclosure services messages) to the SCSI bus. This decreases the likelihood that the drive, which may be under warranty, will be damaged during removal from the hot-swap drive bay. When a new drive is inserted, the power control waits a small amount of time for the drive to be fully seated, and then applies power to the drive in preparation for operation.

Also, the hardware will turn off power to a drive slot when it detects that a drive has been removed. This prevents the unwanted condition where a drive is partially removed and re-inserted while full power is

available. If such a condition were allowed, the resultant sags in supply voltages could disrupt the entire SCSI array.

An additional feature of power control, which can be implemented in the firmware, is to allow for hot spare drives. In this case, spare drives are kept in the hot swap bay, but are left powered down. When any drive is determined to have failed, the hot spare can be powered up and put into service without requiring immediate operator intervention to replace the drive.

Microcontroller

The microcontroller provides all the intelligence on the backplane. It is an 80C51 based microcontroller, with a built-in I^2C (Inter-Integrated Circuit) bus. The microcontroller block includes the EPROM and RAM that the microcontroller needs to operate.

Fault LEDs

The drive fault LEDs are driven by the microcontroller, and serve to indicate failure status for each drive. The LEDs are not physically located on the Hot-Swap SCSI backplane, but are only driven from the backplane. For more information, see the SAF-TE specification.

I^2C bus

The I^2C bus is intended to function as a system wide management bus. The I^2C bus controller is integrated into the microcontroller. Further information can be found in the SAF-TE specification, and the I^2C bus specification.

Fan

The hot swap backplane supports a fan with a digital output tachometer for speed monitoring. The fan's digital output is connected to the microcontroller. Software is responsible for monitoring the fan speed and reporting its status.

Temperature sensor

The temperature sensor is an I^2C bus temperature sensor which resides on a private (hot swap backplane only) I^2C bus. The temperature information is available to other devices in the chassis through Enclosure Services messages. The private I^2C bus is a "bit banged" bus with only one master (the microcontroller) and one slave, the temperature sensor. The firmware must implement the private I^2C bus "manually" by explicitly setting and clearing the clock and data signals, as there is no hardware which directly supports this private bus.

Connectors

Wide SCSI Connector

The Wide SCSI connector is a 0.050" spacing 68-pin, unshielded connector. Signals are described in the board TPS.

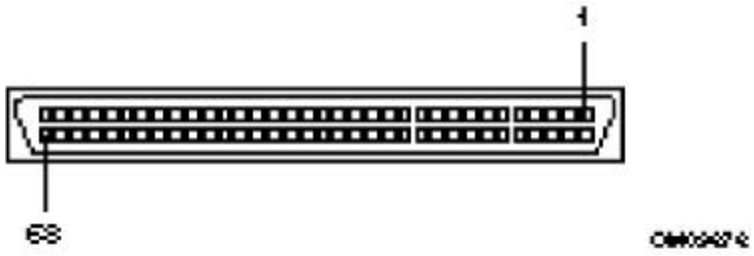

Figure 8-7 Wide SCSI Connector

SCA Connectors

The five SCSI SCA I connectors are Molex 15-92-10800, .050" spacing, 80-pin, unshielded connectors.

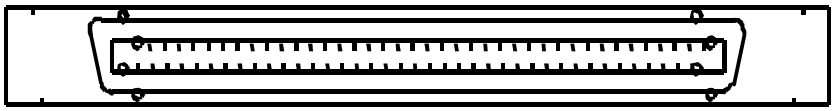

Figure 8-8 SCA Connector

Front Panel Connector

The front panel 10-pin connector that attaches to the system front panel which in-turn passes drive management information to the system baseboard. Signals are described in the front panel section of this document, table titled - *"Hot-Swap Backplane Connector Pinout".*

Table 8-2 Hot-Swap Backplane Connector Pinout

Name	Pin	Description
GND	1	Electrical ground (0V)
I2C_SDA	2	I^2C SDA (Serial Data)
GND	3	Electrical ground (0V)
I2C_SCL	4	I^2C SCL (Serial Clock)
RFU	5	Reserved for future use. No connections to this signal or pin are allowed.
FAULT1#	6	Fault signal for drive 1 (logical drive 0). Active low signal
FAULT2#	7	Fault signal for drive 2 (logical drive 1) . Active low signal
FAULT3#	8	Fault signal for drive 3 (logical drive 2) . Active low signal
FAULT4#	9	Fault signal for drive 4 (logical drive 3) . Active low signal
FAULT5#	10	Fault signal for drive 5 (logical drive 4) . Active low signal

Fan Connector

The fan connector supports a 3-pin 12V fan. Signals are described in section 7 *Fan Connectors*.

Power Connectors

The power connectors are identical to those used on standard peripherals: a 4-pin shrouded plastic connector with mechanical keying

Front Panel

Balboa II Front Panel Overview

The front panel provides electrical connection and mounting of switches and indicators accessible from the front of the chassis. The power-on/off and system reset are examples of switches mounted on the

front panel board, which are accessible at the front of the chassis. Power-on and disk activities are examples of indicators mounted on the front panel board, which are viewable at the front of the chassis.

The Balboa II front panel has three switches and 14 LEDs on it. It also contains a 16 pin baseboard connector, three 3 pin chassis intrusion connectors, and two 10 pin connectors which are used to interconnect to the two potential hot-swap drive backplanes in a system. The hot-swap drive backplane connectors contain the I^2C bus passed through from the baseboard and the signals to drive the five error LEDs for the respective hard drive backplane. Of the remaining four LEDs, one indicates power on, two are used to indicate fan and power faults, and one indicates hard drive activity. The three switches control power-on, reset, and NMI.

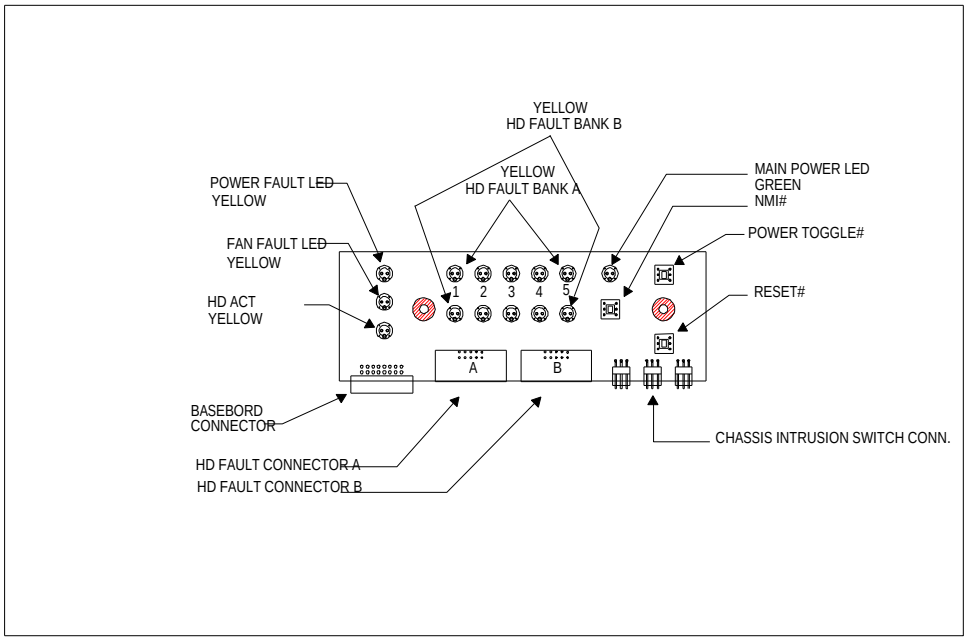

Figure 8-9 Balboa II Front Panel Layout

Front Panel Connector Descriptions

Table 8-3 Front Panel Connector Pinout

Pin	Name	Description
1	GND	0V
2	Hard Drive-Activity	TTL Low true = hard disk activity, requires series R for LED
3	Reset	TTL Low True = reset system
4	Power-Control	TTL Low True = toggle system power
5	VCC	+5V
6	N/C	Spare
7	NMI	TTL Low True = NMI to CPU
8	VCC	+5V
9	Fan-Failed	TTL Low True = fan failed, requires series R for LED
10	Chassis - Intrusion	TTL High True = chassis intrusion, This signal comes from the chassis
11	Power-Fault	TTL Low True = power fault condition, requires series R for LED
12	+5V-STBY	+5V-Standby
13	I^2C-SDA	I^2C - SDA (Serial Data)
14	GND	0V
15	I^2C-SCL	I^2C - SCL (Serial Clock)
16	GND	0V

Table 8-4 Balboa II Chassis Intrusion Switch Connector Pinout

Pin #	I/O	Description
1	O	TTL High True = Chassis switch
2		Chassis switch return (GND or output of next chassis switch connector)
3	O	TTL High True = Chassis switch

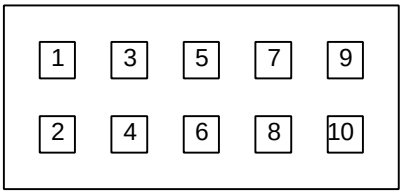

Figure 8-10 HD Backplane Connector Diagram

Table 8-5 Balboa II Front Panel LED Current

SIGNAL NAME	RECOMMENDED SERIES R VALUE	MAX CURRENT	LED COLOR
PWR_GOOD	150 ohms	20 mA	GREEN
HD_FAULT_1..4#	100 ohms	35 mA	YELLOW
HD_ACTIVITY#	100 ohms	35 mA	YELLOW
FAN_FAIL#	100 ohms	35 mA	YELLOW
POWER_FAULT#	300 ohms	10 mA	YELLOW

I^2C Diagnostic Bus

An I^2C interface on the baseboard is connected to the front panel via the baseboard-to-front panel cable. This bus is not used on the front panel, but is passed through the front panel to the connectors for the hard drive backplanes. The I^2C bus is then utilized by the hard drive backplanes to pass error information back to the baseboard.

9 Certifications

Safety

USA

The system is UL listed to UL 1950, 3rd Edition.

Canada

The system is certified by UL (cUL) to meet the requirements of CSA C22.2 No. 950-M93. The product will bear the cUL mark.

Europe

The system is certified to meet the requirements of EN 60 950 with amendments by TUV (GS License).

International

The system is certified by NEMKO to meet the requirements of EN 60 950 with amendments and Nordic deviations, and IEC 950 with amendments.

Electro-Magnetic Compatibility

USA

The system is certified to FCC CFR 47 Part 15, Class B

Canada

The system complies with the Limits for Radio Noise Emissions from Class B Digital Apparatus as required by Industry Canada (IC).

Europe

The system complies with the EU EMC directive (89/336/EEC) via EN 55022, Class B and EN 50082-1. The product will carry the CE mark. The system is tested to the following immunity standards and maintains normal performance within these specification limits:

IEC 801-2	ESD Susceptibility (level 2 contact discharge, level 3 air discharge)
IEC 801-3	Radiated Immunity (level 2)
IEC 801-4	Electrical fast transient (level 2)

International

The system is compliant with CISPR 22 Class B

Japan

The system is registered with VCCI and complies with VCCI Class 2 limits (CISPR 22 B Limit).

10 Reliability, Serviceability and Availability

Mean Time between Failure - MTBF

The Mean-Time-Between-Failures (MTBF) data is calculated from predicted data.

Table 10-1 System MTBF

Sub Assembly	QTY	MTBF Quote (hrs)
Baseboard	1	77,360
VRM modules	1	1,857,631
Memory EDO	1	614,368
RPX board	1	396,107
SCSI back plane	2	399,631
Front panel board	1	2,418,321
Termination board power card	1	4,370,629
Power DIST board	1	129,254
CD-ROM	1	100,000
PRO 100 B	1	464,382
Power supply	2	50,333
1.44MB 3.5" FDU	1	81,000
32 MB DIMM	4	1,358,496
FAN Blower	2	597,946
FAN	2	548,593
MTBF TOTAL		20,210

Serviceability

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

The desired MTTR of the system is 30 minutes including diagnosis of the system problem. To meet this goal, the system enclosure and hardware have been designed to minimize the MTTR.

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

Remove cover	1 minute
Remove and replace disk drive	1 minute
Remove and replace power supply	5 minutes
Remove and replace fan	5 minutes
Remove and replace expansion board	5 minutes
Remove and replace front panel board	5 minutes
Remove and replace baseboard (with no expansion boards)	10 minutes
Remove and replace power back plane	15 minutes
Remove and replace SCSI back plane	15 minutes
Overall MTTR	20 minutes

11 Environmental Limits

System Office Environment

Table 11-1 System Office Environment Summary

Operating Temperature	+5°C to +35°C Maximum rate of change of 10 °C per hour.
Non-Operating Temperature	-40°C to +70°C
Non-operating Humidity	95%, non-condensing @ 30 °C
Acoustic noise	< 45 dBA at typical office ambient temperature (65-75F)
Operating Shock	No errors with a half sine wave shock of 2G (with 11 millisecond duration).
Package Shock	operational after a 24 inch free fall, although cosmetic damage may be present
ESD	20kV per Intel Environmental test specification

APPENDIX A - SPARE PARTS

PRODUCT CODE	DESCRIPTION	Qty Per	COMMENTS/Part #
Accessories			
ABAL22NDHDA	SCSI BKPLN KIT	1	2nd Array include: 5X Drive Tray, EMI Clips, SCSI Cable, Backplane, Docs
ABAL2RPWRA	PWR SHARE UPGD KIT	1	POWER SHR BD, COVER, CABLES, MANUAL, POWER CORD, LABELS
ABAL2COOLA	REDUNDANT FAN KIT	1	1 FAN, HOUSING, 2 ADAPTERS, DOCUMENTATION
AMAB2INTKIT	HARDWARE INTIGRATOR	1	
AMAB2PKGKIT	PACKAGING INTIGRATOR	1	
ABAL2360PS1A	POWER SPLY	1	1 X 360 W POWER SUPPLY AND DOCS. STAND ALONE OR USE WITH PWR SHR KIT
ABALRACKADPT	RACK ADAPTER	1	RACK RAILS, MODIFIED COVER, MISC HDWR, DOCS
Boards			
BMAD440LX	M440LX DP Server Baseboard	1	661880-301
BMADKIT266UP	Pentium II processor UP Kit - w/CPU 266	1	CPU ASSEMB, TERM, RET'N MECH, HTSNK
BMADKIT266UG	Pentium II processor DP Kit - w/CPU 266	1	CPU ASSEMB, VRM, HTSNK
BMADKIT300UP	Pentium II processor UP Kit - w/CPU 300	1	CPU ASSEMB, TERM, RET'N MECH, HTSNK
BMADKIT300UG	Pentium II processor DP Kit - w/CPU 300	1	
BMADMEM00E	EDO Memory Board	1	657664-001
BMADMEM00S	SDRAM Memory Board	1	665775-101
BMADRPXA	MAD01 RPX Mod	1	657684-202
SPARES:			
FRU669496	CPU retention mechanism	10	669496-001
FRU676936	Country Kit	10	will change to - 002 676936-001
FRU679191	PBA, SCSI Backplane	1	679191-301
FRU659708	PBA, Power Share Board	1	659708-401
FRU665001	Chassis Assy	1	665001-003
FRU676752	Blower 97MM, 10CFM	1	676752-002
FRU673833	Fan, 92MM, 45CFM	1	673833-001
FRU651034	PBA, Front Panel	1	651034-001
FRU660391	SLT1TERM Terminator Bd	20	660391-102
FRU651013	Cable, Front panel-BB	10	651013-002
FRU665240	Cable, Floppy	10	665240-005
FRU665233	Cable, Wide, SCSI, Top	10	665233-004
FRU651014	Cable, Front Panel HSBP1	10	651014-002
FRU665235	Cable, Wide, SCSI, Bottom	10	665235-004
FRU651015	Cable, Front PanelHSBP2	10	651015-004
FRU670098	Cable, Alarm PK	10	670098-001
FRU651012	Cable, Intrusion, Front	10	651012-001
FRU665241	Cable, Narrow SCSI	10	665241-004
FRU665236	Cable, IDE	10	665236-005

PRODUCT CODE	DESCRIPTION	Qty Per	COMMENTS/Part #
FRU676453	IDE Bracket	10	676453-001
FRU648336	Fan Bracket		
FRU678540	EPAC Blower Duct		
FRU657372	Module Rail Assy	30	657372-001
FRU648331	Card Guide	8	648331-001
FRU651016	PSB,Cable_24,Balboa	10	651016-004
FRU651011	PSB,Cable_Per,Bay,Balboa	10	651011-004
FRU651017	Cable, PSB_ Control,Balboa	10	651017-003
FRU687201	Top Cover Assy		
FRU687195	Side Cover Assy		