

Sun Ultra 5 Service Manual



THE NETWORK IS THE COMPUTER™

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Preface

The *Sun Ultra 5 Service Manual* provides detailed procedures that describe the removal and replacement of replaceable parts in the Sun Ultra™ 5 systems. The service manual also includes information about the use and maintenance of the system units. This manual is written for technicians, system administrators, authorized service providers (ASPs), and advanced computer system end users who have experience in troubleshooting and replacing hardware.

About the Multimedia Links in This Manual

Removal and replacement procedures for selected system components are also illustrated with interactive multimedia audio and video instructions in the *Sun Ultra 10 ShowMe How2* multimedia documentation, which is linked to the online version of this manual. These multimedia links can be accessed wherever you see this film-clip icon:



How This Book Is Organized

This document is organized into chapters and appendixes as listed in the following table. A glossary is also included.

TABLE P-1 Document Organization

Chapter	Content Description
“Regulatory Compliance Statements and Declaration of Conformity,” page xxv	Provides regulatory agency compliance statements and the declaration of conformity for the product.
“Safety Agency Compliance Statements,” page xxix	Provides safety agency compliance statements.
Chapter 1, “Product Description”	Describes the major components of the system.
Chapter 2, “SunVTS Overview”	Describes the execution of individual tests for verifying hardware configuration and functionality.
Chapter 3, “Power-On Self-Test”	Describes the execution of POST and provides examples of POST output patterns.
Chapter 4, “Troubleshooting Procedures”	Provides troubleshooting advice and suggested corrective actions for hardware problems.
Chapter 5, “Preparing For Component Replacement”	Explains how to work safely when replacing system components. Provides procedures for powering off the system, removing the system cover, and attaching the wrist strap.
Chapter 6, “Major Subassemblies”	Provides procedures for removing and replacing major subassemblies.
Chapter 7, “Storage Devices”	Provides procedures for removing and replacing storage devices.
Chapter 8, “Motherboard and Component Replacement”	Provides procedures for removing and replacing the motherboard and various components associated with motherboard operation.
Chapter 9, “Illustrated Parts List”	Lists replaceable parts for the system.
Chapter 10, “Finishing Component Replacement”	Provides procedures for replacing the system cover and powering on the system.
Appendix A, “Product Specifications”	Provides specifications on power and environment, system dimensions, weight, memory mapping, and peripheral component interconnect (PCI) card slots.

TABLE P-1 Document Organization (Continued)

Chapter	Content Description
Appendix B, "Signal Descriptions"	Provides signal descriptions, instructions for connecting the system unit to a 10BASE-T/100BASE-T twisted-pair Ethernet (TPE) local area network (LAN), and modem settings for systems used in specific network telecommunication applications.
Appendix C, "Functional Description"	Provides functional descriptions of the system.
Appendix D, "Software Notes"	Identifies software issues and software upgrades.

Using UNIX Commands

For complete information on basic UNIX™ commands and procedures such as shutting down the system, booting the system, and configuring devices, refer to the following:

- *Solaris Handbook for Sun Peripherals*
- AnswerBook2™ online documentation for the Solaris™ software environment
- Other software documentation that you received with your system

Typographic Conventions

Typographic conventions used in this manual are listed in the following table.

TABLE P-2 Typographic Conventions

Typeface or Symbol	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output.	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
AaBbCc123	What you type, when contrasted with on-screen computer output.	% su Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized. Command-line variable; replace with a real name or value.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be <code>root</code> to do this. To delete a file, type <code>rm filename</code> .

Shell Prompts

The following table lists the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE P-3 Shell Prompts

Shell	Prompt
C shell	<i>machine_name</i> %
C shell superuser	<i>machine_name</i> #
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

Related Documents

Additional information for servicing the system are listed in the following table. Some of these documents are also available online on the *Solaris on Sun Hardware AnswerBook*.

TABLE P-4 Related Documents

Application	Title	Part Number
Installation	<i>Sun Ultra 5/Ultra 10 CD-ROM Drive and Hard Drive Installation Guide</i>	805-7115
Installation, software notes	<i>Getting Started with the Sun Ultra 5 with Preinstalled Software</i>	805-0162
Configuration	<i>Solaris Handbook for Sun Peripherals</i>	805-4440
Configuration	<i>Solaris Handbook for Sun Frame Buffers</i>	805-4441
Specification	<i>17-Inch Entry, 17-Inch Premium, and 20-Inch Premium Color Monitors Specifications</i>	802-6178
Specification	<i>Diskette Drive Specification</i>	802-6285

Ordering Sun Documents

The `docs.sun.com` web site enables you to access Sun technical documentation on the web. You can browse the `docs.sun.com` archive or search for a specific book title or subject at:

`http://docs.sun.com`

Sun Welcomes Your Comments

We are interested in improving our documentation and welcome your comments and suggestions. You can email your comments to us at:

`docfeedback@sun.com`

Please include the part number of your document in the subject line of your email.

Regulatory Compliance Statements and Declaration of Conformity

Your Sun product is marked to indicate its compliance class:

- Federal Communications Commission (FCC) — USA
- Industry Canada Equipment Standard for Digital Equipment (ICES-003) - Canada
- Voluntary Control Council for Interference (VCCI) — Japan
- Bureau of Standards Metrology and Inspection (BSMI) - Taiwan

Please read the sections that correspond to the marking on your Sun product before attempting to install the product.

FCC Class A Notice

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

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

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Shielded Cables: Connections between the workstation and peripherals must be made using shielded cables to comply with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted-pair (UTP) cables.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

FCC Class B Notice

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

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

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Shielded Cables: Connections between the workstation and peripherals must be made using shielded cables in order to maintain compliance with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted pair (UTP) cables.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

ICES-003 Class A Notice - Avis NMB-003, Classe A

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

ICES-003 Class B Notice - Avis NMB-003, Classe B

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.


VCCI 基準について

クラス A VCCI 基準について

クラス A VCCI の表示があるワークステーションおよびオプション製品は、クラス A 情報技術装置です。これらの製品には、下記の項目が該当します。

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

クラス B VCCI 基準について

クラス B VCCI の表示  があるワークステーションおよびオプション製品は、クラス B 情報技術装置です。これらの製品には、下記の項目が該当します。

この装置は、情報処理装置等電波障害自主規制協議会 (VCCI) の基準に基づくクラス B 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。取扱説明書に従って正しい取り扱いをしてください。

BSMI Class A Notice

The following statement is applicable to products shipped to Taiwan and marked as Class A on the product compliance label.

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

Agency Compliance

The system complies with international and domestic regulatory requirements for safety, ergonomics, and electromagnetic compatibility. When installed and operated in accordance with this service manual, the EMC class marked on your system label remains the same.

German Acoustic Compliance

ACHTUNG: Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635.

Teil 1000 beträgt 70 Db(A) oder weniger.

Declaration of Conformity

The declaration of conformity for the Sun Ultra 5 product is on the following page.

Declaration of Conformity

Compliance ID: 200

Product Name: Sun Ultra 5 Family

This product has been tested and complies with:

EMC

USA—FCC Class B

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

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

European Union—EC

This equipment complies with the following requirements of the EMC Directive 89/336/EEC

EN55022 / CISPR22 (1985)		Class B
EN50082-1	IEC801-2 (1991)	4 kV (Direct), 8 kV (Air)
	IEC801-3 (1984)	3 V/m
	IEC801-4 (1988)	1.0 kV Power Lines, 0.5 kV Signal Lines
EN61000-3-2/IEC1000-3-2(1994)		Pass

Safety

This equipment complies with the following requirements of the Low Voltage Directive 73/23/EEC:

EC Type Examination Certificates:

EN60950/IEC950 (1993)

EN60950 w/ Nordic Deviations

Supplementary Information

This product was tested and complies with all the requirements for the CE Mark.

/ S /

Dennis P. Symanski DATE

Manager, Product Compliance

/ S /

John Shades DATE

Quality Assurance Manager

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Fax: 0506 760011

Safety Agency Compliance Statements

Read this section before beginning any procedure. The following text provides safety precautions to follow when installing a Sun Microsystems product.

Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

Symbols

The following symbols may appear in this book:



Caution – There is risk of personal injury and equipment damage. Follow the instructions.



Caution – Hot surface. Avoid contact. Surfaces are hot and may cause personal injury if touched.



Caution – Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

On – Applies AC power to the system.

Depending on the type of power switch your device has, one of the following symbols may be used:



Off - Removes AC power from the system.



Standby – The On/Standby switch is in the standby position.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. Sun Microsystems is not responsible for regulatory compliance of a modified Sun product.

Placement of a Sun Product



Caution – Do not block or cover the openings of your Sun product. Never place a Sun product near a radiator or heat register. Failure to follow these guidelines can cause overheating and affect the reliability of your Sun product.



Caution – The workplace-dependent noise level defined in DIN 45 635 Part 1000 must be 70Db(A) or less.

SELV Compliance

Safety status of I/O connections comply to SELV requirements.

Power Cord Connection



Caution – Sun products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electric shock, do not plug Sun products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.



Caution – Not all power cords have the same current ratings. Household extension cords do not have overload protection and are not meant for use with computer systems. Do not use household extension cords with your Sun product.



Caution – Your Sun product is shipped with a grounding type (three-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

The following caution applies only to devices with a Standby power switch:



Caution – The power switch of this product functions as a standby type device only. The power cord serves as the primary disconnect device for the system. Be sure to plug the power cord into a grounded power outlet that is nearby the system and is readily accessible. Do not connect the power cord when the power supply has been removed from the system chassis.

Lithium Battery



Caution – On Sun CPU boards, there is a lithium battery molded into the real-time clock, SGS No. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, or MK48T08. Batteries are not customer replaceable parts. They may explode if mishandled. Do not dispose of the battery in fire. Do not disassemble it or attempt to recharge it.

Battery Pack



Caution – There is a sealed lead acid battery in Ultra 5 units. Portable Energy Products No. TLC02V50. There is danger of explosion if the battery pack is mishandled or incorrectly replaced. Replace only with the same type of Sun Microsystems battery pack. Do not disassemble it or attempt to recharge it outside the system. Do not dispose of the battery in fire. Dispose of the battery properly in accordance with local regulations.

System Unit Cover

You must remove the cover of your Sun computer system unit to add cards, memory, or internal storage devices. Be sure to replace the top cover before powering on your computer system.



Caution – Do not operate Sun products without the top cover in place. Failure to take this precaution may result in personal injury and system damage.

Laser Compliance Notice

Sun products that use laser technology comply with Class 1 laser requirements.

Class 1 Laser Product
Luokan 1 Laserlaite
Klasse 1 Laser Apparat
Laser Klasse 1

CD-ROM



Caution – Use of controls, adjustments, or the performance of procedures other than those specified herein may result in hazardous radiation exposure.

Einhaltung sicherheitsbehördlicher Vorschriften

Auf dieser Seite werden Sicherheitsrichtlinien beschrieben, die bei der Installation von Sun-Produkten zu beachten sind.

Sicherheitsvorkehrungen

Treffen Sie zu Ihrem eigenen Schutz die folgenden Sicherheitsvorkehrungen, wenn Sie Ihr Gerät installieren:

- Beachten Sie alle auf den Geräten angebrachten Warnhinweise und Anweisungen.
- Vergewissern Sie sich, daß Spannung und Frequenz Ihrer Stromquelle mit der Spannung und Frequenz übereinstimmen, die auf dem Etikett mit den elektrischen Nennwerten des Geräts angegeben sind.
- Stecken Sie auf keinen Fall irgendwelche Gegenstände in Öffnungen in den Geräten. Leitfähige Gegenstände könnten aufgrund der möglicherweise vorliegenden gefährlichen Spannungen einen Kurzschluß verursachen, der einen Brand, Stromschlag oder Geräteschaden herbeiführen kann.

Symbole

Die Symbole in diesem Handbuch haben folgende Bedeutung:



Achtung – Gefahr von Verletzung und Geräteschaden. Befolgen Sie die Anweisungen.



Achtung – Hohe Temperatur. Nicht berühren, da Verletzungsgefahr durch heiße Oberfläche besteht.



Achtung – Gefährliche Spannungen. Anweisungen befolgen, um Stromschläge und Verletzungen zu vermeiden.



Ein – Setzt das System unter Wechselstrom.

Je nach Netzschalterttyp an Ihrem Gerät kann eines der folgenden Symbole benutzt werden:



Aus – Unterbricht die Wechselstromzufuhr zum Gerät.



Wartezustand (Stand-by-Position) - Der Ein-/Wartezustand-Schalter steht auf Wartezustand. Änderungen an Sun-Geräten.

Nehmen Sie keine mechanischen oder elektrischen Änderungen an den Geräten vor. Sun Microsystems, übernimmt bei einem Sun-Produkt, das geändert wurde, keine Verantwortung für die Einhaltung behördlicher Vorschriften

Aufstellung von Sun-Geräten



Achtung – Um den zuverlässigen Betrieb Ihres Sun-Geräts zu gewährleisten und es vor Überhitzung zu schützen, dürfen die Öffnungen im Gerät nicht blockiert oder verdeckt werden. Sun-Produkte sollten niemals in der Nähe von Heizkörpern oder Heizluftklappen aufgestellt werden.



Achtung – Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70Db(A) oder weniger.

Einhaltung der SELV-Richtlinien

Die Sicherung der I/O-Verbindungen entspricht den Anforderungen der SELV-Spezifikation.

Anschluß des Netzkabels



Achtung – Sun-Produkte sind für den Betrieb an Einphasen-Stromnetzen mit geerdetem Nulleiter vorgesehen. Um die Stromschlaggefahr zu reduzieren, schließen Sie Sun-Produkte nicht an andere Stromquellen an. Ihr Betriebsleiter oder ein qualifizierter Elektriker kann Ihnen die Daten zur Stromversorgung in Ihrem Gebäude geben.



Achtung – Nicht alle Netzkabel haben die gleichen Nennwerte. Herkömmliche, im Haushalt verwendete Verlängerungskabel besitzen keinen Überlastungsschutz und sind daher für Computersysteme nicht geeignet.



Achtung – Ihr Sun-Gerät wird mit einem dreidadrigen Netzkabel für geerdete Netzsteckdosen geliefert. Um die Gefahr eines Stromschlags zu reduzieren, schließen Sie das Kabel nur an eine fachgerecht verlegte, geerdete Steckdose an.

Die folgende Warnung gilt nur für Geräte mit Wartezustand-Netzschalter:



Achtung – Der Ein/Aus-Schalter dieses Geräts schaltet nur auf Wartezustand (Stand-By-Modus). Um die Stromzufuhr zum Gerät vollständig zu unterbrechen, müssen Sie das Netzkabel von der Steckdose abziehen. Schließen Sie den Stecker des Netzkabels an eine in der Nähe befindliche, frei zugängliche, geerdete Netzsteckdose an. Schließen Sie das Netzkabel nicht an, wenn das Netzteil aus der Systemeinheit entfernt wurde.

Lithiumbatterie



Achtung – CPU-Karten von Sun verfügen über eine Echtzeituhr mit integrierter Lithiumbatterie (Teile-Nr. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, oder MK48T08). Diese Batterie darf nur von einem qualifizierten Servicetechniker ausgewechselt werden, da sie bei falscher Handhabung explodieren kann. Werfen Sie die Batterie nicht ins Feuer. Versuchen Sie auf keinen Fall, die Batterie auszubauen oder wiederaufzuladen.

Batterien



Achtung – Die Geräte Ultra 5 enthalten auslaufsichere Bleiakumulatoren. Produkt-Nr. TLC02V50 für portable Stromversorgung. Werden bei der Behandlung oder beim Austausch der Batterie Fehler gemacht, besteht Explosionsgefahr. Batterie nur gegen Batterien gleichen Typs von Sun Microsystems austauschen. Nicht demontieren und nicht versuchen, die Batterie außerhalb des Geräts zu laden. Batterie nicht ins Feuer werfen. Ordnungsgemäß entsprechend den vor Ort geltenden Vorschriften entsorgen.

Gehäuseabdeckung

Sie müssen die obere Abdeckung Ihres Sun-Systems entfernen, um interne Komponenten wie Karten,

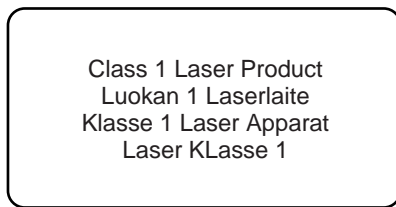
Speicherchips oder Massenspeicher hinzuzufügen. Bringen Sie die obere Gehäuseabdeckung wieder an, bevor Sie Ihr System einschalten.



Achtung – Bei Betrieb des Systems ohne obere Abdeckung besteht die Gefahr von Stromschlag und Systemschäden.

Einhaltung der Richtlinien für Laser

Sun-Produkte, die mit Laser-Technologie arbeiten, entsprechen den Anforderungen der Laser Klasse 1.



CD-ROM



Warnung – Die Verwendung von anderen Steuerungen und Einstellungen oder die Durchführung von Prozeduren, die von den hier beschriebenen abweichen, können gefährliche Strahlungen zur Folge haben.

Conformité aux normes de sécurité

Ce texte traite des mesures de sécurité qu'il convient de prendre pour l'installation d'un produit Sun Microsystems.

Mesures de sécurité

Pour votre protection, veuillez prendre les précautions suivantes pendant l'installation du matériel :

- Suivre tous les avertissements et toutes les instructions inscrites sur le matériel.
- Vérifier que la tension et la fréquence de la source d'alimentation électrique correspondent à la tension et à la fréquence indiquées sur l'étiquette de classification de l'appareil.
- Ne jamais introduire d'objets quels qu'ils soient dans une des ouvertures de l'appareil. Vous pourriez vous trouver en présence de hautes tensions dangereuses. Tout objet conducteur introduit de la sorte pourrait

produire un court-circuit qui entraînerait des flammes, des risques d'électrocution ou des dégâts matériels.

Symboles

Vous trouverez ci-dessous la signification des différents symboles utilisés :



Attention: – risques de blessures corporelles et de dégâts matériels. Veuillez suivre les instructions.



Attention: – surface à température élevée. Évitez le contact. La température des surfaces est élevée et leur contact peut provoquer des blessures corporelles.



Attention: – présence de tensions dangereuses. Pour éviter les risques d'électrocution et de danger pour la santé physique, veuillez suivre les instructions.



MARCHE – Votre système est sous tension (courant alternatif).

Un des symboles suivants sera peut-être utilisé en fonction du type d'interrupteur de votre système:



ARRET - Votre système est hors tension (courant alternatif).



VEILLEUSE – L'interrupteur Marche/Veilleuse est en position « Veilleuse ».

Modification du matériel

Ne pas apporter de modification mécanique ou électrique au matériel. Sun Microsystems n'est pas responsable de la conformité réglementaire d'un produit Sun qui a été modifié.

Positionnement d'un produit Sun



Attention: – pour assurer le bon fonctionnement de votre produit Sun et pour l'empêcher de surchauffer, il convient de ne pas obstruer ni recouvrir les ouvertures prévues dans l'appareil. Un produit Sun ne doit jamais être placé à proximité d'un radiateur ou d'une source de chaleur.



Attention: – Le niveau de pression acoustique au poste de travail s'élève selon la norme DIN 45 635 section 1000, à 70 dB (A) ou moins.

Conformité SELV

Sécurité : les raccordements E/S sont conformes aux normes SELV.

Connexion du cordon d'alimentation



Attention: – les produits Sun sont conçus pour fonctionner avec des alimentations monophasées munies d'un conducteur neutre mis à la terre. Pour écarter les risques d'électrocution, ne pas brancher de produit Sun dans un autre type d'alimentation secteur. En cas de doute quant au type d'alimentation électrique du local, veuillez vous adresser au directeur de l'exploitation ou à un électricien qualifié.



Attention: – tous les cordons d'alimentation n'ont pas forcément la même puissance nominale en matière de courant. Les rallonges d'usage domestique n'offrent pas de protection contre les surcharges et ne sont pas prévues pour les systèmes d'ordinateurs. Ne pas utiliser de rallonge d'usage domestique avec votre produit Sun.



Attention: – votre produit Sun a été livré équipé d'un cordon d'alimentation à trois fils (avec prise de terre). Pour écarter tout risque d'électrocution, branchez toujours ce cordon dans une prise mise à la terre.

L'avertissement suivant s'applique uniquement aux systèmes équipés d'un interrupteur VEILLEUSE:



Attention: – le commutateur d'alimentation de ce produit fonctionne comme un dispositif de mise en veille uniquement. C'est la prise d'alimentation qui sert à mettre le produit hors tension. Veuillez donc à installer le produit à proximité d'une prise murale facilement accessible. Ne connectez pas la prise d'alimentation lorsque le châssis du système n'est plus alimenté.

Batterie au lithium



Attention: – sur les cartes CPU Sun, une batterie au lithium (référence MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, ou MK48T08.) a été moulée dans l'horloge temps réel SGS. Les batteries ne sont pas des pièces remplaçables par le client. Elles risquent d'exploser en cas de mauvais traitement. Ne pas jeter la batterie au feu. Ne pas la démonter ni tenter de la recharger.

Bloc-batterie



Attention: – Les unités Ultra 5 contiennent une batterie étanche au plomb (produits énergétiques portatifs n°TLC02V50). Il existe un risque d'explosion si ce bloc-batterie est manipulé de façon erronée ou mal mis en place. Ne remplacez ce bloc que par un bloc-batterie Sun Microsystems du même type. Ne le démontez pas et n'essayez pas de le recharger hors du système. Ne faites pas brûler la batterie mais mettez-la au rebut conformément aux réglementations locales en vigueur.

Couvercle

Pour ajouter des cartes, de la mémoire, ou des unités de stockage internes, vous devrez démonter le couvercle de l'unité système Sun. Ne pas oublier de remettre ce couvercle en place avant de mettre le système sous tension.



Attention: – Il est dangereux de faire fonctionner un produit Sun sans le couvercle en place. Si l'on néglige cette précaution, on encourt des risques de blessures corporelles et de dégâts matériels.

Conformité aux certifications Laser

Les produits Sun qui font appel aux technologies lasers sont conformes aux normes de la classe 1 en la matière.

Class 1 Laser Product
Luokan 1 Laserlaitte
Klasse 1 Laser Apparat
Laser Klasse 1

CD-ROM



Attention: – L'utilisation de contrôles, de réglages ou de performances de procédures autre que celle spécifiée dans le présent document peut provoquer une exposition à des radiations dangereuses.

Normativas de seguridad

El siguiente texto incluye las medidas de seguridad que se deben seguir cuando se instale algún producto de Sun Microsystems.

Precauciones de seguridad

Para su protección observe las siguientes medidas de seguridad cuando manipule su equipo:

- Siga todas las avisos e instrucciones marcados en el equipo.
- Asegúrese de que el voltaje y la frecuencia de la red eléctrica concuerdan con las descritas en las etiquetas de especificaciones eléctricas del equipo.
- No introduzca nunca objetos de ningún tipo a través de los orificios del equipo. Pueden haber voltajes peligrosos. Los objetos extraños conductores de la electricidad pueden producir cortocircuitos que provoquen un incendio, descargas eléctricas o daños en el equipo.

Símbolos

En este libro aparecen los siguientes símbolos:



Precaución – Existe el riesgo de lesiones personales y daños al equipo. Siga las instrucciones.



Precaución – Superficie caliente. Evite el contacto. Las superficies están calientes y pueden causar daños personales si se tocan.



Precaución – Voltaje peligroso presente. Para reducir el riesgo de descarga y daños para la salud siga las instrucciones.



Encendido – Aplica la alimentación de CA al sistema.

Según el tipo de interruptor de encendido que su equipo tenga, es posible que se utilice uno de los siguientes símbolos:



Apagado - Elimina la alimentación de CA del sistema.



En espera – El interruptor de Encendido/En espera se ha colocado en la posición de En espera.

Modificaciones en el equipo

No realice modificaciones de tipo mecánico o eléctrico en el equipo. Sun Microsystems no se hace responsable del cumplimiento de las normativas de seguridad en los equipos Sun modificados.

Ubicación de un producto Sun



Precaución – Para asegurar la fiabilidad de funcionamiento de su producto Sun y para protegerlo de sobrecalentamientos no deben obstruirse o taparse las rejillas del equipo. Los productos Sun nunca deben situarse cerca de radiadores o de fuentes de calor.



Precaución – De acuerdo con la norma DIN 45 635, Parte 1000, se admite un nivel de presión acústica para puestos de trabajo máximo de 70Db(A).

Cumplimiento de la normativa SELV

El estado de la seguridad de las conexiones de entrada/salida cumple los requisitos de la normativa SELV.

Conexión del cable de alimentación eléctrica



Precaución – Los productos Sun están diseñados para trabajar en una red eléctrica monofásica con toma de tierra. Para reducir el riesgo de descarga eléctrica, no conecte los productos Sun a otro tipo de sistema de alimentación eléctrica. Póngase en contacto con el responsable de mantenimiento o con un electricista cualificado si no está seguro del sistema de alimentación eléctrica del que se dispone en su edificio.



Precaución – No todos los cables de alimentación eléctrica tienen la misma capacidad. Los cables de tipo doméstico no están provistos de protecciones contra sobrecargas y por tanto no son apropiados para su uso con computadores. No utilice alargadores de tipo doméstico para conectar sus productos Sun.



Precaución – Con el producto Sun se proporciona un cable de alimentación con toma de tierra. Para reducir el riesgo de descargas eléctricas conéctelo siempre a un enchufe con toma de tierra.

La siguiente advertencia se aplica solamente a equipos con un interruptor de encendido que tenga una posición "En espera":



Precaución – El interruptor de encendido de este producto funciona exclusivamente como un dispositivo de puesta en espera. El enchufe de la fuente de alimentación está diseñado para ser el elemento primario de desconexión del equipo. El equipo debe instalarse cerca del enchufe de forma que este último pueda ser fácil y rápidamente accesible. No conecte el cable de alimentación cuando se ha retirado la fuente de alimentación del chasis del sistema.

Batería de litio



Precaución – En las placas de CPU Sun hay una batería de litio insertada en el reloj de tiempo real, tipo SGS Núm. MK48T59Y, MK48TXXB-XX, MK48T18-XXXPCZ, M48T59W-XXXPCZ, o MK48T08. Las baterías no son elementos reemplazables por el propio cliente. Pueden explotar si se manipulan de forma errónea. No arroje las baterías al fuego. No las abra o intente recargarlas.

Paquete de pilas



Precaución – Las unidades Ultra 5 contienen una pila de plomo sellada, Productos de energía portátil nº TLC02V50. Existe riesgo de estallido si el paquete de pilas se maneja sin cuidado o se sustituye de manera indebida. Las pilas sólo deben sustituirse por el mismo tipo de paquete de pilas de Sun Microsystems. No las desmonte ni intente recargarlas fuera del sistema. No arroje las pilas al fuego. Deséchelas siguiendo el método indicado por las disposiciones vigentes.

Tapa de la unidad del sistema

Debe quitar la tapa del sistema cuando sea necesario añadir tarjetas, memoria o dispositivos de almacenamiento internos. Asegúrese de cerrar la tapa superior antes de volver a encender el equipo.



Precaución – Es peligroso hacer funcionar los productos Sun sin la tapa superior colocada. El hecho de no tener en cuenta esta precaución puede ocasionar daños personales o perjudicar el funcionamiento del equipo.

Aviso de cumplimiento con requisitos de láser

Los productos Sun que utilizan la tecnología de láser cumplen con los requisitos de láser de Clase 1.

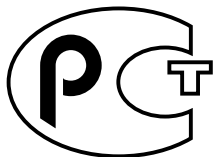
Class 1 Laser Product
Luokan 1 Laserlaite
Klasse 1 Laser Apparat
Laser Klasse 1

CD-ROM



Precaución – El manejo de los controles, los ajustes o la ejecución de procedimientos distintos a los aquí especificados pueden exponer al usuario a radiaciones peligrosas.

GOST-R Certification Mark



Nordic Lithium Battery Cautions

Norge



ADVARSEL – Litiumbatteri —
Ekspløsjonsfare. Ved utskifting benyttes kun
batteri som anbefalt av apparatfabrikanten.
Brukt batteri returneres apparatleverandøren.

Sverige



VARNING – Explosionsfara vid felaktigt
batteribyte. Använd samma batterityp eller
en ekvivalent typ som rekommenderas av
apparatillverkaren. Kassera använt batteri
enligt fabrikantens instruktion.

Danmark



ADVARSEL! – Litiumbatteri —
Ekspløsjonsfare ved fejlagtig håndtering.
Udskiftning må kun ske med batteri af samme
fabrikat og type. Levér det brugte batteri
tilbage til leverandøren.

Suomi



VAROITUS – Paristo voi räjähtää, jos se on
virheellisesti asennettu. Vaihda paristo
ainoastaan laitevalmistajan suosittelemaan
tyyppiin. Hävitä käytetty paristo valmistajan
ohjeiden mukaisesti.

Product Description

The Ultra 5 workstations are uniprocessor devices that use the family of UltraSPARC™ processors. They support high-performance CPU module (UltraSPARC-III) processing. FIGURE 1-1 shows the Ultra 5 system.

This chapter contains the following topics:

- Section 1.1 “Feature Overview” on page 1-3
- Section 1.2 “I/O Devices” on page 1-4
- Section 1.3 “System Description” on page 1-5
- Section 1.4 “Replaceable Components” on page 1-6

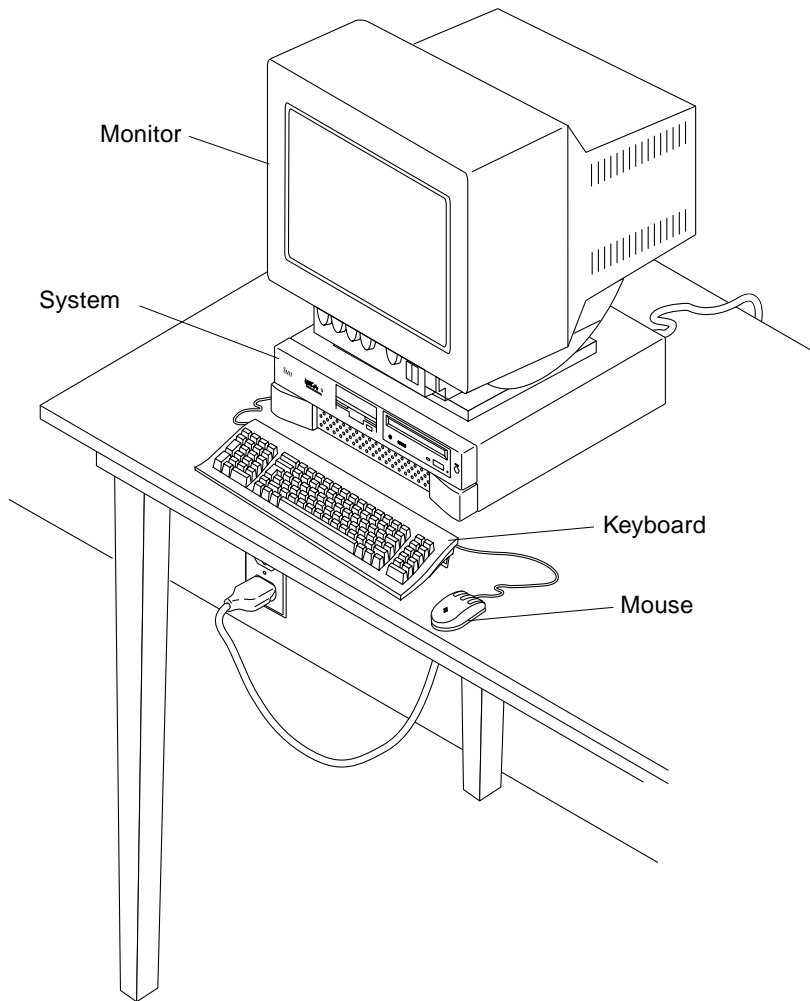


FIGURE 1-1 Ultra 5 System

1.1 Feature Overview

The Ultra 5 system provides the following features:

- Desktop-style enclosure
- 200-watt power supply
- One hard drive bay (a second, optional hard drive bracket can be added)
- Up to two enhanced integrated drive electronic (EIDE) hard drives
- CD-ROM drive
- CD quality audio
- 1.44-megabyte (Mbyte) manual-eject diskette drive
- Front access Personal Computer Memory Card International Association (PCMCIA) bay (two Type II or one Type III slot(s))
- UltraSPARC-IIi processor module (CPU module)/advanced PCI bridge (APB) application-specific integrated circuit (ASIC)
- 440-MHz, 360-MHz, 333-MHz, or 270-MHz CPU module
- Three PCI slots (PCI riser board expansion with two long PCI cards and one short PCI card)
- 33-megahertz (MHz), 32-bit peripheral component interconnect (PCI)
- PGX on-board graphics or PGX24 PCI on-board graphics

Note – Systems with PGX24 graphics have "PGX24" or "Series 3" printed on the serial number label that is affixed to the front bezel.

- Two serial ports
- One parallel port
- 10-/100-megabit per second Ethernet

Note – This manual covers all versions of the Ultra 5 system. You can determine which version you have from the information printed on the serial number label that is affixed to the front bezel. If the label contains:

- * Serial number only - Ultra 5 system,
 - * Serial number and PGX24 - Ultra 5 Model 270 or Model 333,
 - * Serial number and Series 3 - Ultra 5 Model 360 or Model 440
-

1.2 I/O Devices

The Ultra 5 systems use the I/O devices listed in TABLE 1-1.

TABLE 1-1 Supported I/O Devices

I/O Device	Description
17-inch (43-cm) color monitor	1280 x 1024 resolution, 76- or 66-Hz refresh rate, 110 dots per inch (dpi)
20-inch (51-cm) color monitor	1152 x 900 resolution, 76- or 66-Hz refresh rate, 84 dpi 1280 x 1024 resolution, 76- or 66-Hz refresh rate, 93 dpi
24-inch (61-cm) color monitor	960 x 680 resolution, 112-Hz refresh rate, 70 dpi 1920 x 1200 resolution, 70-Hz refresh rate, 103 dpi 1600 x 1000 resolution, 76- or 66-Hz refresh rate, 86 dpi 1400 x 900 resolution, 76-Hz refresh rate, 77 dpi 1280 x 800 resolution, 76-Hz refresh rate, 69 dpi
Keyboard	Sun Type-5: AT 101 or UNIX layout available; Sun I/O Type-6: AT 101 layout
Mouse	Sun Type-5: 3-button, optomechanical mouse Sun Type-6: 3-button, crossbow mouse

1.3 System Description

System components are housed in a desktop-style enclosure. Overall chassis dimensions for the Ultra 5 system are listed in the following table.

TABLE 1-2 Ultra 5 System Physical Dimensions

Unit	Width	Height	Depth
Ultra 5 desktop enclosure	17.17 inches (43.60 cm)	4.31 inches (10.95 cm)	16.69 inches (42.40 cm)

System electronics are contained on a single printed circuit board (motherboard). The motherboard contains the CPU module, memory modules, system control ASICs, and I/O ASICs.

The following figures illustrate the Ultra 5 system front and back views.

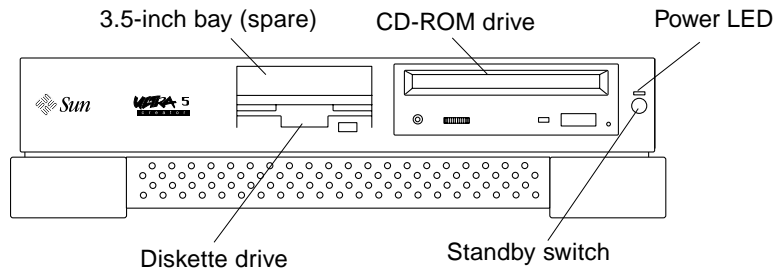


FIGURE 1-2 Ultra 5 System Front View

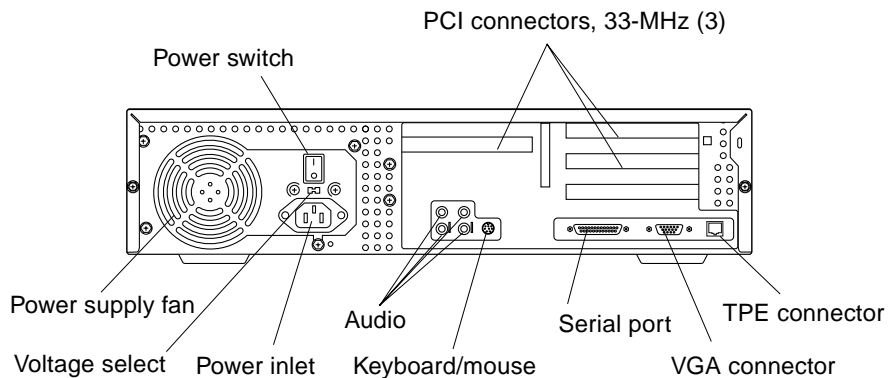


FIGURE 1-3 Ultra 5 System Back View

1.4 Replaceable Components

The following table lists the Ultra 5 system replaceable components. A brief description of each listed component is also provided.

Note – Consult your authorized Sun sales representative or service provider prior to ordering a replacement part.

TABLE 1-3 Ultra 5 System Replaceable Components

Component	Description
16-Mbyte DIMM	60-ns, 16-Mbyte DIMM
32-Mbyte DIMM	60-ns, 32-Mbyte DIMM
64-Mbyte DIMM	60-ns, 64-Mbyte DIMM
128-Mbyte DIMM	60-ns, 128-Mbyte DIMM
256-Mbyte DIMM	60-ns, 256-Mbyte DIMM
32-Mbyte DIMM	50-ns, 32-Mbyte DIMM
64-Mbyte DIMM	50-ns, 64-Mbyte DIMM
128-Mbyte DIMM	50-ns, 128-Mbyte DIMM
256-Mbyte DIMM	50-ns, 256-Mbyte DIMM
CPU module	270-MHz, 256-kilobyte (Kbyte) external cache
CPU module	333-MHz, 500-Kbyte external cache
CPU module	360-MHz, 256-Kbyte external cache
CPU module	360-MHz, 2-Mbyte external cache
CPU module	440-MHz, 2-Mbyte external cache
CPU fan assembly	CPU fan, 80-mm
Motherboard	System board

TABLE 1-3 Ultra 5 System Replaceable Components *(Continued)*

Component	Description
NVRAM/TOD	Time of day, 48T59, with carrier
PCI card	Generic
PCI riser board	3-slot riser expansion board
Hard drive	Disk drive, 4.3-Gbyte, 5400 RPM
Hard drive	Disk drive, 8.4-Gbyte, 5400 RPM
Hard drive	Disk drive, 9.1-Gbyte, 7200 RPM
CD-ROM drive	CD-ROM drive
Manual eject floppy	Diskette drive
Power supply	Power supply, 200 watts
Front bezel	System front bezel
Audio cable assembly	Cables for audio subsystem
Service kit	Includes diskette drive cable assembly, hard drive cable assembly, CD-ROM drive cable assembly, and serial/parallel cable assembly.

Note – The Ultra 5 diskette drive cable assembly, hard drive cable assembly, CD-ROM drive cable assembly, and serial/parallel cable assembly are part of service kit 370-3266 and cannot be ordered separately.

SunVTS Overview

This chapter contains an overview of the SunVTS™ diagnostic tool.

This chapter contains the following topics:

- Section 2.1 “SunVTS Description” on page 2-1
- Section 2.1.1 “SunVTS Requirements” on page 2-2
- Section 2.1.2 “SunVTS References” on page 2-2

2.1 SunVTS Description

SunVTS is Sun’s online Validation Test Suite. SunVTS is a comprehensive software diagnostic package that tests and validates hardware by verifying the connectivity and functionality of most hardware controllers, devices, and platforms.

SunVTS can be tailored to run on various types of systems ranging from desktops to servers with many customizable features to meet the varying requirements of many diagnostic situations.

Use SunVTS to validate a system during development, production, receiving inspection, troubleshooting, periodic maintenance, and system or subsystem stressing.

SunVTS executes multiple diagnostic tests from one graphical user interface (GUI) that provides test configuration and status monitoring. The user interface can run in the CDE or OPEN LOOK environments or through a TTY-mode interface for situations when running a GUI is not possible.

The SunVTS interface can run on one system to display the SunVTS test session of another system on the network.

SunVTS is distributed with each SPARC™ Solaris™ operating environment release. It is located on the *Sun Computer Systems Supplement CD*.

2.1.1 SunVTS Requirements

Your system must meet the following requirements to run SunVTS:

- The SunVTS packages must be installed. The main package is SUNWvts. There are additional supporting packages that differ based on the version of the Solaris operating environment that is installed. For specific details, refer to the corresponding SunVTS documentation (described below).
- The system must be booted to the multiuser level (level 3).
- To run SunVTS with a GUI, that GUI must be installed. Otherwise, run SunVTS with the TTY-mode interface.

2.1.2 SunVTS References

For more information about using SunVTS, refer to the SunVTS documentation that corresponds to the Solaris software version that you are running.

The SunVTS documents are part of the *Solaris on Sun Hardware AnswerBook* collection. This AnswerBook collection is preinstalled on the hard disk of new systems. It is also distributed on the *Software Supplement CD* that is part of each Solaris Media Kit release and is also accessible at <http://docs.sun.com>.

The following list describes the content of each SunVTS document:

- *SunVTS User's Guide* – describes how to install, configure, and run the SunVTS diagnostic software.
- *SunVTS Quick Reference Card* – provides an overview of how to use the SunVTS CDE interface.
- *SunVTS Test Reference Manual* – provides details about each individual SunVTS test.

Power-On Self-Test

This chapter describes how to initiate power-on self-test (POST) diagnostics.

This chapter contains the following topics:

- Section 3.1 “POST Overview” on page 3-1
- Section 3.2 “Pre-POST Preparation” on page 3-2
- Section 3.3 “Initializing POST” on page 3-5
- Section 3.4 “Maximum and Minimum POST Levels” on page 3-7
- Section 3.5 “Bypassing POST” on page 3-22
- Section 3.6 “Resetting Variables to Default Settings” on page 3-22
- Section 3.7 “Initializing Motherboard POST” on page 3-23

3.1 POST Overview

POST is useful in determining if a portion of the system has failed and should be replaced. POST detects approximately 95 percent of system faults and is located in the motherboard OpenBoot™ PROM (OBP). The setting of two NVRAM variables, `diag-switch?` and `diag-level`, determines whether POST is executed and to what level (see Section 3.3 “Initializing POST” on page 3-5).

3.2 Pre-POST Preparation

Pre-POST preparation includes:

- Setting up a TIP connection to another workstation or terminal to view POST progress and error messages. See Section 3.2.1 “Setting Up a TIP Connection” on page 3-2.
- Verifying baud rates between a workstation and a monitor or terminal. See Section 3.2.2 “Verifying the Baud Rate” on page 3-4.

If a terminal or a monitor is not connected to serial port A (default port) of a workstation to be tested, the keyboard light-emitting diodes (LEDs) are used to determine error conditions. See Section 3.4.3 “POST Progress and Error Reporting” on page 3-19.

3.2.1 Setting Up a TIP Connection

A TIP connection enables a remote shell window to be used as a terminal to display test data from a tested system. Serial port A or serial port B of a tested system is connected to another Sun workstation monitor or TTY-type terminal.

To set up a TIP connection, proceed as follows:

1. **Connect serial port A of the tested system to serial port B of a second Sun workstation using a serial null modem cable (connect cable pins 2-3, 3-2, 7-20, and 20-7). See FIGURE 3-1.**

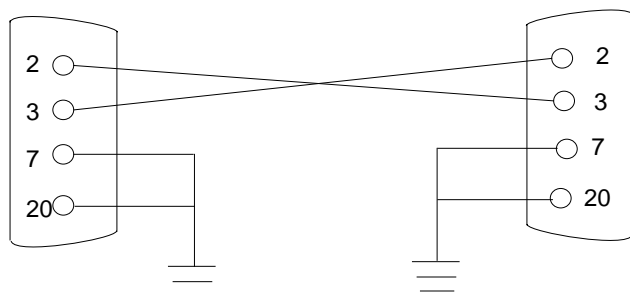


FIGURE 3-1 Setting Up a TIP Connection

2. **At the second Sun workstation, check the `/etc/remote` file by changing to the `/etc` directory and editing the `remote` file. The following sample `remote` file text shows connection to serial port B:**

```
hardware: /dv=/dev/term/b:br#9600:el=^C^S^Q^U^D:ie=%$:oe=^D:
```

3. **To use serial port A:**

- a. **Copy and paste the `remote` file text that shows connection to serial port B.**
- b. **Modify the pasted text as follows to change the connection to serial port A:**

```
hardware: /dv=/dev/term/a:br#9600:el=^C^S^Q^U^D:ie=%$:oe=^D:
```

4. **In a shell window on the second Sun workstation, type `tip hardware`.**

```
% tip hardware
connected
```

The shell window becomes a TIP window directed to serial port A of the tested system. When power is applied to the tested system, POST messages are displayed in this shell window.

5. **When POST is completed, disconnect the TIP connection as follows:**

- a. **Open another shell window at the second workstation.**
- b. **Type `ps -a` to view the active TIP line and process ID (PID) number.**
- c. **Type the following to disconnect the TIP hardware process.**

```
% kill -9 PID#
```

3.2.2 Verifying the Baud Rate

To verify the baud rate between the tested system and a terminal or another Sun workstation monitor:

1. **Open a shell window.**
2. **Type** `eeeprom`.
3. **Verify the following serial port default settings:**

```
ttyb-mode = 9600,8,n,1  
ttya-mode = 9600,8,n,1
```

Note – Ensure that the settings are consistent with TTY-type terminal or workstation monitor settings.

3.3 Initializing POST

POST can be initialized in two ways:

- By setting the `diag-switch?` to `true` and the `diag-level` to `max` or `min`, followed by power-cycling the system
- By simultaneously pressing the keyboard Stop and D keys while power is applied to the system

To set the `diag-switch?` to `true` and power-cycle the system:

1. At the system prompt, type:

```
ok% setenv diag-switch? true
```

- 2. At the keyboard (Sun Type-5 or Sun I/O Type-6), power-cycle the system by simultaneously pressing the Shift key and the Standby (Power) key. After a few seconds, press the Standby (Power) key again (see FIGURE 3-2 or FIGURE 3-3).**

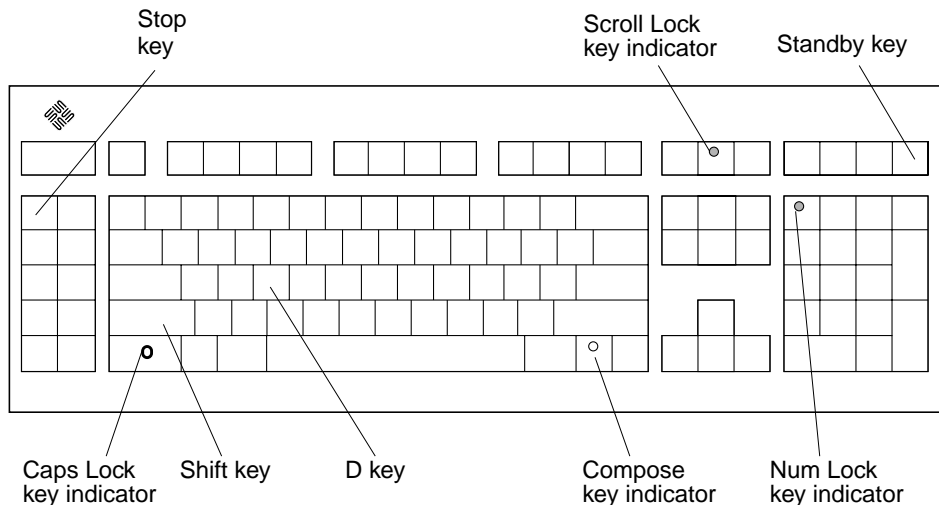


FIGURE 3-2 Sun Type-5 Keyboard

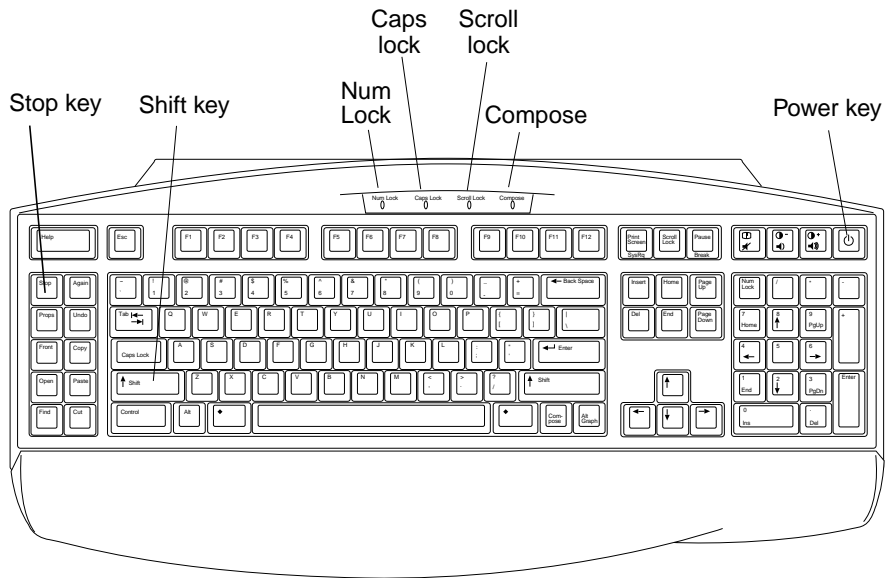


FIGURE 3-3 Sun I/O Type-6 Keyboard

3. Verify the following:

- The display prompt is no longer displayed.
- The monitor power-on indicator flashes on and off.
- The keyboard Caps Lock key indicator flashes on and off.

4. When the POST is complete, type the following at the system prompt:

```
ok% setenv diag-switch? false
```

3.4 Maximum and Minimum POST Levels

Two levels of POST are available: maximum (max) level and minimum (min) level. The system initiates the selected level of POST based upon the setting of `diag-level`, an NVRAM variable. The default setting for `diag-level` is `max`.

To set the `diag-level` variable to `min` before power-cycling the system, type:

```
ok% setenv diag-level min
```

To return to the default setting:

```
ok% setenv diag-level max
```

An example of a `max`-level POST output on serial port A is provided in Section 3.4.1 “`diag-level` Variable Set to `max`” on page 3-7. An example of a `min`-level POST output on serial port A is provided in Section 3.4.2 “`diag-level` Variable Set to `min`” on page 3-15.

3.4.1 `diag-level` Variable Set to `max`

When you set the `diag-level` variable to `max`, POST enables an extended set of diagnostic-level tests. This mode requires approximately two minutes to complete (with 128 Mbytes of DIMM installed). CODE EXAMPLE 3-1 shows a typical serial port A POST output with `diag-level` set to `max`.

Note – Video output is disabled while POST is initialized.

CODE EXAMPLE 3-1 `diag-level` Variable Set to `max`

```
Power On Selftest Completed
Software Power ON0.0000.0000.0000 ffff.ffff.f00b.4100
0002.3333.0200.001b

@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Clearing E$ Tags Done
Clearing I/D TLBs Done
Probing Memory Done
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
MEM BASE = 0000.0000.0000.0000
MEM SIZE = 0000.0000.1000.0000
11-Column Mode Enabled
MMUs ON
Copy Done
PC = 0000.01ff.f000.20ec
PC = 0000.0000.0000.2130
Decompressing into Memory Done
Size = 0000.0000.0007.5300
ttya initialized
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2 0 + 0 : 0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2 0 + 0 : 0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there

Sun Ultra 5/10 UPA/PCI (UltraSPARC-III 300MHz), No Keyboard
OpenBoot 3.9 P2.1 , 256 MB memory installed, Serial #9337477.
Ethernet address 8:0:20:8e:7a:85, Host ID: 808e7a85.

ok Hardware Power ON

@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
```


CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
Probing keyboard Done
%o0 = 0000.0000.0000.4001

Executing Power On SelfTest

@(#) Sun Ultra 5/10 (Darwin) POST 2.1.1 (Build No. 293) 08/21/97:
15:59

CPU: UltraSPARC-LC (MHz: 301 Ecache Size: 512KB)

Init POST BSS
  Init System BSS
NVRAM
  NVRAM Battery Detect Test
  NVRAM Scratch Addr Test
  NVRAM Scratch Data Test
DMMU TLB Tags
  DMMU TLB Tag Access Test
DMMU TLB RAM
  DMMU TLB RAM Access Test
Probe Ecache
  Probe Ecache
Ecache Tests
  Ecache RAM Addr Test
  Ecache Tag Addr Test
  Ecache RAM Test
  Ecache Tag Test
All CPU Basic Tests
  V9 Instruction Test
  CPU Tick and Tick Compare Reg Test
  CPU Soft Trap Test
  CPU Softint Reg and Int Test
All Basic MMU Tests
  DMMU Primary Context Reg Test
  DMMU Secondary Context Reg Test
  DMMU TSB Reg Test
  DMMU Tag Access Reg Test
  DMMU VA Watchpoint Reg Test
  DMMU PA Watchpoint Reg Test
  IMMU TSB Reg Test
  IMMU Tag Access Reg Test
All Basic Cache Tests
  Dcache RAM Test
  Dcache Tag Test
  Icache RAM Test
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
  Icache Tag Test
  Icache Next Test
  Icache Predecode Test
Sabre MCU Control & Status Regs Init and Tests
  Init Sabre MCU Control & Status Regs
  Initializing SC registers in SabreIO
Memory Probe and Init
  Probe Memory
  INFO:      256MB Bank 0
  bank 2:   0MB
frequency = 301, refvalue = 146, no_of_banks = 1
INFO: MC0 = 0x00000000.80001192, MC1 = 0x00000000.0c4aab14
  Malloc Post Memory
  Memory Addr w/ Ecache
  Load Post In Memory
  Run POST from MEM
  .....
loaded POST in memory
  Map PROM/STACK/NVRAM in DMMU
  Update Master Stack/Frame Pointers
All FPU Basic Tests
  FPU Regs Test
  FPU Move Regs Test
  FPU State Reg Test
  FPU Functional Test
  FPU Trap Test
UPA Data Bus Line Test
Memory Tests
  Init Memory
  INFO:      256MB at bank 0 stack 0 (2 dimms per bank)
  .....
  .....
  INFO:      0MB at bank 0 stack 1
  INFO:      0MB at bank 2 stack 0
  INFO:      0MB at bank 2 stack 1
  Memory Addr w/ Ecache Test
  INFO:      256MB at bank 0 stack 0 (2 dimms per bank)
  INFO:      0MB at bank 0 stack 1
  INFO:      0MB at bank 2 stack 0
  INFO:      0MB at bank 2 stack 1
  ECC Memory Addr Test
  INFO:      256MB at bank 0 stack 0 (2 dimms per bank)
  INFO:      0MB at bank 0 stack 1
  INFO:      0MB at bank 2 stack 0
  INFO:      0MB at bank 2 stack 1
  Block Memory Addr Test
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
  INFO:    256MB at bank 0 stack 0 (2 dimms per bank)
  INFO:    0MB at bank 0 stack 1
  INFO:    0MB at bank 2 stack 0
  INFO:    0MB at bank 2 stack 1
Block Memory Test
  INFO:    256MB at bank 0 stack 0 (2 dimms per bank)
Write 0x33333333.33333333
.....
.....
Read
.....
.....
Write 0x55555555.55555555
.....
.....
Read
.....
.....
Write 0xcccccccc.cccccccc
.....
.....
Read
.....
.....
Write 0xaaaaaaaa.aaaaaaaa
.....
.....
Read
.....
.....

  INFO:    0MB at bank 0 stack 1
  INFO:    0MB at bank 2 stack 0
  INFO:    0MB at bank 2 stack 1
ECC Blk Memory Test
  INFO:    256MB at bank 0 stack 0 (2 dimms per bank)
Write 0xa5a5a5a5.a5a5a5a5
.....
.....
Read
.....
.....
Write 0x96969696.96969696
.....
.....
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
Read
.....
.....
Write 0xbbbbbbbb.bbbbbbbb
.....
.....
Read
.....
.....
Write 0xdddddddd.dddddddd
.....
.....
Read
.....
.....
```

```
INFO:      OMB at bank 0 stack 1
INFO:      OMB at bank 2 stack 0
INFO:      OMB at bank 2 stack 1
```

```
All Basic Sabre MMU Tests
  Init Sabre
  PIO Decoder and BCT Test
  PCI Byte Enable Test
  Interrupt Map (short) Reg Test
  Interrupt Set/Clr Reg Test
  Sabre IOMMU Regs Test
  Sabre IOMMU RAM Address Test
  Sabre IOMMU CAM Address Test
  IOMMU TLB Compare Test
  IOMMU TLB Flush Test
  PBMA PCI Config Space Regs Test
  PBMA Control/Status Reg Test
  PBMA Diag Reg Test
  Sabre IO Regs Test
All Advanced CPU Tests
  DMMU Hit/Miss Test
  IMMU Hit/Miss Test
  DMMU Little Endian Test
  IU ASI Access Test
  FPU ASI Access Test
  Ecache Thrash Test
All CPU Error Reporting Tests
  CPU Data Access Trap Test
  CPU Addr Align Trap Test
  DMMU Access Priv Page Test
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
  DMMU Write Protected Page Test
All Advanced Sabre IOMMU Tests
  Init Sabre
  Consist DMA Rd, IOMMU miss Ebus Test
  Consist DMA Rd, IOMMU hit Ebus Test
  Consist DMA Wr, IOMMU miss Ebus Test
  Consist DMA Wr, IOMMU hit Ebus Test
  Pass-Thru DMA Rd, Ebus device Test
  Pass-Thru DMA Wr, Ebus device Test
  Consist DMA Rd, IOMMU LRU Lock Ebus Test
  Consist DMA Wr, IOMMU LRU Locked Ebus Test
All Basic Cheerio Tests
  Cheerio Ebus PCI Config Space Test
  Cheerio Ethernet PCI Config Space Test
  Cheerio Init
All Sabre IOMMU Error Reporting Tests
  Init Sabre
  PIO Read, Master Abort Test
  PIO Read, Target Abort Test

Status of this POST run:PASS
manufacturing mode=OFF
Time Stamp [hour:min:sec] 00:02:01 [month/date year] 08/22 1997

Power On Selftest Completed
Software Power ON0.0000.0000.0000 ffff.ffff.f00b.4100
0002.3333.0200.001b

@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Clearing E$ Tags Done
Clearing I/D TLBs Done
Probing Memory Done
MEM BASE = 0000.0000.0000.0000
MEM SIZE = 0000.0000.1000.0000
11-Column Mode Enabled
MMUs ON
Copy Done
PC = 0000.01ff.f000.20ec
PC = 0000.0000.0000.2130
Decompressing into Memory Done
Size = 0000.0000.0007.5300
```

CODE EXAMPLE 3-1 diag-level Variable Set to max (Continued)

```
Power On Selftest Completed
ttya initialized
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2  0 +  0 :  0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2  SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3  ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1  Nothing there
Probing /pci@1f,0/pci@1 at Device 2  Nothing there
Probing /pci@1f,0/pci@1 at Device 3  Nothing there
Probing /pci@1f,0/pci@1 at Device 4  Nothing there
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2  0 +  0 :  0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2  SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3  ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1  Nothing there
Probing /pci@1f,0/pci@1 at Device 2  Nothing there
Probing /pci@1f,0/pci@1 at Device 3  Nothing there
Probing /pci@1f,0/pci@1 at Device 4  Nothing there

Sun Ultra 5/10 UPA/PCI (UltraSPARC-III 300MHz), No Keyboard
OpenBoot 3.9 P2.1 , 256 MB memory installed, Serial #9337477.
Ethernet address 8:0:20:8e:7a:85, Host ID: 808e7a85.

ok
```

3.4.2 diag-level Variable Set to min

When you set the `diag-level` variable to `min`, POST enables an abbreviated set of diagnostic-level tests. This mode requires approximately one minute to complete (with 128 Mbytes of DIMM installed). CODE EXAMPLE 3-2 shows a serial port A POST output with `diag-level` set to `min`.

Note – Video output is disabled while POST is initialized.

CODE EXAMPLE 3-2 `diag-level` Variable Set to min

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Probing keyboard Done
%o0 = 0000.0000.0000.2001

Executing Power On SelfTest

@(#) Sun Ultra 5/10 (Darwin) POST 2.1.1 (Build No. 293) 08/21/97:
15:59

CPU: UltraSPARC-LC (MHz: 301 Ecache Size: 512KB)

Init POST BSS
  Init System BSS
NVRAM
  NVRAM Battery Detect Test
  NVRAM Scratch Addr Test
  NVRAM Scratch Data Test
DMMU TLB Tags
  DMMU TLB Tag Access Test
DMMU TLB RAM
  DMMU TLB RAM Access Test
Probe Ecache
  Probe Ecache
Ecache Tests
  Ecache RAM Addr Test
  Ecache Tag Addr Test
All CPU Basic Tests
  V9 Instruction Test
  CPU Soft Trap Test
  CPU Softint Reg and Int Test
All Basic MMU Tests
  DMMU Primary Context Reg Test
  DMMU Secondary Context Reg Test
```

CODE EXAMPLE 3-2 diag-level Variable Set to min (Continued)

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
    DMMU TSB Reg Test
    DMMU Tag Access Reg Test
    IMMU TSB Reg Test
    IMMU Tag Access Reg Test
All Basic Cache Tests
    Dcache RAM Test
    Icache RAM Test
Sabre MCU Control & Status Regs Init and Tests
    Init Sabre MCU Control & Status Regs
    Initializing SC registers in SabreIO
Memory Probe and Init
    Probe Memory
    INFO:    256MB Bank 0
    bank 2:  OMB
frequency = 301, refvalue = 146, no_of_banks = 1
INFO: MC0 = 0x00000000.80001192, MC1 = 0x00000000.0c4aab14
    Malloc Post Memory
    Memory Addr w/ Ecache
    Load Post In Memory
    Run POST from MEM
    .....
loaded POST in memory
    Map PROM/STACK/NVRAM in DMMU
    Update Master Stack/Frame Pointers
All FPU Basic Tests
    FPU Regs Test
    FPU Move Regs Test
UPA Data Bus Line Test
Memory Tests
    Init Memory
    INFO:    256MB at bank 0 stack 0 (2 dimms per bank)
    .....
    .....
    .....
    INFO:    OMB at bank 0 stack 1
    INFO:    OMB at bank 2 stack 0
    INFO:    OMB at bank 2 stack 1
    ECC Memory Addr Test
    INFO:    256MB at bank 0 stack 0 (2 dimms per bank)
    INFO:    OMB at bank 0 stack 1
    INFO:    OMB at bank 2 stack 0
    INFO:    OMB at bank 2 stack 1
All Basic Sabre MMU Tests
    Init Sabre
```


CODE EXAMPLE 3-2 diag-level Variable Set to min (Continued)

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
    Interrupt Map (short) Reg Test
    Interrupt Set/Clr Reg Test
    Sabre IOMMU Regs Test
    Sabre IOMMU RAM Address Test
    Sabre IOMMU CAM Address Test
    PBMA PCI Config Space Regs Test
    PBMA Control/Status Reg Test
    PBMA Diag Reg Test
    Sabre IO Regs Test
All Advanced CPU Tests
    IU ASI Access Test
    FPU ASI Access Test
All CPU Error Reporting Tests
    CPU Data Access Trap Test
    CPU Addr Align Trap Test
    DMMU Access Priv Page Test
    DMMU Write Protected Page Test
All Advanced Sabre IOMMU Tests
    Init Sabre
    Consist DMA Rd, IOMMU miss Ebus Test
All Basic Cheerio Tests
    Cheerio Ebus PCI Config Space Test
    Cheerio Ethernet PCI Config Space Test
    Cheerio Init
All Sabre IOMMU Error Reporting Tests
    Init Sabre
    PIO Read, Master Abort Test
    PIO Read, Target Abort Test

Status of this POST run:PASS
manufacturing mode=OFF
Time Stamp [hour:min:sec] 00:10:33 [month/date year] 08/22 1997

Power On Selftest Completed
Software Power ON0.0000.0000.0000 ffff.ffff.f00b.4100
0002.3333.0200.001b

@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Clearing E$ Tags Done
Clearing I/D TLBs Done
```

CODE EXAMPLE 3-2 diag-level Variable Set to min (Continued)

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Probing Memory Done
MEM BASE = 0000.0000.0000.0000
MEM SIZE = 0000.0000.1000.0000
11-Column Mode Enabled
MMUs ON
Copy Done
PC = 0000.01ff.f000.20ec
PC = 0000.0000.0000.2130
Decompressing into Memory Done
Size = 0000.0000.0007.5300
ttya initialized
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2 0 + 0 : 0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 128 + 128 : 256 Megabytes
Probing Memory Bank #2 0 + 0 : 0 Megabytes
Probing Floppy: drive detected on ID0
Probing EBUS SUNW,CS4231
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there

Sun Ultra 5/10 UPA/PCI (UltraSPARC-III 300MHz), No Keyboard
OpenBoot 3.9 P2.1 , 256 MB memory installed, Serial #9337477.
Ethernet address 8:0:20:8e:7a:85, Host ID: 808e7a85.

ok
```

3.4.3 POST Progress and Error Reporting

When POST is initialized, the Caps Lock key on the Sun Type-5 or Type-6 keyboard flashes on and off to indicate that POST is active (see FIGURE 3-2 or FIGURE 3-3). Additional POST progress indications are also visible when a TTY-type terminal or a TIP line is connected between serial port A (default port) of the tested system and a second Sun workstation.

If an error occurs during POST execution, the keyboard Caps Lock key indicator stops flashing and an error code pattern is indicated using the Caps Lock, Compose, Scroll Lock, and Num Lock key indicators (see FIGURE 3-2 or FIGURE 3-3). The error code pattern indicates a particular system hardware failure. If a keyboard error code pattern is displayed, determine the meaning of the pattern by using TABLE 3-1.

Note – An error code might be visible for only a few seconds. Observe the Caps Lock, Compose, Scroll Lock, and Num Lock key indicators closely while POST is active.

TABLE 3-1 Keyboard LED Error Indication Patterns

Caps Lock	Compose	Scroll Lock	Num Lock	Bit Value	Meaning of Pattern
Blink	Off	Off	Off	x000(2)	POST in progress
Off	Off	Off	Off	0000(2)	POST successfully completed
On	Off	Off	On	1001(2)	System board failed
On	Off	On	Off	1010(2)	No memory found
On	Off	On	On	1011(2)	Reserved
On	On	Off	Off	1100(2)	Reserved
On	On	Off	On	1101(2)	Reserved
On	On	On	Off	1110(2)	Bad CPU
On	On	On	On	1111(2)	Reserved

In most cases, POST also attempts to send a failure message to the POST monitoring system. CODE EXAMPLE 3-3 shows the typical appearance of an error message.

Note – The system does not automatically boot if a POST error occurs; it halts at the ok prompt to indicate a failure.

CODE EXAMPLE 3-3 Typical Error Code Failure Message

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
Probing keyboard Done
%o0 = 0000.0000.0000.2001

Executing Power On SelfTest

@(#) Sun Ultra 5/10 (Darwin) POST 2.1.1 (Build No. 293) 08/21/97:
15:59

CPU: UltraSPARC-LC (MHz: 301 Ecache Size: 512KB)

Init POST BSS
  Init System BSS
NVRAM
  NVRAM Battery Detect Test
  NVRAM Scratch Addr Test
  NVRAM Scratch Data Test
DMMU TLB Tags
  DMMU TLB Tag Access Test
DMMU TLB RAM
  DMMU TLB RAM Access Test
Probe Ecache
  Probe Ecache
Ecache Tests
  Ecache RAM Addr Test
  Ecache Tag Addr Test
All CPU Basic Tests
  V9 Instruction Test
  CPU Soft Trap Test
  CPU Softint Reg and Int Test
All Basic MMU Tests
  DMMU Primary Context Reg Test
  DMMU Secondary Context Reg Test
  DMMU TSB Reg Test
  DMMU Tag Access Reg Test
  IMMU TSB Reg Test
  IMMU Tag Access Reg Test
All Basic Cache Tests
  Dcache RAM Test
```

CODE EXAMPLE 3-3 Typical Error Code Failure Message (*Continued*)

```
@(#) Sun Ultra 5/10 UPA/PCI 3.9 P2.1 Version 9 created 1997/08/
05 16:24
    Icache RAM Test
Sabre MCU Control & Status Regs Init and Tests
    Init Sabre MCU Control & Status Regs
    Initializing SC registers in SabreIO
Memory Probe and Init
    Probe Memory
    INFO: All the memory banks in 10 bit column mode
    INFO:      32MB Bank 0
frequency = 301, refvalue = 73, no_of_banks = 2
INFO: MC0 = 0x00000000.80000549, MC1 = 0x00000000.0c4aab14
    Malloc Post Memory
    Memory Addr w/ Ecache
    Load Post In Memory
    Run POST from MEM
    .....
loaded POST in memory
    Map PROM/STACK/NVRAM in DMMU
    Update Master Stack/Frame Pointers
All FPU Basic Tests
    FPU Regs Test
    FPU Move Regs Test
UPA Data Bus Line Test
Memory Tests
    Init Memory
    INFO:      32MB at bank 0 stack 0 (2 dimms per bank)
    .....
    INFO:      0MB at bank 0 stack 1
    ERROR:    DIMM Undetected on some sockets on the board!
    ERROR:    DIMM Undetected on some sockets on the board!
    ECC Memory Addr Test
    INFO:      32MB at bank 0 stack 0 (2 dimms per bank)
    INFO:      0MB at bank 0 stack 1
    ERROR:    DIMM Undetected on some sockets on the board!
    ERROR:    DIMM Undetected on some sockets on the board!
```

3.5 Bypassing POST

To bypass POST:

1. **Prior to powering on the system, press and hold the Stop key on the keyboard (FIGURE 3-2 or FIGURE 3-3).**
2. **With the Stop key held down, turn on the system by pressing the Standby (Power) key.**

Note – Press and hold the Stop key for approximately 5 seconds.

3.6 Resetting Variables to Default Settings

To set the system NVRAM parameters to the original default settings:

1. **Press and hold the Stop and N keys while powering on the system (FIGURE 3-2 or FIGURE 3-3).**
2. **Continue to hold the Stop and N keys until the system banner displays on the monitor.**

3.7 Initializing Motherboard POST

To initialize the motherboard POST:

1. **Power off the system.**
2. **Simultaneously press and hold the Stop and D keys, then press the Standby (Power) key** (FIGURE 3-2 or FIGURE 3-3).

Note – Video output is disabled while motherboard POST is initialized.

Note – To view the POST output results, you must set up a TIP connection. See Section 3.2.1 “Setting Up a TIP Connection” on page 3-2.

3. **Verify the keyboard Caps Lock key LED flashes on and off to indicate the system has enabled POST.**
4. **If a failure occurs during POST, a keyboard key LED other than the Caps Lock key LED might light, indicating a failed system component.**
See Section 3.4.3 “POST Progress and Error Reporting” on page 3-19.

Note – The most probable cause of this type of failure is the motherboard. However, optional system components could also cause POST to fail.

5. **Before replacing the motherboard, remove any optional components, such as PCI cards, then repeat the POST.**

Note – Non-optional components such as DIMMs, the motherboard, the power supply, and the keyboard must be installed for POST to execute properly. Removing the optional system components and retesting the system isolates the possibility that those components are the cause of the failure.

Troubleshooting Procedures

This chapter describes how to troubleshoot possible hardware problems and includes suggested corrective actions.

This chapter contains the following topics:

- Section 4.1 “Power-On Failure” on page 4-2
- Section 4.2 “Video Output Failure” on page 4-3
- Section 4.3 “Hard Drive or CD-ROM Drive Failure” on page 4-4
- Section 4.4 “Power Supply Test” on page 4-5
- Section 4.5 “DIMM Failure” on page 4-7
- Section 4.6 “OpenBoot PROM On-Board Diagnostics” on page 4-8
- Section 4.7 “OpenBoot Diagnostics” on page 4-12

4.1 Power-On Failure

This section provides examples of power-on failure symptoms and suggested actions. Perform the suggested actions until you isolate the problem.

Symptom 1

The system does not power on when you press the keyboard Standby (Power).

Actions

1. **Check the keyboard connection to ensure that the keyboard is properly connected to the system.**
2. **Check the power cord to ensure that it is properly connected to the system and to the wall receptacle.**
3. **Verify that the system power switch is set to on.**
4. **Verify that the wall receptacle is supplying power to the system.**
5. **Check the voltage-line select switch to ensure that it is set correctly.**
6. **Press the front panel standby switch. If the system powers on, the keyboard might be defective or the system might be unable to accept the keyboard power-on signal.**
7. **Power off the system (if necessary) and press the keyboard Standby (Power) key again. If the system powers on, no further action is required. If the system does not power on, the CPU module might not be correctly seated.**
8. **Inspect the CPU module to ensure correct seating.**
9. **Press the keyboard Standby (Power) key again. If the system powers on, no further action is required. If the system does not power on, the keyboard might be defective.**
10. **Connect a spare Sun Type-5 or Sun I/O Type-6 keyboard to the system and press the Standby (Power) key.**
11. **If the system still does not power up, the system power supply might be defective. See Section 4.4 “Power Supply Test” on page 4-5.**

Symptom 2

The system attempts to power on but does not boot or initialize the monitor.

Actions

- 1. Press the keyboard Standby (Power) key and watch the keyboard. The keyboard LEDs should light briefly and you should hear a tone from the keyboard.**
- 2. If you do not hear a keyboard tone or if the keyboard LEDs do not light briefly, the system power supply may be defective. See Section 4.4 “Power Supply Test” on page 4-5.**
- 3. If you hear a keyboard tone and the keyboard LEDs light briefly but the system still fails to initialize, see Section 3.7 “Initializing Motherboard POST” on page 3-23.**

4.2 Video Output Failure

This section provides video output failure symptoms and suggested actions. Perform the suggested actions until you isolate the problem.

Symptom

The video does not display at the system monitor.

Actions

- 1. Check the monitor power cord to ensure that the cord is connected to the monitor and to the wall receptacle.**
- 2. Verify that the wall receptacle is supplying power to the monitor.**
- 3. Check the video cable connection between the monitor and the motherboard video output connector.**
- 4. Check that the CPU module is properly seated.**
- 5. If video still does not display on the monitor, the monitor, graphics card, or motherboard video chip may be defective.**

4.3 Hard Drive or CD-ROM Drive Failure

This section provides hard drive and CD-ROM drive failure symptoms and suggested actions. Perform the suggested actions until you isolate the problem.

Symptoms

- A hard drive read, write, or parity error is reported by the operating system or a customer application.
- A CD-ROM drive read error or parity error is reported by the operating system or a customer application.

Action

- **Replace the drive indicated by the failure message. The operating system identifies the internal drives as shown in TABLE 4-1.**

TABLE 4-1 Internal Drives Identification

Operating Environment Address	Drive Physical Location and Target
c0t0d0s#	Master (primary) hard drive, target 0
c0t1d0s#	Slave (secondary) hard drive, target 1 (optional)
c0t6d0s#	CD-ROM drive, target 6 (optional)

Note – The # symbol in the operating system address examples may be a numeral between 0 and 7 that describes the slice or partition on the drive.

Symptom

Hard drive or CD-ROM drive fails to respond to commands.

Action

Test the drive response to the `probe-ide` command as follows:

1. **To bypass POST, type `setenv diag-switch? false` at the `ok` prompt.**
2. **At the system `ok` prompt, type:**

```
ok% reset-all
ok% probe-ide
```

- If the hard drive responds correctly to `probe-ide` command, the message shown in CODE EXAMPLE 4-4 on page 4-10 is displayed, which means that the system EIDE controller has successfully probed the device. This is an indication that the motherboard is operating correctly.
- If an optional hard drive is installed and one drive does not respond to the EIDE controller probe but the other does, replace the unresponsive drive.
- If the `probe-ide` test fails to show the device in the message, replace the drive (see). If replacing the hard drive does not correct the problem, replace the motherboard.

4.4 Power Supply Test

The section describes how to test the power supply. FIGURE 4-1 and TABLE 4-2 describe power supply connector J17.

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**
2. **Remove the PCI card from riser board connector 2 (adjacent to the power supply), if necessary for clearance. Disconnect the ribbon cables from the motherboard to expose connectors J17.**
3. **Power on the system.**

See Section 10.2 “Powering On the System” on page 10-2.



Caution – With the system cover removed and the system powered on, there is unprotected access to voltage and energy levels that are potentially hazardous to equipment and personnel. If you are unsure how to safely proceed, please seek the assistance of qualified service personnel.

4. **Using a digital voltage meter (DVM), check the power supply output voltages as follows:**

Note – Power supply connector J17 must remain connected to the motherboard.

- a. **With the negative probe of the DVM placed on a connector ground (Gnd) pin, position the positive probe on each power pin.**
 - b. **Verify voltage and signal availability as listed in TABLE 4-2.**
5. **If any power pin signal is not present with the power supply active and properly connected to the motherboard, replace the power supply.**

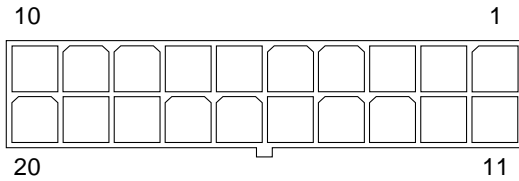


FIGURE 4-1 Power Supply Connector J17 Pin Configuration

TABLE 4-2 Power Supply Connector J17 Pin Assignments

Pin	Signal	Description
1	+3.3V	+3.3 VDC
2	+3.3V	+3.3 VDC
3	Gnd	Chassis ground
4	+5V	+5 VDC
5	Gnd	Chassis ground
6	+5V	+5 VDC
7	Gnd	Chassis ground
8	PWR_OK	Power okay
9	5VSB	
10	+12V	+12 VDC
11	+3.3V	+3.3 VDC
12	-12V	-12 VDC
13	Gnd	Chassis ground
14	PS_ON	Power supply on
15	Gnd	Chassis ground
16	Gnd	Chassis ground
17	Gnd	Chassis ground

TABLE 4-2 Power Supply Connector J17 Pin Assignments (*Continued*)

Pin	Signal	Description
18	-5V	-5 VDC
19	+5V	+5 VDC
20	+5V	+5 VDC

6. After you finish testing the power supply, remove the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

4.5 DIMM Failure

At times, the operating environment, diagnostic program, or POST might not display a DIMM location (U number) as part of a memory error message. In this situation, the only available information is a physical memory address and failing byte (or bit). The following table lists physical memory addresses that can be used to locate a defective DIMM.

TABLE 4-3 DIMM Physical Memory Address

DIMM Slot	DIMM Pair (non-interleave)
DIMM0 DIMM1	00000000 - 0ffffff
DIMM2 DIMM3	10000000 - 1ffffff

4.6 OpenBoot PROM On-Board Diagnostics

The following sections describe the OpenBoot PROM (OBP) on-board diagnostics. To execute the OBP on-board diagnostics, the system must be at the `ok` prompt. The OBP on-board diagnostics are described as follows:

- Section 4.6.1 “Watch-Clock Diagnostic” on page 4-8
- Section 4.6.2 “Watch-Net and Watch-Net-All Diagnostics” on page 4-8
- Section 4.6.3 “Probe-IDE Diagnostic” on page 4-10
- Section 4.6.4 “Test device alias, device path, -All Diagnostic” on page 4-10

4.6.1 Watch-Clock Diagnostic

The watch-clock diagnostic reads a register in the NVRAM/TOD chip and displays the result as a seconds counter. During normal operation, the seconds counter repeatedly increments from 0 to 59 until interrupted by pressing any key on the Sun keyboard. The watch-clock diagnostic is initialized by typing the `watch-clock` command at the `ok` prompt. The following code example identifies the watch-clock diagnostic output message.

CODE EXAMPLE 4-1 Watch-Clock Diagnostic Output Message

```
ok watch-clock
Watching the 'seconds' register of the real time clock chip.
It should be 'ticking' once a second.
Type any key to stop.
49
ok
```

4.6.2 Watch-Net and Watch-Net-All Diagnostics

The watch-net and watch-net-all diagnostics monitor Ethernet packets on the Ethernet interfaces connected to the system. Good packets received by the system are indicated by a period (.). Errors such as the framing error and the cyclic redundancy check (CRC) error are indicated with an “X” and an associated error description. The watch-net diagnostic is initialized by typing the `watch-net` command at the `ok` prompt and the watch-net-all diagnostic is initialized by typing

the `watch-net-all` command at the `ok` prompt. The following code example identifies the `watch-net` diagnostic output message. CODE EXAMPLE 4-3 identifies the `watch-net-all` diagnostic output message.

CODE EXAMPLE 4-2 Watch-Net Diagnostic Output Message

```
ok watch-net
Hme register test --- succeeded.
Internal loopback test -- succeeded.
Transceiver check -- Using Onboard Transceiver - Link Up.
passed
Using Onboard Transceiver - Link Up.
Looking for Ethernet Packets.
'.' is a Good Packet. 'X' is a Bad Packet.
Type any key to stop.
.....
.....
.....
.....
.....
ok
```

CODE EXAMPLE 4-3 Watch-Net-All Diagnostic Output Message

```
ok watch-net-all
/pci@1f,0/pci@1,1/network@1,1
Hme register test --- succeeded.
Internal loopback test -- succeeded.
Transceiver check -- Using Onboard Transceiver - Link Up.
passed
Using Onboard Transceiver - Link Up.
Looking for Ethernet Packets.
'.' is a Good Packet. 'X' is a Bad Packet.
Type any key to stop.
.....
.....
.....
.....
.....
ok
```

4.6.3 Probe-IDE Diagnostic

The probe-ide diagnostic transmits an inquiry command to internal and external IDE devices connected to the system's on-board IDE interface. If the IDE device is connected and active, the target address, unit number, device type, and manufacturer name are displayed. Initialize the probe-ide diagnostic by typing the probe-ide command at the ok prompt. The following code example identifies the probe-ide diagnostic output message.

CODE EXAMPLE 4-4 Probe-IDE Diagnostic Output Message

```
ok probe-ide
  Device 0 ( Primary Master )
           ATA Model: ST34342A

  Device 1 ( Primary Slave )
           ATA Model: ST34342A

  Device 2 ( Secondary Master )
           Removable ATAPI Model: CRD-8160B

  Device 3 ( Secondary Slave )
           Removable ATAPI Model:

ok
```

4.6.4 Test *device alias*, *device path*, -All Diagnostic

The test diagnostic, when combined with a device alias or device path, enables a device self-test diagnostic program. If a device has no self-test program, the message No selftest method for device name is displayed. To enable the self-test program for a device, type the test command followed by the device alias or device path name.

The following code example identifies the test diagnostic output message. Test diagnostics are initialized by typing the test *device alias* or *device path* command at the ok prompt. TABLE 4-4 lists the types of tests that can be used, a brief description of each test, and preparation.

Note – The diskette drive (floppy) is selected as the test alias name example.

CODE EXAMPLE 4-5 Test Diagnostic Output Message

```
ok test floppy

Testing floppy disk system. A formatted disk should be in the
drive.
Test succeeded.

ok
```

TABLE 4-4 Selected OBP On-Board Diagnostic Tests

Type of Test	Description	Preparation
test screen	Tests the system video graphics hardware and the monitor.	Diag-switch? NVRAM parameter must be true for the test to execute.
test floppy	Tests the diskette drive response to commands.	A formatted diskette must be inserted into the diskette drive.
test net	Performs an internal/external loopback test of the system auto-selected Ethernet interface.	An Ethernet cable must be attached to the system and to an Ethernet tap or hub.
test ttya test ttyb	Outputs an alphanumeric test pattern on the system serial ports: ttya, serial port A; ttyb, serial port B	A terminal must be connected to the port being tested to observe the output.
test keyboard	Executes the keyboard selftest.	Four keyboard LEDs should flash once and a message should be displayed: Keyboard Present.
test -all	Sequentially tests system-configured devices containing selftest.	Tests are sequentially executed in device-tree order (viewed with the show-devs command).

4.7 OpenBoot Diagnostics

The OpenBoot diagnostic (OBDiag) is a menu-driven diagnostic tool that verifies:

- Internal I/O system
- Ethernet
- Keyboard
- Mouse
- Diskette drive (floppy)
- Parallel port
- Serial ports
- NVRAM
- Audio
- EIDE
- Video

OBDiag performs root-cause failure analysis on the referenced devices by testing internal registers, confirming subsystem integrity, and verifying device functionality.

Note – The OBDiag test result data captured in the following code examples represent the test result data that is output when the system being tested is connected to a remote shell window through a `tip` connection. When the system being tested is tested in a stand-alone configuration, the test result data may differ.

4.7.1 Starting the OBDiag Menu

1. At the `ok` prompt, type:

```
ok% setenv mfg-mode on
mfg-mode = on
```

2. At the `ok` prompt, type:

```
ok% setenv diag-switch? true
diag-switch? = true
```

3. At the ok prompt, type:

```
ok% setenv auto-boot? false  
auto-boot? = false
```

4. At the ok prompt, type:

```
ok% reset-all
```

5. Verify that the platform resets, as shown in CODE EXAMPLE 4-6.

CODE EXAMPLE 4-6 Reset Verification

```
ok setenv mfg-mode on  
mfg-mode = on  
ok setenv diag-switch? true  
diag-switch? = true  
ok setenv auto-boot? false  
auto-boot? = false  
ok reset-all  
Resetting...  
  
Software Power ON  
  
@(#) Sun Ultra 5/10 UPA/PCI 3.11 Version 9 created 1998/03/06  
10:31  
Clearing E$ Tags Done  
Clearing I/D TLBs Done  
Probing Memory Done  
MEM BASE = 0000.0000.2000.0000  
MEM SIZE = 0000.0000.1000.0000  
11-Column Mode Enabled  
MMUs ON  
Copy Done  
PC = 0000.01ff.f000.1ffc  
PC = 0000.0000.0000.2040  
Decompressing into Memory Done  
Size = 0000.0000.0006.e160  
ttya initialized  
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0  
UltraSPARC-III 2-2 module  
Probing Memory Bank #0 256 + 256: 512 Megabytes  
Probing Memory Bank #2 0 + 0: 0 Megabytes  
Probing UPA Slot at 1e,0 SUNW,ffb
```

CODE EXAMPLE 4-6 Reset Verification (Continued)

```
Probing /pci@1f,0/pci@1,1 at Device 1 pci108e,1000 network
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 pci
Probing /pci@1f,0/pci@1/pci@1 at Device 0 pci108e,1000 SUNW,hme
Probing /pci@1f,0/pci@1/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 4 SUNW,isptwo sd st
Probing /pci@1f,0/pci@1/pci@1 at Device 5 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 6 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 7 Nothing there

Probing /pci@1f,0/pci@1/pci@1 at Device 8 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 9 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device a Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device b Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device c Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device d Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device e Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device f Nothing there

Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there
Reset Control: BXIR:0 BPOR:0 SXIR:0 SPOR:1 POR:0
UltraSPARC-III 2-2 module
Probing Memory Bank #0 256 + 256: 512 Megabytes
Probing Memory Bank #2 0 + 0: 0 Megabytes
Probing UPA Slot at 1e,0 SUNW,ffb
Probing /pci@1f,0/pci@1,1 at Device 1 pci108e,1000 network
Probing /pci@1f,0/pci@1,1 at Device 2 SUNW,m64B
Probing /pci@1f,0/pci@1,1 at Device 3 ide disk cdrom
Probing /pci@1f,0/pci@1 at Device 1 pci
Probing /pci@1f,0/pci@1/pci@1 at Device 0 pci108e,1000 SUNW,hme
Probing /pci@1f,0/pci@1/pci@1 at Device 1 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 4 SUNW,isptwo sd st
Probing /pci@1f,0/pci@1/pci@1 at Device 5 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 6 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 7 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 8 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device 9 Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device a Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device b Nothing there
```

CODE EXAMPLE 4-6 Reset Verification (*Continued*)

```
Probing /pci@1f,0/pci@1/pci@1 at Device c Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device d Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device e Nothing there
Probing /pci@1f,0/pci@1/pci@1 at Device f Nothing there

Probing /pci@1f,0/pci@1 at Device 2 Nothing there
Probing /pci@1f,0/pci@1 at Device 3 Nothing there
Probing /pci@1f,0/pci@1 at Device 4 Nothing there

Sun Ultra 5/10 UPA/PCI (UltraSPARC-IIIi 300MHz), No Keyboard
OpenBoot 3.11, 512 MB memory installed, Serial #9337777.
Ethernet address 8:0:20:8e:7b:b1, Host ID: 808e7bb1.

ok
```

- 6. At the `ok` prompt, type `obdiag`. Verify that the OBDDiag menu is displayed, as shown in CODE EXAMPLE 4-7.**
- 7. At the OBDDiag menu prompt, type 16 to enable script-debug messages.**
- 8. At the OBDDiag menu prompt, type 18 to disable external loopback tests.**

CODE EXAMPLE 4-7 OBDDiag Menu

```
ok obdiag
stdin: fffe2008
stdout: fffe2010
loading code into: /pci@1f,0/pci@1,1/ebus@1
loading code into: /pci@1f,0/pci@1,1/ebus@1/eprom@14,0
loading code into: /pci@1f,0/pci@1,1/ebus@1/ecpp@14,3043bc
loading code into: /pci@1f,0/pci@1,1/ebus@1/su@14,3062f8
loading code into: /pci@1f,0/pci@1,1/ebus@1/se@14,400000
loading code into: /pci@1f,0/pci@1,1/network@1,1
loading code into: /pci@1f,0/pci@1,1/ebus@1/fdthree@14,3023f0
loading code into: /pci@1f,0/pci@1,1/ebus@1/
SUNW,CS4231@14,200000
loading code into: /pci@1f,0/pci@1,1/ide@3
loading code into: /pci@1f,0/pci@1,1/ide@3/disk
loading code into: /pci@1f,0/pci@1,1/ide@3/cdrom
loading code into: /pci@1f,0/pci@1,1/SUNW,m64B@2
Debugging enabled

OBDDiag Menu
```

CODE EXAMPLE 4-7 OBDiag Menu (Continued)

```
0..... PCI/Cheerio
1..... EBUS DMA/TCR Registers
2..... Ethernet
3..... Keyboard
4..... Mouse
5..... Floppy
6..... Parallel Port
7..... Serial Port A
8..... Serial Port B
9..... NVRAM
10..... Audio
11..... EIDE
12..... Video
13..... All Above
14..... Quit
15..... Display this Menu
16..... Toggle script-debug
17..... Enable External Loopback Tests
18..... Disable External Loopback Tests

Enter (0-13 tests, 14 -Quit, 15 -Menu) ===>
```

4.7.2 OB Diagnostics

The OBDiags are described in the following sections:

- Section 4.7.2.1 “PCI/PCIO Diagnostic” on page 4-17
- Section 4.7.2.2 “EBus DMA/TCR Registers Diagnostic” on page 4-18
- Section 4.7.2.3 “Ethernet Diagnostic” on page 4-18
- Section 4.7.2.4 “Keyboard Diagnostic” on page 4-19
- Section 4.7.2.5 “Mouse Diagnostic” on page 4-20
- Section 4.7.2.6 “Diskette Drive (Floppy) Diagnostic” on page 4-20
- Section 4.7.2.7 “Parallel Port Diagnostic” on page 4-21
- Section 4.7.2.8 “Serial Port A Diagnostic” on page 4-21
- Section 4.7.2.9 “Serial Port B Diagnostic” on page 4-23
- Section 4.7.2.10 “NVRAM Diagnostic” on page 4-24
- Section 4.7.2.11 “Audio Diagnostic” on page 4-24
- Section 4.7.2.12 “EIDE Diagnostic” on page 4-25
- Section 4.7.2.13 “Video Diagnostic” on page 4-25
- Section 4.7.2.14 “All Above Diagnostic” on page 4-26

4.7.2.1 PCI/PCIO Diagnostic

To start the PCI/PCIO diagnostic, type 0 at the OBDDiag menu prompt. The PCI/PCIO diagnostic performs the following:

1. `vendor_id_test` - Verifies the PCIO ASIC vendor ID is 108e.
2. `device_id_test` - Verifies the PCIO ASIC device ID is 1000.
3. `mixmode_read` - Verifies the PCI configuration space is accessible as half-word bytes by reading the EBus2 vendor ID address.
4. `e2_class_test` - Verifies the address class code. Address class codes include bridge device (0 x B, 0 x 6), other bridge device (0 x A and 0 x 80), and programmable interface (0 x 9 and 0 x 0).
5. `status_reg_walk1` - Performs a walk-one test on the status register with mask 0 x 280 (PCIO ASIC is accepting fast back-to-back transactions, DEVSEL timing is 0 x 1).
6. `line_size_walk1` - Performs tests 1 through 5.
7. `latency_walk1` - Performs a walk-one test on the latency timer.
8. `line_walk1` - Performs a walk-one test on the interrupt line.
9. `pin_test` - Verifies the interrupt pin is logic-level high (1) after reset.

The following code example shows the PCI/PCIO output message.

CODE EXAMPLE 4-8 PCI/PCIO Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==> 0

TEST='all_pci/PCIO_test'
SUBTEST='vendor_id_test'
SUBTEST='device_id_test'
SUBTEST='mixmode_read'
SUBTEST='e2_class_test'
SUBTEST='status_reg_walk1'
SUBTEST='line_size_walk1'
SUBTEST='latency_walk1'
SUBTEST='line_walk1'
SUBTEST='pin_test'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==>
```

4.7.2.2

EBus DMA/TCR Registers Diagnostic

To start the DMA/TCR registers diagnostic, type 1 at the OBDDiag menu prompt. The EBus DMA/TCR registers diagnostic performs the following:

1. `dma_reg_test` - Performs a walking-ones bit test for the control status register, address register, and byte-count register of each channel. Verifies the control status register is set properly.
2. `dma_func_test` - Validates the DMA capabilities and FIFOs. The test is executed in a DMA diagnostic loopback mode. Initializes the data of transmitting memory with its address, performs a DMA read and write, and verifies that the data received is correct. Repeats for four channels.

The following code example shows the EBus DMA/TCR registers output message.

CODE EXAMPLE 4-9 EBus DMA/TCR Registers Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==> 1

TEST='all_dma/ebus_test'
SUBTEST='dma_reg_test'
SUBTEST='dma_func_test'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==>
```

4.7.2.3

Ethernet Diagnostic

To start the Ethernet diagnostic, type 2 at the OBDDiag menu prompt. The Ethernet diagnostic performs the following:

1. `my_channel_reset` - Resets the Ethernet channel.
2. `hme_reg_test` - Performs a walk-one test on the following registers set: global register 1, global register 2, bmac xif register, bmac tx register, and mif register.
3. `MAC_internal_loopback_test` - Performs an Ethernet channel engine internal loopback test.
4. `10_mb_xcvr_loopback_test` - Enables the 10Base-T data present at the transmit MII data inputs, to be routed back to the receive MII data outputs.
5. `100_mb_phy_loopback_test` - Enables MII transmit data to be routed to the MII receive data path.
6. `100_mb_twister_loopback_test` - Forces the twisted-pair transceiver into loopback mode.

The following code example shows the Ethernet output message.

CODE EXAMPLE 4-10 Ethernet Output Message

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 2

TEST='ethernet_test'
Using Onboard Transceiver - Link Up.
SUBTEST='my_channel_reset'
SUBTEST='hme_reg_test'
SUBTEST='global_reg1_test'
SUBTEST='global_reg2_test'
SUBTEST='bmac_xif_reg_test'
SUBTEST='bmac_tx_reg_test'
SUBTEST='mif_reg_test'
SUBTEST='mac_internal_loopback_test'
SUBTEST='10mb_xcvr_loopback_test'
SUBTEST='100mb_phy_loopback_test'
SUBTEST='100mb_twister_loopback_test'
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==>
```

4.7.2.4 Keyboard Diagnostic

To start the keyboard diagnostic, type 3 at the OBDiag menu prompt. The keyboard diagnostic consists of an external and internal loopback test. The external loopback requires a passive loopback connector. The internal loopback verifies the keyboard port by transmitting and receiving 128 characters.

The following code example shows the keyboard output message.

CODE EXAMPLE 4-11 Keyboard Output Message

```
setenv Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 3

TEST='keyboard_test'
SUBTEST='internal_loopback'
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==>
```

4.7.2.5 Mouse Diagnostic

To start the mouse diagnostic, type 4 at the OBdiag menu prompt. The mouse diagnostic performs a keyboard-to-mouse loopback test.

The following code example shows the mouse output message.

CODE EXAMPLE 4-12 Mouse Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==> 4

TEST='mouse_test'
SUBTEST='mouse_loopback'

###OBDIAG_MFG_START###
TEST='mouse_test'
STATUS='FAILED'
SUBTEST='mouse_loopback'
ERRORS='1 '
TTF='1656 '
SPEED='295.99 MHz'
PASSES='1 '
MESSAGE='Error: Timeout receiving a character'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==>
```

4.7.2.6 Diskette Drive (Floppy) Diagnostic

To start the diskette drive (floppy) diagnostic, type 5 at the OBdiag menu prompt. The floppy diagnostic verifies the diskette drive controller initialization. It also validates the status of a selected disk drive and reads the diskette drive header.

The following code example shows the floppy test output message.

CODE EXAMPLE 4-13 Floppy Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==> 5

TEST='floppy_test'
SUBTEST='floppy_id0_read_test'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==>
```

4.7.2.7 Parallel Port Diagnostic

To start the parallel port diagnostic, type 6 at the OBDDiag menu prompt. The parallel port diagnostic performs the following:

1. `sio-passive-lb` – Sets up the SuperIO configuration register to enable extended/compatible parallel port select, then does a write 0, walk-one, write 0 x ff to the data register. It verifies the results by reading the status register.
2. `dma_read` – Enables ECP mode, ECP DMA configuration, and FIFO test mode. Transfers 16 bytes of data from memory to the parallel port device and then verifies the data is in TFIFO.

The following code example shows the parallel port output message.

CODE EXAMPLE 4-14 Parallel Port Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===> 6

TEST='parallel_port_test'
SUBTEST='dma_read'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===>
```

4.7.2.8 Serial Port A Diagnostic

To start the serial port A diagnostic, type 7 at the OBDDiag menu prompt. The serial port A diagnostic invokes the `uart_loopback` test. This test transmits and receives 128 characters and checks serial port A transaction validity.

The following code example shows the serial port A output message.

CODE EXAMPLE 4-15 Serial Port A Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===> 7

TEST='uarta_test'
BAUDRATE='1200'
SUBTEST='internal_loopback'
BAUDRATE='1800'
SUBTEST='internal_loopback'
BAUDRATE='2400'
SUBTEST='internal_loopback'
BAUDRATE='4800'
SUBTEST='internal_loopback'
```

CODE EXAMPLE 4-15 Serial Port A Output Message (Continued)

```
BAUDRATE='9600'  
SUBTEST='internal_loopback'  
BAUDRATE='19200'  
SUBTEST='internal_loopback'  
BAUDRATE='38400'  
SUBTEST='internal_loopback'  
BAUDRATE='57600'  
SUBTEST='internal_loopback'  
BAUDRATE='76800'  
SUBTEST='internal_loopback'  
BAUDRATE='115200'  
SUBTEST='internal_loopback'  
BAUDRATE='153600'  
SUBTEST='internal_loopback'  
BAUDRATE='230400'  
SUBTEST='internal_loopback'  
BAUDRATE='307200'  
SUBTEST='internal_loopback'  
BAUDRATE='460800'  
SUBTEST='internal_loopback'  
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===>
```

Note – The serial port A diagnostic will stall if the TIP line is installed on serial port A. The following code example shows the serial port A output message when the TIP line is installed on serial port A.

CODE EXAMPLE 4-16 Serial Port A Output Message With TIP Line Installed

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===> 7  
  
TEST='uarta_test'  
'UART A in use as console - Test not run.'  
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===>
```

4.7.2.9 Serial Port B Diagnostic

To start the serial port B diagnostic, type 8 at the OBDiag menu prompt. The serial port B diagnostic is identical to the serial port A diagnostic.

The following code example shows the serial port B output message.

Note – The serial port B diagnostic will stall if the TIP line is installed on serial port B.

CODE EXAMPLE 4-17 Serial Port B Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===> 8

TEST='uartb_test'
BAUDRATE='1200'
SUBTEST='internal_loopback'
BAUDRATE='1800'
SUBTEST='internal_loopback'
BAUDRATE='2400'
SUBTEST='internal_loopback'
BAUDRATE='4800'
SUBTEST='internal_loopback'
BAUDRATE='9600'
SUBTEST='internal_loopback'
BAUDRATE='19200'
SUBTEST='internal_loopback'
BAUDRATE='38400'

SUBTEST='internal_loopback'
BAUDRATE='57600'
SUBTEST='internal_loopback'
BAUDRATE='76800'
SUBTEST='internal_loopback'
BAUDRATE='115200'
SUBTEST='internal_loopback'
BAUDRATE='153600'
SUBTEST='internal_loopback'
BAUDRATE='230400'
SUBTEST='internal_loopback'
BAUDRATE='307200'
SUBTEST='internal_loopback'
BAUDRATE='460800'
SUBTEST='internal_loopback'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ===>
```

4.7.2.10 NVRAM Diagnostic

To start the NVRAM diagnostic, type **9** at the OBDiag menu prompt. The NVRAM diagnostic verifies the NVRAM operation by performing a write and read to the NVRAM.

The following code example shows the NVRAM output message.

CODE EXAMPLE 4-18 NVRAM Output Message

```
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==> 9

TEST='nvram_test'
SUBTEST='write/read_patterns'
SUBTEST='write/read_inverted_patterns'
Enter (0-12 tests, 13 -Quit, 14 -Menu) ==>
```

4.7.2.11 Audio Diagnostic

To start the audio diagnostic, type **10** at the OBDiag menu prompt. The audio diagnostic performs the following:

1. cs4231_test - Verifies the cs4231 internal registers.
2. Line-in to line-out external loopback test.
3. Microphone to headphone external loopback test.

The following code example shows the audio output message.

CODE EXAMPLE 4-19 Audio Output Message

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 10

TEST='audio_test'
SUBTEST='cs4231_test'
Codec_ID='8a'
Version_ID='a0'
SUBTEST='external_lpbk'

###OBDIAG_MFG_START###
TEST='audio_test'
STATUS='FAILED'
SUBTEST='external_lpbk'
ERRORS='1 '
```


CODE EXAMPLE 4-19 Audio Output Message (Continued)

```
TTF='505 `
SPEED='299.80 MHz'
PASSES='1 `
MESSAGE='Error: External Audio Test not run: Please set the mfg-
mode to sys-ext.'
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==>
```

4.7.2.12 EIDE Diagnostic

To start the EIDE diagnostic, type 11 at the OBDDiag menu prompt. The EIDE diagnostic validates both the EIDE chip and the IDE bus subsystem.

The following code example shows the EIDE output message.

CODE EXAMPLE 4-20 EIDE Output Message

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 11

TEST='ide_test'
SUBTEST='probe-cmd-device'
SUBTEST='hd-and-cd-check'
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==>
```

4.7.2.13 Video Diagnostic

To start the video diagnostic, type 12 at the OBDDiag menu prompt. The video diagnostic validates the graphics.

The following code example shows the video output message.

CODE EXAMPLE 4-21 Video Output Message

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 12

TEST='video_test'
Please connect the monitor and use ttya/ttyb when running this test
if you are using the screen it may be become unreadable
SUBTEST='mach64-chip-id-vendor-id-check'
SUBTEST='video-frame-buffer-test'
```

CODE EXAMPLE 4-21 Video Output Message (Continued)

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 12
SUBTEST='mach64-walk-one-test'
SUBTEST='mach64-walk-zero-test'
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==>
```

4.7.2.14 All Above Diagnostic

To start the all above diagnostic, type 13 at the OBdiag menu prompt. The all above diagnostic validates the entire system.

The following code example shows the all above output message.

Note – The all above diagnostic will stall if the TIP line is installed on serial port A or serial port B.

CODE EXAMPLE 4-22 All Above Output Message

```
Enter (0-13 tests, 14 -Quit, 15 -Menu) ==> 13

TEST='all_pci/cheerio_test'
SUBTEST='vendor_id_test'
SUBTEST='device_id_test'
SUBTEST='mixmode_read'
SUBTEST='e2_class_test'
SUBTEST='status_reg_walk1'
SUBTEST='line_size_walk1'
SUBTEST='latency_walk1'
SUBTEST='line_walk1'
SUBTEST='pin_test'

TEST='all_dma/ebus_test'
SUBTEST='dma_reg_test'
SUBTEST='dma_func_test'

TEST='ethernet_test'
Using Onboard Transceiver - Link Up.
SUBTEST='my_channel_reset'
SUBTEST='hme_reg_test'
SUBTEST='global_reg1_test'
SUBTEST='global_reg2_test'
SUBTEST='bmac_xif_reg_test'
```

CODE EXAMPLE 4-22 All Above Output Message (Continued)

```
SUBTEST='bmac_tx_reg_test'
SUBTEST='mif_reg_test'
SUBTEST='mac_internal_loopback_test'
SUBTEST='10mb_xcvr_loopback_test'
SUBTEST='100mb_phy_loopback_test'
SUBTEST='100mb_twister_loopback_test'

TEST='keyboard_test'
SUBTEST='internal_loopback'

TEST='mouse_test'
SUBTEST='mouse_loopback'

###OBDIAG_MFG_START###
TEST='mouse_test'
STATUS='FAILED'
SUBTEST='mouse_loopback'
ERRORS='1 '
TTF='1011 '
SPEED='299.80 MHz'
PASSES='1 '
MESSAGE='Error: Timeout receiving a character'

TEST='floppy_test'
SUBTEST='floppy_id0_read_test'

TEST='parallel_port_test'
SUBTEST='dma_read'

TEST='uarta_test'
'UART A in use as console - Test not run.'

TEST='uartb_test'
BAUDRATE='1200'
SUBTEST='internal_loopback'
BAUDRATE='1800'
SUBTEST='internal_loopback'
BAUDRATE='2400'
SUBTEST='internal_loopback'
BAUDRATE='4800'
SUBTEST='internal_loopback'
BAUDRATE='9600'
SUBTEST='internal_loopback'
BAUDRATE='19200'
SUBTEST='internal_loopback'
BAUDRATE='38400'
```

CODE EXAMPLE 4-22 All Above Output Message (Continued)

```
SUBTEST='internal_loopback'  
BAUDRATE='57600'  
SUBTEST='internal_loopback'  
BAUDRATE='76800'  
SUBTEST='internal_loopback'  
BAUDRATE='115200'  
SUBTEST='internal_loopback'  
BAUDRATE='153600'  
SUBTEST='internal_loopback'  
BAUDRATE='230400'  
SUBTEST='internal_loopback'  
BAUDRATE='307200'  
SUBTEST='internal_loopback'  
BAUDRATE='460800'  
SUBTEST='internal_loopback'  
  
TEST='nvram_test'  
SUBTEST='write/read_patterns'  
SUBTEST='write/read_inverted_patterns'  
  
TEST='audio_test'  
SUBTEST='cs4231_test'  
Codec_ID='8a'  
Version_ID='a0'  
SUBTEST='external_lpbk'  
  
###OBDIAG_MFG_START###  
TEST='audio_test'  
STATUS='FAILED'  
SUBTEST='external_lpbk'  
ERRORS='1 '  
TTF='1030 '  
SPEED='299.80 MHz'  
PASSES='1 '  
MESSAGE='Error: External Audio Test not run: Please set the mfg-  
mode to sys-ext.'  
  
TEST='ide_test'  
SUBTEST='probe-cmd-device'  
SUBTEST='hd-and-cd-check'  
  
TEST='video_test'  
Please connect the monitor and use ttya/ttyb when running this test  
if you are using the screen it may be become unreadable  
SUBTEST='mach64-chip-id-vendor-id-check'  
SUBTEST='video-frame-buffer-test'
```

CODE EXAMPLE 4-22 All Above Output Message (*Continued*)

```
SUBTEST='mach64-walk-one-test'  
SUBTEST='mach64-walk-zero-test'  
Enter (0-13 tests, 14 -Quit, 15 -Menu) ===>
```

4.7.3 Exiting the OBDiag Menu

1. At the `ok` prompt, type:

```
ok% setenv mfg-mode off  
mfg-mode = off
```

2. At the `ok` prompt, type:

```
ok% setenv diag-switch? false  
diag-switch? = false
```

3. At the `ok` prompt, type:

```
ok% setenv auto-boot? true  
auto-boot? = true
```

4. At the `ok` prompt, type:

```
ok% reset-all
```


Preparing for Component Replacement

This chapter describes the activities you must do to prepare for removal and replacement of internal system components.

Note – It is very important that you review the safety requirements, symbols, and precautions in this chapter before you begin to remove or replace system components.

This chapter contains the following topics:

- Section 5.1 “Safety Requirements” on page 5-1
- Section 5.2 “Safety Symbols” on page 5-2
- Section 5.3 “Safety Precautions” on page 5-2
- Section 5.4 “Tools Required” on page 5-4
- Section 5.5 “Powering Off the System” on page 5-5
- Section 5.6 “Removing the System Cover” on page 5-8
- Section 5.7 “Attaching the Wrist Strap” on page 5-9

5.1 Safety Requirements

For protection, observe the following safety precautions when setting up the equipment:

- Follow all cautions, warnings, and instructions marked on the equipment.
- Ensure that the voltages and frequency rating of the power receptacle match the electrical rating label on the equipment.
- Never push objects of any kind through openings in equipment. Objects may touch dangerous voltage points or short components, resulting in fire or electric shock.
- Refer servicing of equipment to qualified personnel.

5.2 Safety Symbols

The following symbols mean:



Caution – Risk of personal injury and equipment damage. Follow the instructions.



Caution – Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.



Caution – Hot surfaces. Avoid contact. Surfaces are hot and may cause personal injury if touched.

5.3 Safety Precautions

Follow all safety precautions.

5.3.1 Modification to Equipment



Caution – Do not make mechanical or electrical modifications to the equipment. Sun Microsystems is not responsible for regulatory compliance of a modified Sun product.

5.3.2 Placement of a Sun Product



Caution – To ensure reliable operation of the Sun product and to protect it from overheating, ensure equipment openings are not blocked or covered. Never place a Sun product near a radiator or hot air register.

5.3.3 Power Cord Connection



Caution – Not all power cords have the same current ratings. Household extension cords do not have overload protection. Do not use household extension cords with a Sun product.



Caution – The power switch on this product functions as a standby type device only. The power cord serves as the primary disconnect device for the system. Be sure to connect the power cord into a grounded electrical receptacle that is nearby the system and is readily accessible. Do not connect the power cord when the power supply has been removed from the system chassis.



Caution – The power supply of this product is not an autoranging power supply. You must set the power supply voltage setting to either 115V or 230V on the voltage select switch. Failure to correctly set this switch may result in damage to the equipment.

5.3.4 Electrostatic Discharge



Caution – The boards and hard drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy components. Do not touch the components themselves or any metal parts. Wear an antistatic wrist strap when handling the drive assemblies, boards, or cards.



Caution – Wear an antistatic wrist strap and use an ESD-protected mat when handling components. When servicing or removing system components, attach an ESD strap to your wrist, then to a metal area on the chassis. Then disconnect the power cord from the system and the wall receptacle. Following this caution equalizes all electrical potentials with the system.

5.3.5 Lithium Battery



Caution – On Sun motherboards, a lithium battery is molded into the real-time clock, SDS No. M48T59Y, MK48TXXB-XX, M48T18-XXXPCZ, or M48T59W-XXXPCZ. Batteries are *not* customer-replaceable parts. They may explode if mistreated. Do not dispose of a battery in fire. Do not disassemble a battery or attempt to recharge it.

5.4 Tools Required

The following tools are required to service the Ultra 5 system.

- No. 2 Phillips screwdriver (magnetized tip suggested)
- Needle-nose pliers
- Grounding wrist strap
- Digital voltage meter (DVM)
- Antistatic mat

Place ESD-sensitive components such as the motherboard, circuit cards, hard drives, and NVRAM/TOD on an antistatic mat. The following items can be used as an antistatic mat:

- Bag used to wrap a Sun replacement part
- Shipping container used to package a Sun replacement part
- Inner side (metal part) of the system cover
- Sun ESD mat, part number 250-1088 (available through your Sun sales representative)
- Disposable ESD mat; shipped with replacement parts or optional system features

5.5 Powering Off the System

To power off the system:

1. **Back up system files as necessary.**

See *Solaris Handbook for SMCC Peripherals*, part number 802-7675.



Caution – Exit from the operating system before turning off system power. Failure to do so may result in data loss.

2. **Press the system standby switch (FIGURE 5-1), or press the Sun Type-5 keyboard Standby key (FIGURE 5-2) or the Sun I/O Type-6 keyboard Power key (FIGURE 5-3).**

Note – For the system to gracefully shut down by the standby switch or the Sun Type-5/6 keyboard Standby/Power key, UNIX must be operating. If the system is in POST, the standby switch and the Standby/Power key are inoperative.



Caution – Pressing the standby switch or pressing the Sun Type-5/6 keyboard Standby/Power key does not remove all power from the system; a trickle voltage remains in the power supply. To remove all power from the system, set the power switch on the back panel to the off position.

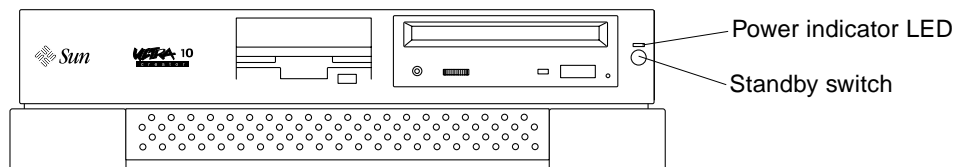


FIGURE 5-1 System Standby Switch

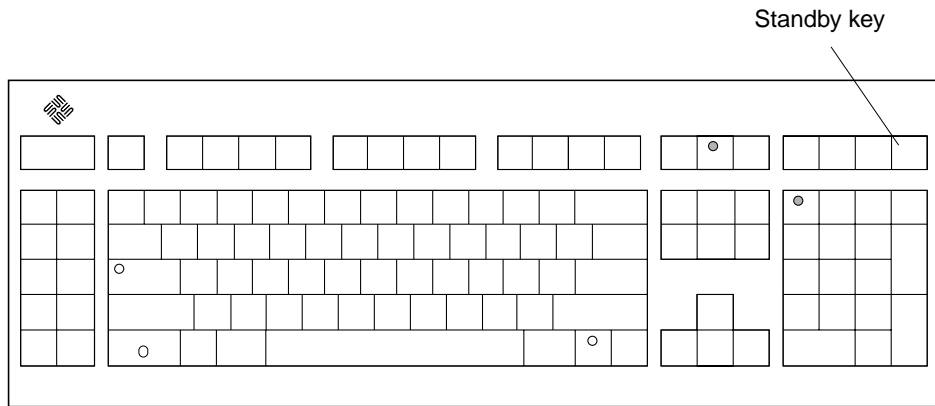


FIGURE 5-2 Sun Type-5 Keyboard

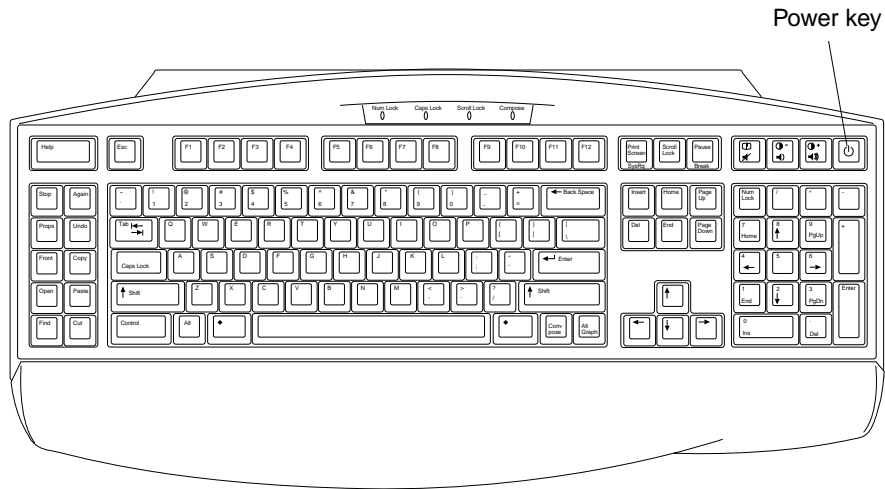


FIGURE 5-3 Sun I/O Type-6 Keyboard

3. Set the system power switch to the off position (FIGURE 5-4).

Note – For a typical system shutdown or restart, it is not necessary to set the power switch to the off position.

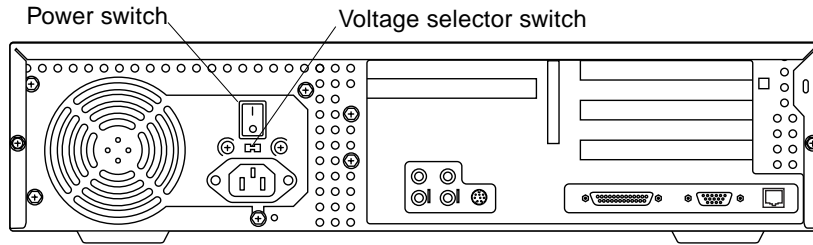


FIGURE 5-4 System Power Switch

- 4. Verify the following:**
 - a. The front panel power indicator LED is off.**
 - b. The system fans are not spinning.**
- 5. Turn off the power to the monitor and any peripheral equipment.**
- 6. Disconnect cables to any peripheral equipment.**

5.6 Removing the System Cover

Remove the system cover as follows (FIGURE 5-5):

1. Using a No. 2 Phillips screwdriver, remove the two screws securing the system cover to the chassis.
2. Grasp the center front edge of the system cover. Slide the system cover toward the rear of the system until the cover tabs release.
3. Lift the system cover straight up. Set it aside in a safe place.

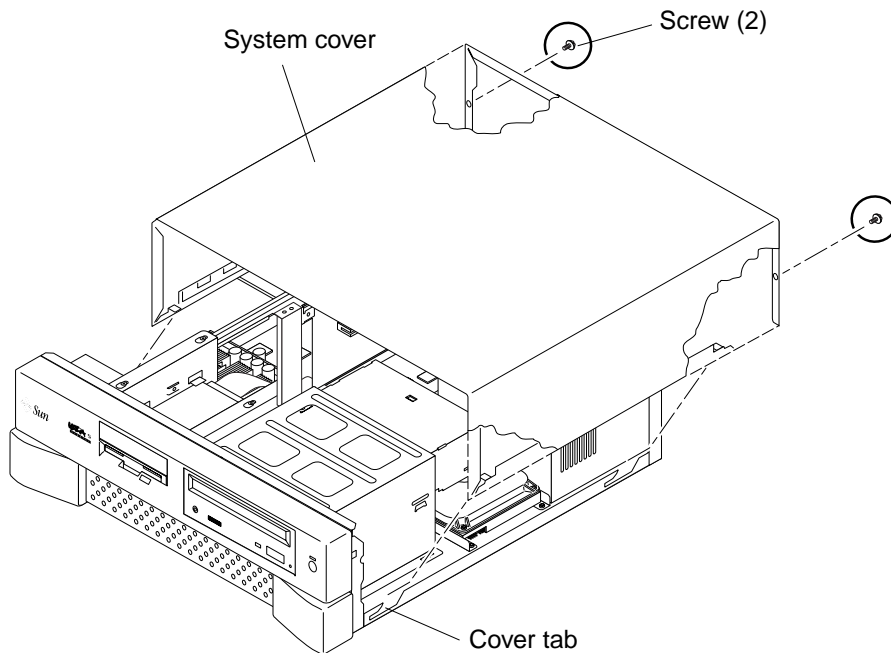


FIGURE 5-5 Removing the System Cover

5.7 Attaching the Wrist Strap



Caution – Wear an antistatic wrist strap and use an ESD-protected mat when handling components. When servicing or removing system components, attach an ESD strap to your wrist, then to a metal area on the chassis. Then disconnect the power cord from the system and the wall receptacle. Following this caution equalizes all electrical potentials with the system.

1. Unwrap the first two folds of the wrist strap; wrap the adhesive side firmly against your wrist.
2. Peel the liner from the copper foil at the opposite end of the wrist strap.
3. Attach the copper end of the wrist strap to the chassis (FIGURE 5-6).
4. Disconnect the AC power cord from the system.

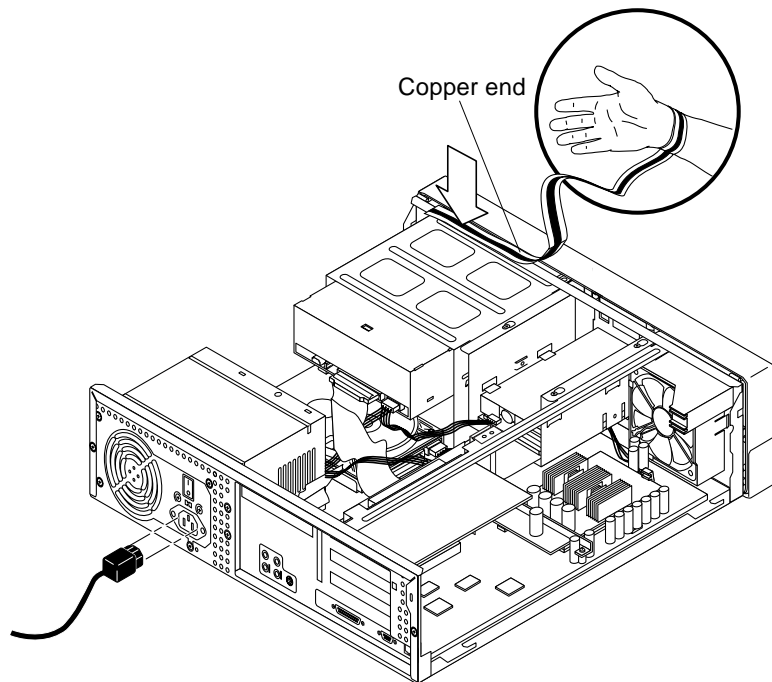


FIGURE 5-6 Attaching the Wrist Strap to the Chassis

Major Subassemblies

This chapter describes how to remove and replace the major subassemblies.

This chapter contains the following topics:

- Section 6.1 “Power Supply” on page 6-1
- Section 6.2 “Cable Assemblies” on page 6-4
- Section 6.3 “Speaker Assembly” on page 6-10
- Section 6.4 “CPU Fan Assembly” on page 6-12
- Section 6.5 “Front Bezel” on page 6-14

6.1 Power Supply

To remove and replace the power supply, proceed as follows.

6.1.1 Removing the Power Supply

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the power supply as follows (FIGURE 6-1):**
 - a. **Disconnect the power cable connectors from the following:**
 - CD-ROM drive
 - Diskette drive

- Hard drive(s)
 - Motherboard (J12)
- b. Using a No. 2 Phillips screwdriver, remove the four screws securing the power supply to the back panel.
 - c. Push the power supply toward the chassis front to disengage the power supply from the chassis bottom mounting hooks.
 - d. Lift the power supply from the chassis.

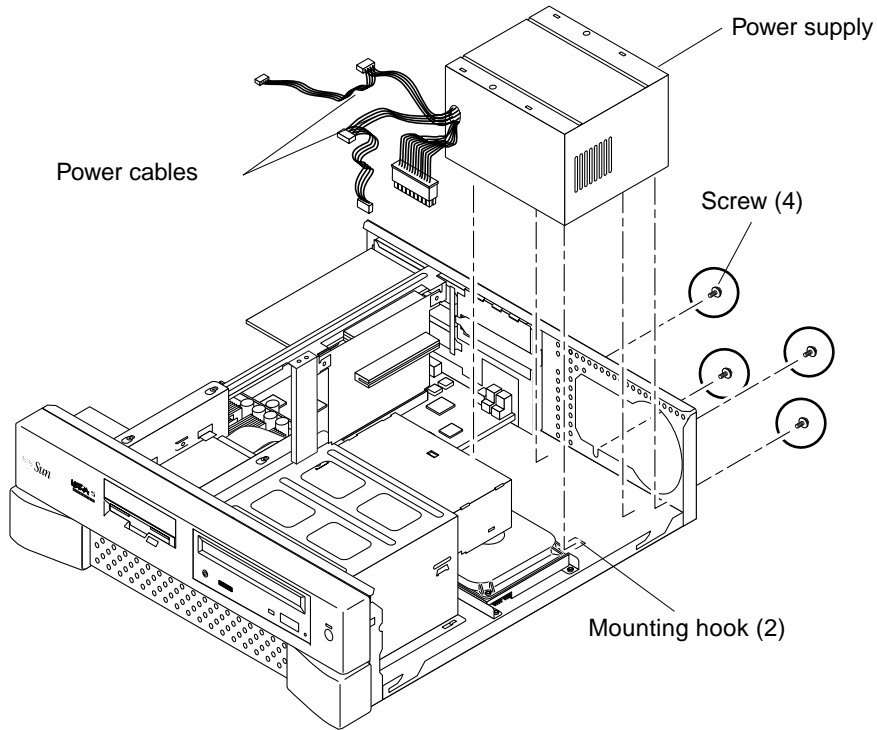


FIGURE 6-1 Removing and Replacing the Power Supply

6.1.2 Replacing the Power Supply

1. Replace the power supply as follows (FIGURE 6-1):



Caution – Verify the voltage selector switch is set to the correct setting: 115V or 230V. Plugging a 115V power cord into a 230V connector will severely damage the system.

- a. Position the power supply into the chassis, tilting it slightly toward the motherboard.
- b. Push the power supply toward the chassis rear to engage the mounting hooks.
- c. Using a No. 2 Phillips screwdriver, replace the four screws securing the power supply to the chassis.
- d. Connect the power cable connectors to the following (not illustrated):
 - CD-ROM drive
 - Diskette drive(s)
 - Hard drive
 - Motherboard (J12)

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

6.2 Cable Assemblies

To remove and replace the diskette drive cable assembly, the hard drive cable assembly, the serial/parallel cable assembly, and the audio cable assembly, proceed as follows.

Note – The Ultra 5 diskette drive cable assembly, hard drive cable assembly, CD-ROM drive cable assembly, and serial/parallel cable assembly are part of service kit 370-3266; they cannot be ordered separately.

6.2.1 Removing the Diskette Drive Cable Assembly

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the diskette drive cable assembly connectors from the following (FIGURE 6-2):**
 - Diskette drive
 - Motherboard (J16)
3. **Remove the diskette drive cable assembly from the chassis.**

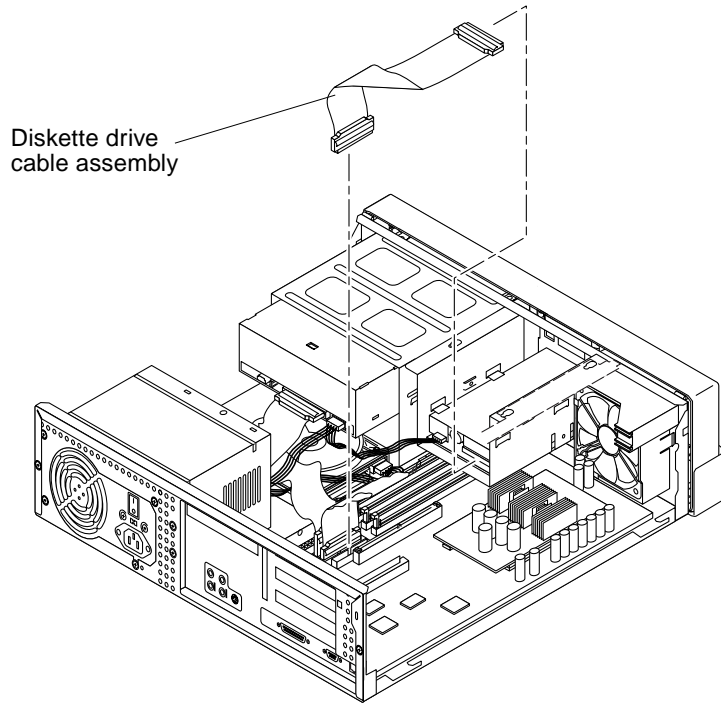


FIGURE 6-2 Removing and Replacing the Diskette Drive Cable Assembly

6.2.2 Replacing the Diskette Drive Cable Assembly

1. **Replace the diskette drive cable assembly as follows (FIGURE 6-2):**
 - a. **Position the diskette drive cable assembly into the chassis.**
 - b. **Connect the diskette drive cable assembly connectors to the following:**
 - Motherboard (J16)
 - Diskette drive

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

6.2.3 Removing the Hard Drive Cable Assembly

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Disconnect the hard drive cable assembly connectors from the following (FIGURE 6-3):
 - Hard drive(s)
 - Motherboard (J15)
3. Remove the hard drive cable assembly from the chassis.

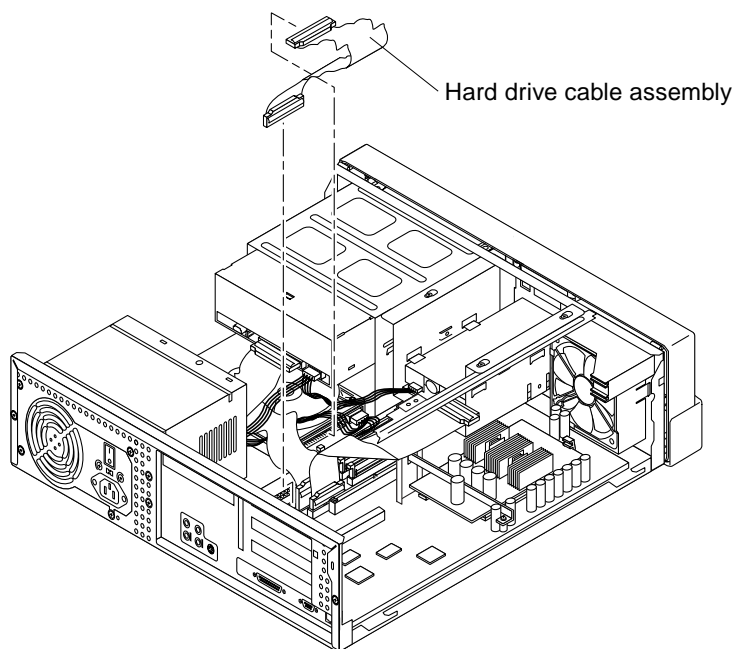


FIGURE 6-3 Removing and Replacing the Hard Drive Cable Assembly

6.2.4 Replacing the Hard Drive Cable Assembly

1. **Replace the hard drive cable assembly as follows (FIGURE 6-3):**
 - a. **Position the hard drive cable assembly into the chassis.**
 - b. **Connect the hard drive cable assembly connectors to the following:**
 - Hard drive(s)
 - Motherboard (J15)

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

Note – If the system has an optional secondary hard drive installed, the drives use a cable with three connectors. Ensure that the three connectors are replaced correctly, as described in Section 7.2.3 “Installing a Secondary Hard Drive” on page 7-8.

2. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

6.2.5 Removing the Serial/Parallel Cable Assembly

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the serial/parallel cable assembly as follows (FIGURE 6-4):**
 - a. **Disconnect the serial/parallel cable assembly connector from the motherboard (J7/J8).**
 - b. **Using a No. 2 Phillips screwdriver, remove the screw securing the serial/parallel cable connector-assembly to the chassis. Remove the connector assembly from the chassis opening.**
 - c. **Remove the serial/parallel cable assembly from the chassis.**

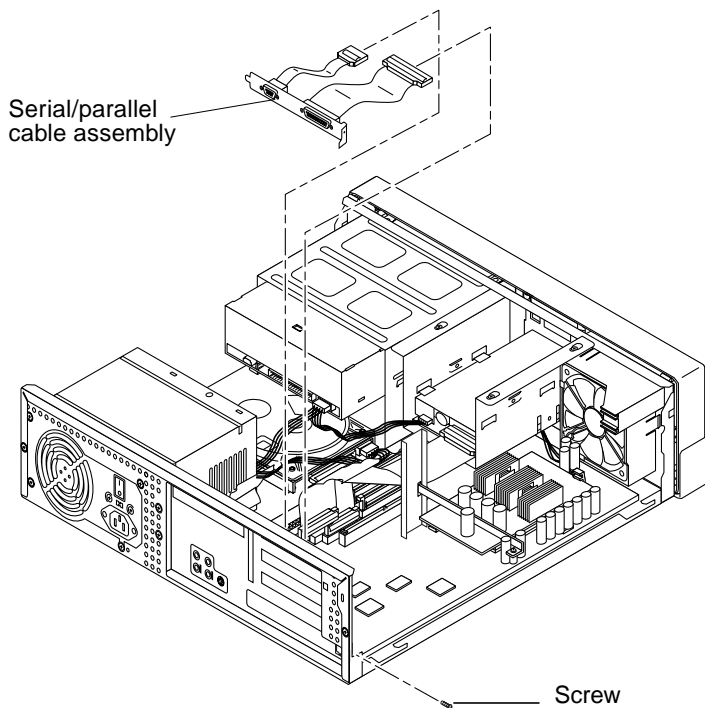


FIGURE 6-4 Removing and Replacing the Serial/Parallel Cable Assembly

6.2.6 Replacing the Serial/Parallel Cable Assembly

1. Replace the serial/parallel cable assembly as follows (FIGURE 6-4):
 - a. Position the serial/parallel cable assembly into the chassis.
 - b. Position the serial/parallel cable connector-assembly into the chassis opening. Using a No. 2 Phillips screwdriver, replace the screw securing the connector assembly to the chassis.
 - c. Connect the serial/parallel cable assembly connector to the motherboard (J7/J8).

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

6.2.7 Removing the Audio Cable Assembly

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Remove the audio cable assembly as follows:

- a. Remove the audio cable assembly connectors from the following (FIGURE 6-5):

- CD-ROM drive
- Motherboard (J5)

- b. Remove the audio cable assembly from the chassis.

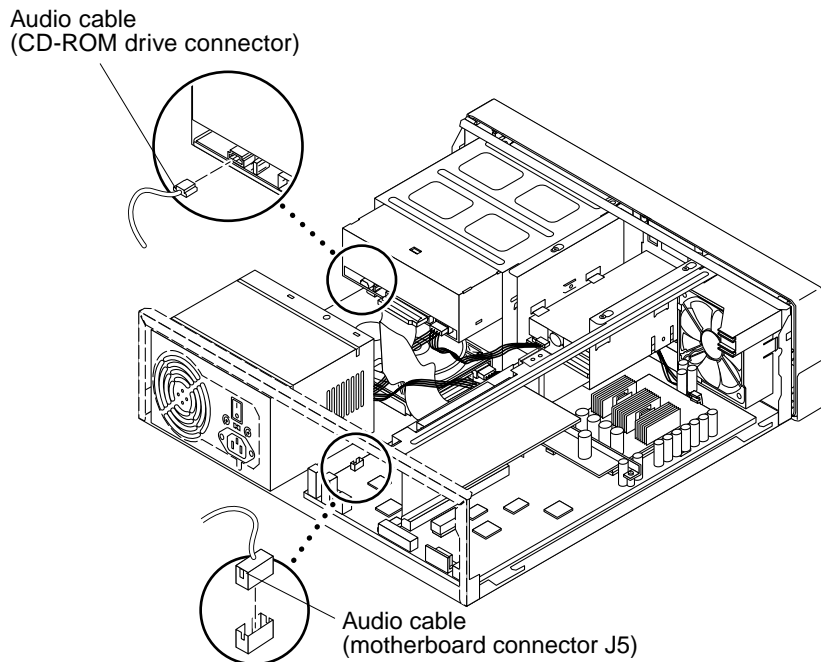


FIGURE 6-5 Removing and Replacing the Audio Cable

6.2.8 Replacing the Audio Cable Assembly

1. **Replace the audio cable assembly as follows (FIGURE 6-5):**
 - a. **Position the audio cable assembly into the chassis.**
 - b. **Connect the audio cable assembly connectors to the following:**
 - Motherboard (J5)
 - CD-ROM drive

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

6.3 Speaker Assembly

To remove and replace the speaker assembly, proceed as follows.

6.3.1 Removing the Speaker Assembly

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the speaker assembly as follows (FIGURE 6-6):**
 - a. **Disconnect the speaker cable from the motherboard (J18).**
 - b. **Move the diskette drive assembly (or optional secondary hard drive bracket) aside to provide clearance:**
 - i. **Using a No. 2 Phillips screwdriver, loosen (but do not remove) the three screws securing the diskette drive bracket to the chassis (see FIGURE 7-1).**

- ii. Slide the diskette drive bracket back and lift it from the three screws. Do not remove any of the cables attached to the diskette drive.
- iii. Set the diskette drive bracket on top of the power supply.
- c. Grasp the speaker magnet and pull the speaker away from the chassis while moving it downward.
- d. Remove the speaker assembly from the chassis.

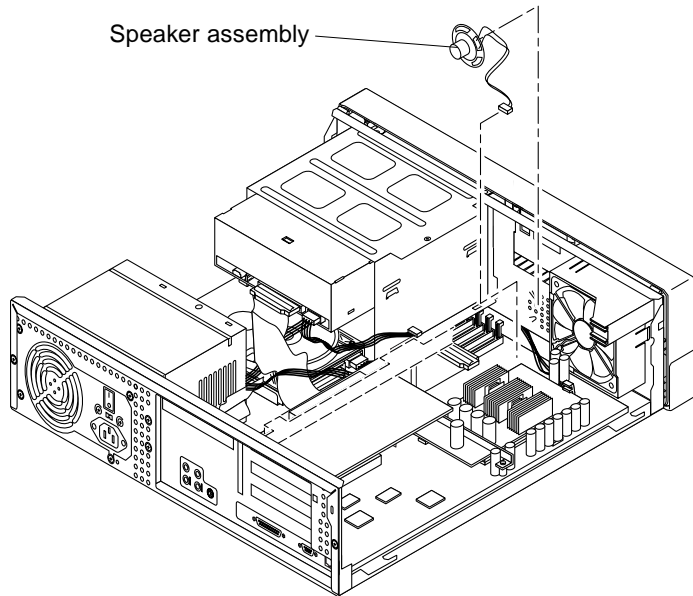


FIGURE 6-6 Removing and Replacing the Speaker Assembly

6.3.2 Replacing the Speaker Assembly

1. Replace the speaker assembly as follows (FIGURE 6-6):
 - a. Position the speaker assembly into the chassis.
 - b. Grasp the speaker magnet and slide the speaker upwards under the three metal chassis speaker tabs until the lower tab engages the outer rim of the speaker.
 - c. Replace the diskette drive assembly (or optional secondary hard drive bracket):
 - i. Place the diskette drive bracket back in position, aligning the three holes in the bracket with the three securing screws on the chassis (see FIGURE 7-1).

- ii. Slide the diskette drive bracket forward until it stops.
 - iii. Using a No. 2 Phillips screwdriver, tighten the three securing screws.
 - d. Connect the speaker cable to the motherboard (J18).
2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

6.4 CPU Fan Assembly

To remove and replace the CPU fan assembly, proceed as follows.

6.4.1 Removing the CPU Fan Assembly

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Remove the CPU fan assembly as follows (FIGURE 6-7):
 - a. If necessary, remove any long PCI cards from riser board connectors 1 and 3 to provide clearance.
See Section 8.4.1 “Removing a PCI Card” on page 8-9.
 - b. Disconnect the CPU fan assembly power-cable connector from the motherboard (J19).
 - c. Press the fan retaining clip and remove the CPU fan assembly from the chassis.

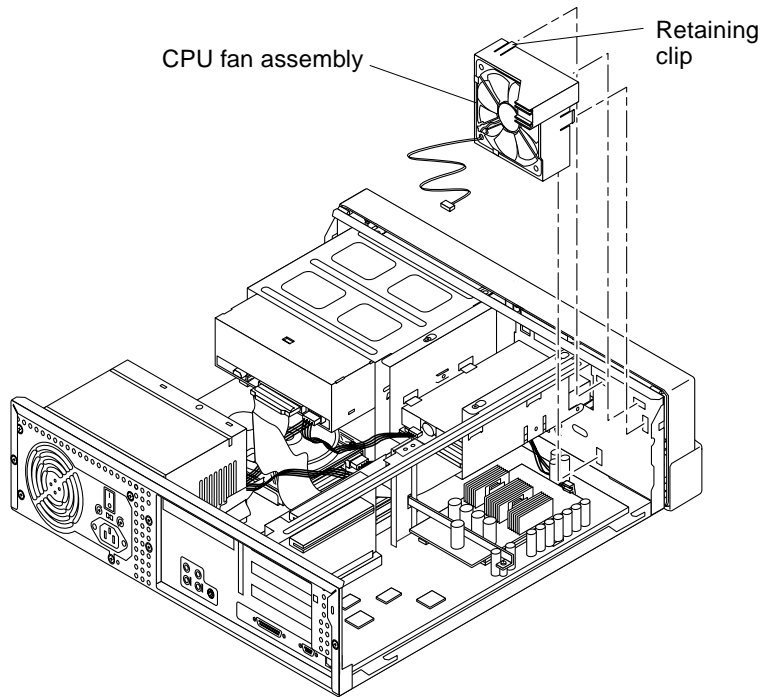


FIGURE 6-7 Removing and Replacing the CPU Fan Assembly

6.4.2 Replacing the CPU Fan Assembly

1. Replace the CPU fan assembly as follows (FIGURE 6-7):
 - a. Position the CPU fan assembly, ensuring that the fan retaining clip is aligned with the chassis retaining-clip hole.
 - b. Secure the fan retaining clip to the chassis.
 - c. Connect the CPU fan assembly power-cable connector to the motherboard (J19).
 - d. Replace the PCI card(s) to the riser board connectors 1 and 3.
See Section 8.4.2 “Replacing a PCI Card” on page 8-11.
2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

6.5 Front Bezel

To remove and replace the front bezel, proceed as follows.

6.5.1 Removing the Front Bezel

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Remove the front bezel as follows (FIGURE 6-8):
 - a. Move the diskette drive assembly (or optional secondary hard drive bracket) aside to provide clearance:
 - i. Using a No. 2 Phillips screwdriver, loosen (but do not remove) the three screws securing the diskette drive bracket to the chassis (see FIGURE 7-1).
 - ii. Slide the diskette drive bracket back and lift it from the three screws. Do not remove any of the cables attached to the diskette drive.
 - iii. Set the diskette drive bracket on top of the power supply.
 - b. Remove the CD-ROM drive.

See Section 7.3.1 “Removing a CD-ROM Drive” on page 7-16.
 - c. Disconnect the standby switch connector from the motherboard.
 - d. Using a No. 2 Phillips screwdriver, remove the two screws securing the front bezel to the chassis.
 - e. Using your thumbs, press down on the front bezel retaining clips and detach the front bezel from the system chassis.

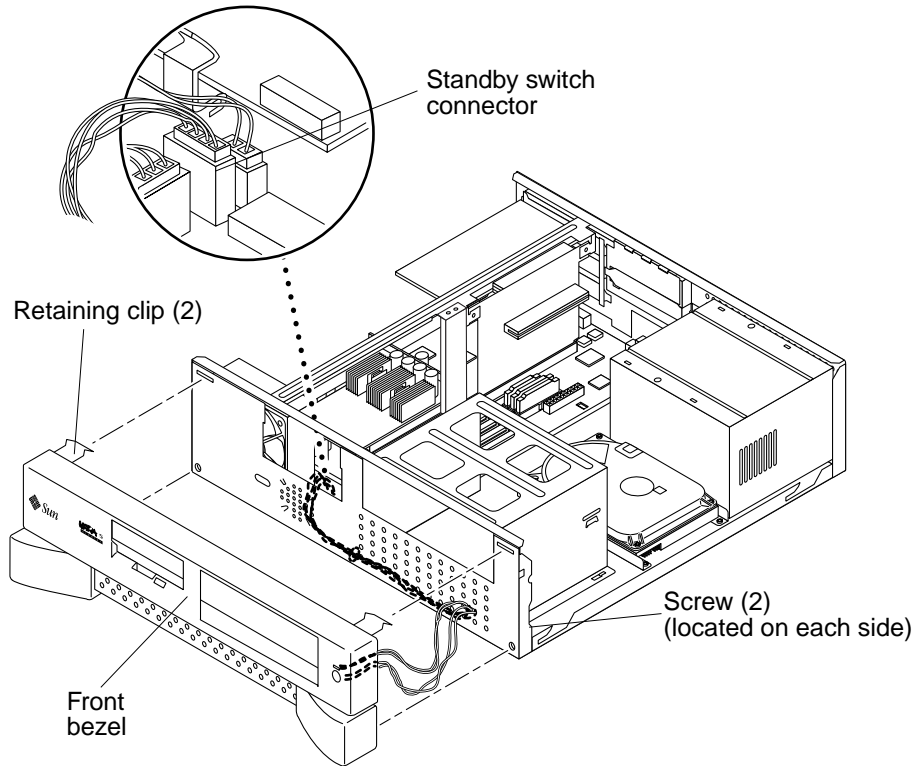


FIGURE 6-8 Removing and Replacing the Front Bezel

6.5.2 Replacing the Front Bezel

1. Replace the front bezel as follows (FIGURE 6-8):
 - a. Position the front bezel on the chassis.
 - b. Thread the Standby switch connector and wires through the chassis access hole and the hole in the CD-ROM drive bracket wall.
 - c. Connect the standby switch connector to the motherboard.
 - d. Using your thumbs, press up on the front bezel retaining clips and attach the front bezel to the chassis.
 - e. Using a No. 2 Phillips screwdriver, replace the two screws securing the front bezel to the chassis.

- f. Replace the CD-ROM drive.**
See Section 7.3.2 “Replacing a CD-ROM Drive” on page 7-17.
 - g. Replace the diskette drive assembly (or optional secondary hard drive bracket):**
 - i. Place the diskette drive bracket back in position, aligning the three holes in the bracket with the three securing screws on the chassis (see FIGURE 7-1).**
 - ii. Slide the diskette drive bracket forward until it stops.**
 - iii. Using a No. 2 Phillips screwdriver, tighten the three securing screws.**
- 2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

Storage Devices

This chapter describes how to remove and replace the Ultra 5 storage devices.

This chapter contains the following topics:

- Section 7.1 “Diskette Drive” on page 7-1
- Section 7.2 “Hard Drives” on page 7-5
- Section 7.3 “CD-ROM Drive” on page 7-16

7.1 Diskette Drive

To remove and replace the diskette drive, proceed as follows.

7.1.1 Removing the Diskette Drive

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the diskette drive as follows (FIGURE 7-1 and FIGURE 7-2):**
 - a. **Disconnect the following:**
 - Diskette drive cable assembly from the diskette drive
 - Power cable connector from the diskette drive

- b. Using a No. 2 Phillips screwdriver, loosen (but do not remove) the three screws securing the diskette drive bracket to the chassis.**

Note – Do not remove the three screws securing the diskette drive bracket to the chassis.

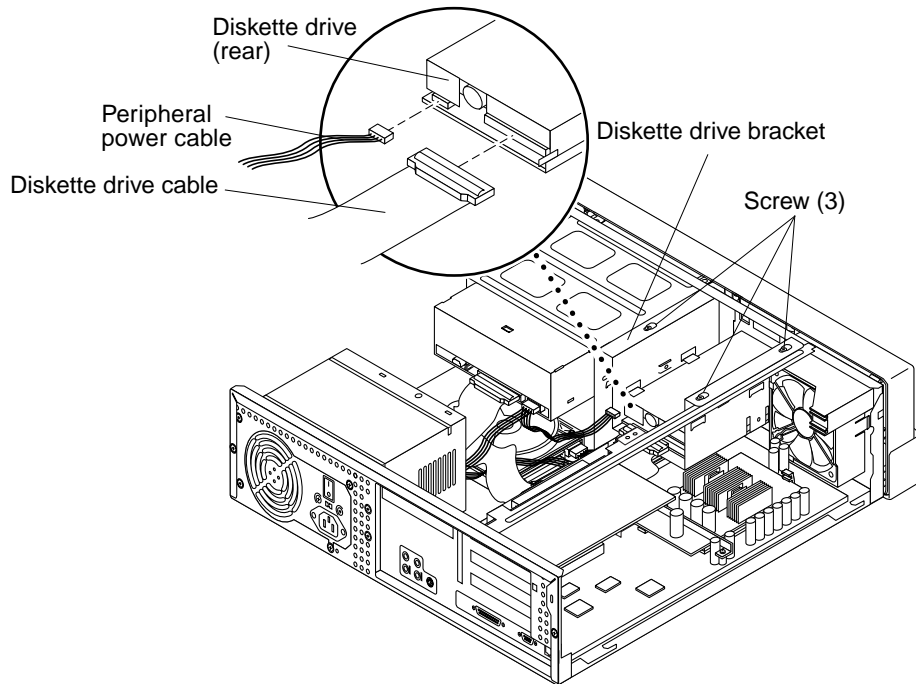


FIGURE 7-1 Removing and Replacing the Diskette Drive, Part 1

- c. Remove the diskette drive bracket from the chassis by sliding back and lifting free of the three screws.**
- d. Using a No. 2 Phillips screwdriver, remove the four screws securing the diskette drive to the diskette drive bracket.**
- e. Remove the diskette drive from the diskette drive bracket.**

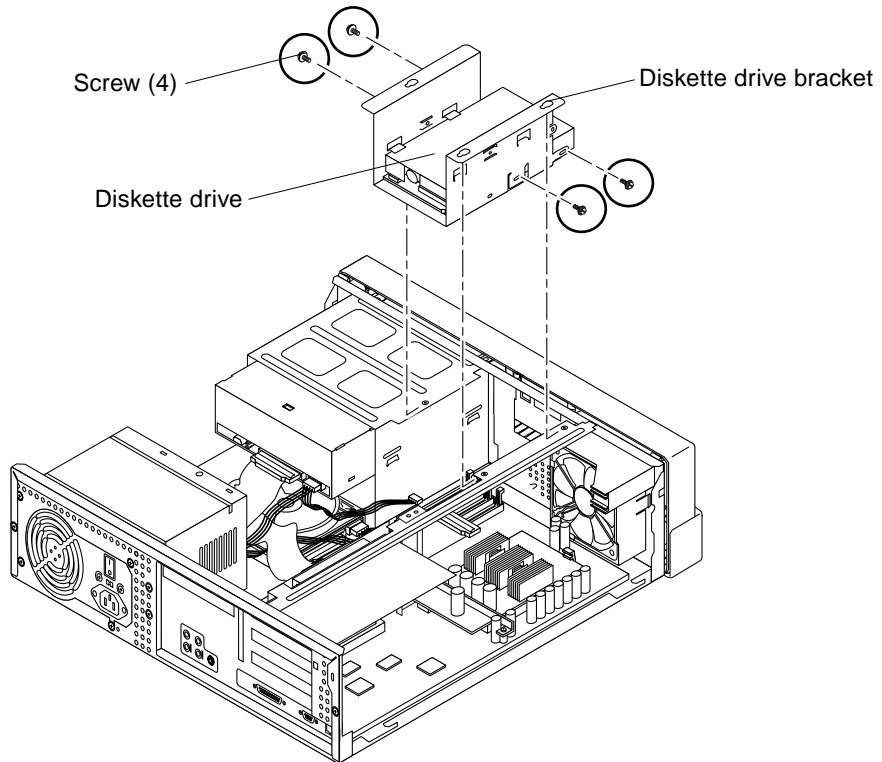


FIGURE 7-2 Removing and Replacing the Diskette Drive, Part 2

7.1.2 Replacing the Diskette Drive

Note – Read the diskette drive product guide for information about jumpers, switch settings, or other installation tasks.

1. **Replace the diskette drive as follows (FIGURE 7-1 and FIGURE 7-2):**
 - a. **Position the diskette drive into the diskette drive bracket.**
 - b. **Using a No. 2 Phillips screwdriver, replace the four screws securing the diskette drive to the diskette drive bracket.**
 - c. **Position the diskette drive bracket into the chassis, aligning the three holes on the bracket with the three screws on the chassis.**
 - d. **Slide the bracket forward until it stops.**

e. Using a No. 2 Phillips screwdriver, tighten the three screws securing the diskette drive bracket to the chassis.

f. Connect the following:

- Diskette drive cable assembly to the diskette drive
- Power cable to the diskette drive

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

7.2 Hard Drives

To remove and replace a primary (master) hard drive, proceed as follows.

7.2.1 Removing a Primary Hard Drive

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the primary hard drive as follows (FIGURE 7-3 and FIGURE 7-4):**
 - a. **Disconnect the power cable connector and the CD-ROM drive cable connector from the rear of the CD-ROM drive. Move the power and CD-ROM drive cables out of the way.**
 - b. **Disconnect the hard drive cable connector and the power cable connector from the hard drive. Move the hard drive and power cables out of the way.**
 - c. **Using a No. 2 Phillips screwdriver, remove the two screws securing the hard drive bracket to the chassis. Lift the hard drive and hard drive bracket from the chassis.**
 - d. **Using a No. 2 Phillips screwdriver, remove the four screws securing the hard drive to the hard drive bracket.**
 - e. **Remove the hard drive from the hard drive bracket.**
 - f. **Place the hard drive on an antistatic mat.**

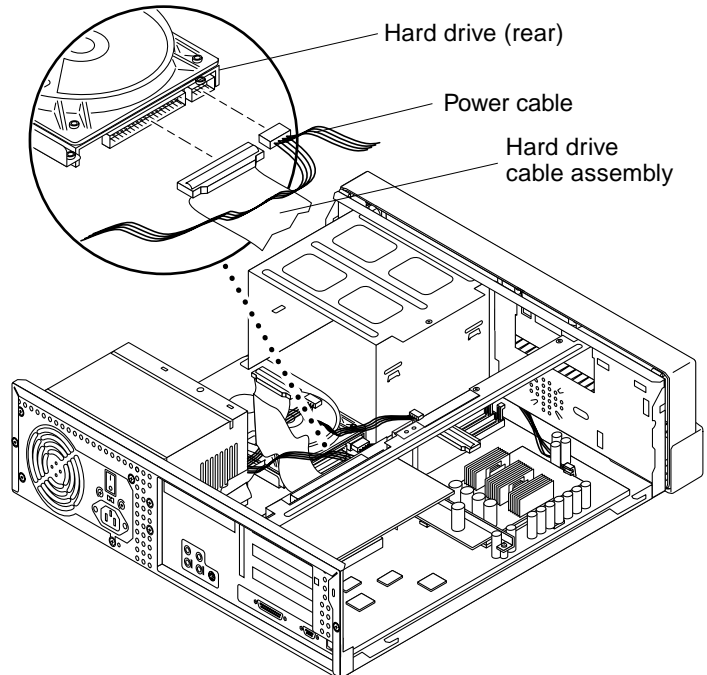


FIGURE 7-3 Removing and Replacing a Primary Hard Drive (Part 1)

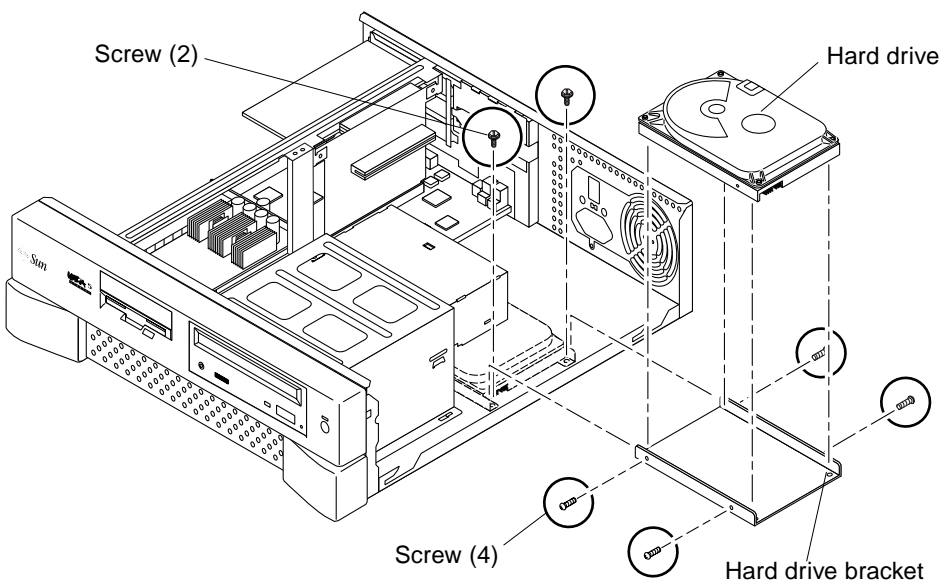


FIGURE 7-4 Removing and Replacing a Primary Hard Drive (Part 2)

7.2.2

Replacing a Primary Hard Drive

Note – Read the hard drive product guide for information about jumpers, switch settings, or other installation tasks.

Note – Prior to replacing a hard drive, verify that the drive's back panel mode-select jumper is set to CS.

1. **Replace the primary hard drive as follows (FIGURE 7-3 and FIGURE 7-4):**
 - a. **Position the hard drive into the hard drive bracket.**
 - b. **Using a No. 2 Phillips screwdriver, replace the four screws securing the hard drive to the hard drive bracket.**
 - c. **Position the hard drive and hard drive bracket into the chassis, ensuring that the bracket engages the two alignment tabs on the chassis bottom.**
 - d. **Using a No. 2 Phillips screwdriver, replace the two screws securing the hard drive bracket to the chassis.**
 - e. **Connect the hard drive cable connector and the power cable connector to the hard drive. Dress cables.**

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

- f. **Connect the power cable connector and the CD-ROM drive cable connector to the rear of the CD-ROM drive. Dress cables.**

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

2. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

7.2.3 Installing a Secondary Hard Drive

The secondary 9.1 GByte hard drive option for the Ultra 5 system ships with a special bracket and a new hard drive cable that has connectors for the primary (master) drive and the secondary (slave) drive. The secondary hard drive and its bracket replace the diskette drive and its bracket. Use the following procedure to install the optional secondary hard drive in place of the diskette drive.

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**
2. **Disconnect all cables from the rear of the diskette drive.**
3. **Loosen, but do not remove the three screws that hold the diskette drive bracket to the chassis (FIGURE 7-6).**
4. **Remove the diskette drive bracket from the chassis by sliding it back and lifting it free of the three screws. Set the bracket aside.**
5. **Remove any PCI card from PCI slot 2.**
See Section 8.4.1 “Removing a PCI Card” on page 8-9.
6. **Disconnect the diskette drive cable from the motherboard and set the cable aside.**
7. **Disconnect the existing hard drive cable from the rear of the master hard drive and from motherboard connector J15.**
8. **Place the new secondary hard drive into the secondary hard drive bracket and install the four screws that hold the drive to the bracket.**

Note – Before installing the hard drive into the system, verify that the drive’s back-panel mode-select jumper is set to CS.

9. **Place the new hard drive bracket and hard drive on top of the power supply.**
10. **Connect the new hard drive cable’s “MOTHERBOARD” connector to motherboard connector J15.**
11. **Connect the new hard drive cable’s “MASTER” connector to the EIDE connector on the back of the primary (master) hard drive.**
12. **Connect the new hard drive cable’s “SLAVE” connector to the EIDE connector on the rear of the new secondary (slave) hard drive.**

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

The following diagram shows the cabling for the hard drives when two hard drives are installed.

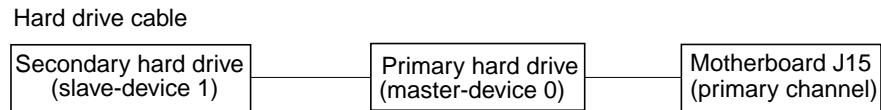


FIGURE 7-5 Hard Drive Cabling Configuration with Two Hard Drives

- 13. Place the three holes on the new hard drive bracket over the three securing screws on the chassis.**
- 14. Carefully slide the hard drive bracket forward until it stops.**
- 15. Tighten the three screws that secure the drive bracket to the chassis.**
- 16. Dress cables to provide clearance.**
- 17. Reinstall any PCI card you removed from PCI slot 2.**
See Section 8.4.2 “Replacing a PCI Card” on page 8-11.
- 18. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

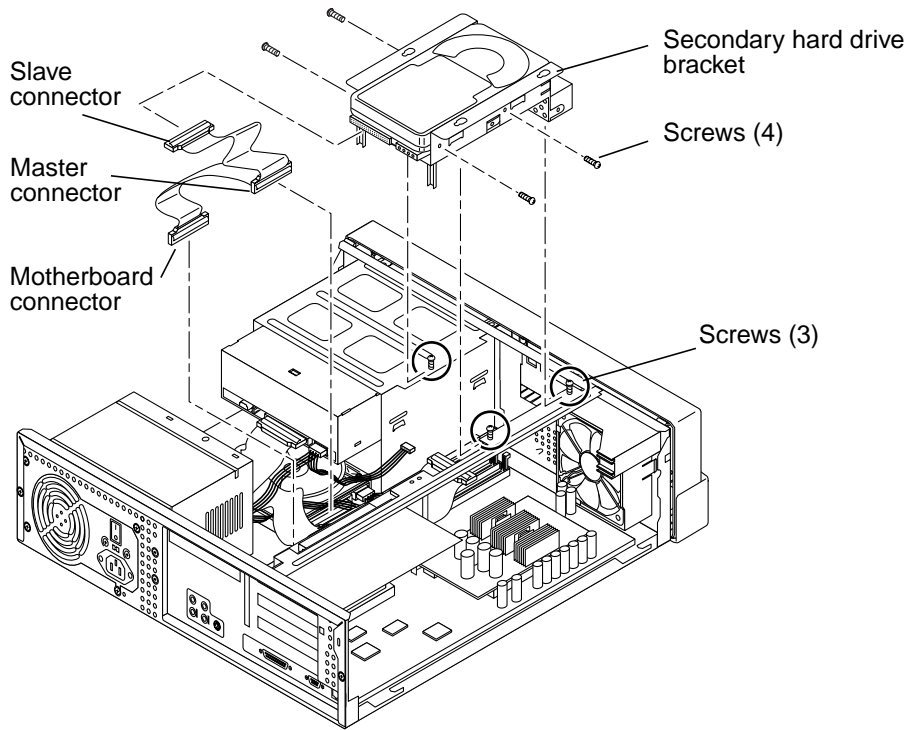


FIGURE 7-6 Installing a Secondary Hard Drive

7.2.4 Hard Drive Mirroring

This section describes the requirements and constraints of a hard drive mirroring solution that utilizes Solstice DiskSuite™ software.

7.2.4.1 Hard Drive Mirroring Configuration

The IDE subsystem of the Ultra 5 system has two independent channels designated “primary” and “secondary”. On the Ultra 5 motherboard there are two separate connectors for each channel, allowing each channel to support two devices. One device may be jumpered as “master” (device 0) and the other as “slave” (device 1).

When mirroring hard drives in an Ultra 5 system, use this hardware configuration:

- Primary channel—One hard drive jumpered as master
- Secondary channel—One hard drive jumpered as master

Two IDE cables are required for this configuration. Each cable is connected to the motherboard at one end and to a hard drive (jumpered as master) at the “MASTER” connector. FIGURE 7-7 shows this hardware configuration (with an optional CD-ROM drive jumpered as a slave device on the secondary channel).

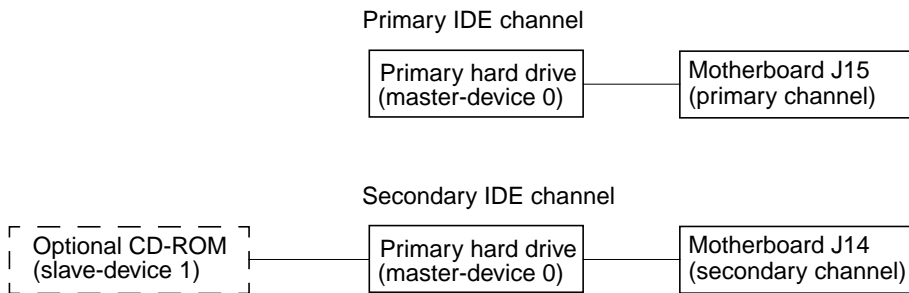


FIGURE 7-7 Hard Drive Mirroring Configuration

7.2.4.2 Hardware Considerations

This section describes special considerations and requirements for hardware when mirroring hard drives in an Ultra 5 system.

Note – The two hard drives that are mirrored cannot be on the same channel. Both hard drives must be jumpered as the master device on two separate channels.

Note – If a CD-ROM drive is included in an Ultra 5 system with this hard drive mirroring configuration, the CD-ROM drive must be jumpered as a slave device on either the primary or the secondary channel.

Note – If a mirrored Ultra 5 system includes a CD-ROM drive, the alias for the CD-ROM drive must be altered at the OBP level before a user can boot using the `boot cdrom` command. The procedure for altering the alias immediately follows this note.

Changing a CD-ROM Drive Alias

If a mirrored Ultra 5 system includes a CD-ROM drive, the alias for the CD-ROM drive must be altered at the OBP level before a user can boot using the `boot cdrom` command. This is because the alias for the CD-ROM drive is hard-coded with the assumption that the CD-ROM drive is connected as the master device on the secondary channel (`/pci@1f,0/pci@1,1/ide@3/cdrom@2,0:f`). In a mirrored configuration, this is not true because the CD-ROM is jumpered as the *slave* device on the primary or secondary channel. Therefore, the alias is incorrect and must be altered. Use the `nvalias` command to alter a CD-ROM drive alias as follows:

- To change the alias for a CD-ROM drive on the primary channel, type:
`nvalias cdrom /pci@1f,0/pci@1,1/ide@3/cdrom@1,0:f`
- To change the alias for a CD-ROM drive on the secondary channel, type:
`nvalias cdrom /pci@1f,0/pci@1,1/ide@3/cdrom@3,0:f`

7.2.4.3 Required Software and Patches

The supported software version number is Solstice DiskSuite 4.1.

The IDE drivers have been modified and made more robust for mirroring support on the Ultra 5 system. The appropriate driver patch must be installed on the system before using the mirroring features of Solstice DiskSuite software. These required patch numbers are:

- For Solaris 7—Patch number 107121
- For Solaris 2.6—Patch number 106407
- For Solaris 2.5.1—Patch number 106197

The latest versions of these patches are available for download from SunSolve Online at: <http://sunsolve.Corp.Sun.COM>

7.2.4.4 Software Constraints

When using Solstice DiskSuite 4.1 software, it is recommended that you have a minimum of three metadevice databases to maintain a “quorum.” It is further recommended that the databases be maintained on different disks, which would require three IDE hard drives in the system. Because the Ultra 5 system can support only two hard drives, only two metadevice databases are possible. This limitation has a known impact.

Solstice DiskSuite software will function with only two disks and two database replicas. However, if one disk fails, there is not a quorum. No problem with the system will be seen until after the system is powered down. After the system is powered down, it will not power on and boot in multiuser mode without system administration intervention.

For example, if the quorum is not seen during boot due to a hard drive failure, the system boots in single-user mode. The problem is reported by the system when the machine is rebooted. The output is similar to the following example:

```
ok boot

Hostname: demo

metainit: demo: stale databases

Use metadb to delete databases which are broken.

Ignore any "Read-only file system" error messages.

Reboot the system when finished to reload the metadevice
database. After reboot, repair any broken database replicas
which were deleted.

Type Ctrl-d to proceed with normal startup,(or give root
password for system maintenance):
```

If you see the message shown above, use the recovery procedure in the next section to replace broken database replicas.

7.2.4.5 Recovery Procedure for Broken Database Replicas

The high-level recovery steps are as follows:

- Delete the broken database replica and reboot.
- Repair or replace the problem hard drive.
- Add back the database replica.

Detailed instructions for the broken database recovery are as follows:

1. **After you see the error messages described in the previous section, type your root password to enter system maintenance mode at the following prompt:**

```
Type Ctrl-d to proceed with normal startup,  
(or give root password for system maintenance): <root password>
```

The following message then displays:

```
Entering System Maintenance Mode
```

2. **Type the `metadb` command as follows to look at the databases to determine which database replica is broken.**

```
# usr/opt/SUNWmd/metadb -i  
flags   first blk   block count  
a p l   1050          1034         /dev/dsk/c0t3d0s3  
M p     unknown    unknown      /dev/dsk/c1t2d0s3
```

In the example shown above, the system can no longer detect the state database replica on slice `/dev/dsk/c1t2d0s3`, which is part of the failed disk. The `metadb` command flags the replicas on this slice as having a problem with the master blocks.

3. **Delete the database replica on the bad disk using the `-d` option of the `metadb` command as follows. Using the example, you would type:**

```
# usr/opt/SUNWmd/metadb -d -f /dev/dsk/c1t2d0s3  
metadb: demo:/etc/opt/SUNWmd/mddb.cf.new: Read-only file system
```

At this point, the root (`/`) file system is read-only. You can ignore any `mddb.cf` error messages that are displayed.

4. Verify that the replica was deleted using the `metadb` command again:

```
# usr/opt/SUNWmd/metadb -i
flags      first blk    block count
a m p l u  1050          1034        /dev/dsk/c0t3d0s3
```

5. Reboot the system.

6. Halt the system and replace the failed hard drive (refer to Section 7.2 “Hard Drives” on page 7-5).

```
# halt
```

7. After replacing the failed hard drive, power on and reboot the system.

```
ok boot
```

8. Use the `format` or the `fmthard` command to partition the hard drive as it was before the failure. Using the example, you would type:

```
# format /dev/rdisk/c1t2d0s0
```

9. Use the `metadb` command to add back the state database replicas and to determine that the state database replicas are correct. Using the example, you would type:

```
# usr/opt/SUNWmd/metadb -a /dev/dsk/c1t2d0s3
flags      first blk    block count
a m p l u o  16          1034        /dev/dsk/c0t3d0s3
a      u      16          1034        /dev/dsk/c1t2d0s3
```

7.3 CD-ROM Drive

To remove and replace a CD-ROM drive, proceed as follows.

7.3.1 Removing a CD-ROM Drive

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Remove the CD-ROM drive as follows (FIGURE 7-8):
 - a. Move the diskette drive assembly (or optional secondary hard drive bracket) aside to provide clearance:
 - i. Using a No. 2 Phillips screwdriver, loosen (but do not remove) the three screws securing the diskette drive bracket to the chassis (see FIGURE 7-1).
 - ii. Slide the diskette drive bracket back and lift it from the three screws. Do not remove any of the cables attached to the diskette drive.
 - iii. Set the diskette drive bracket on top of the power supply.
 - b. Remove the CPU fan assembly
See Section 6.4.1 “Removing the CPU Fan Assembly” on page 6-12.

Note – The CPU fan assembly removal is optional. Remove the CPU fan assembly only if the screws securing the CD-ROM drive to the CD-ROM drive bracket cannot be reached.

- c. Remove the following from the rear of the CD-ROM drive:
 - CD-ROM drive cable connector
 - Power cable connector
 - Audio cable connector
- d. Using a No. 2 Phillips screwdriver, remove the four screws securing the CD-ROM drive to the CD-ROM drive bracket.

- e. Place your fingers on the back of the CD-ROM drive. Push the CD-ROM drive toward the chassis front and remove.
- f. Place the CD-ROM drive on an antistatic mat.

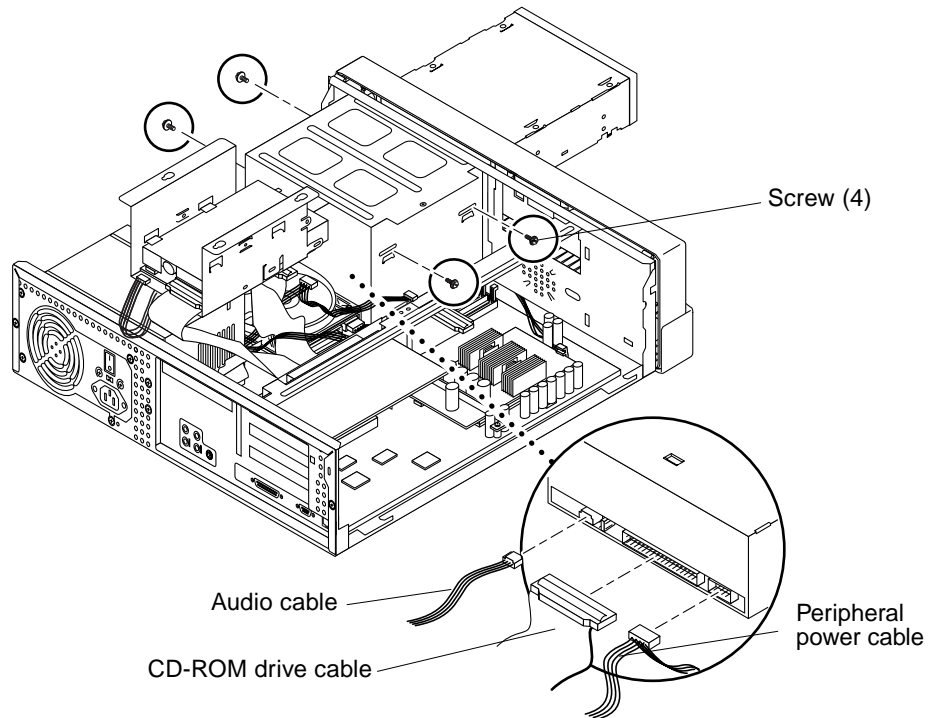


FIGURE 7-8 Removing and Replacing a CD-ROM Drive

7.3.2 Replacing a CD-ROM Drive

Note – Prior to replacing the CD-ROM drive, verify that the CD-ROM drive's back panel mode-select jumper is set to MA.

Replace the CD-ROM drive as follows (FIGURE 7-8):

1. **Position the CD-ROM drive into the CD-ROM drive bracket.**
2. **Push the CD-ROM drive toward the chassis rear.**
3. **Using a No. 2 Phillips screwdriver, replace the four screws securing the CD-ROM drive to the bracket.**

4. Replace the CPU fan assembly.

See Section 6.4.2 “Replacing the CPU Fan Assembly” on page 6-13.

5. Replace the diskette drive assembly (or optional secondary hard drive bracket):

a. Place the diskette drive bracket back in position, aligning the three holes in the bracket with the three securing screws on the chassis (see FIGURE 7-1).

b. Slide the diskette drive bracket forward until it stops.

c. Using a No. 2 Phillips screwdriver, tighten the three securing screws.

6. Connect the following to the rear of the CD-ROM drive:

- CD-ROM drive cable connector
- Power cable connector
- Audio cable connector

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

7. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

Motherboard and Component Replacement

This chapter describes how to remove and replace the Ultra 5 motherboard and motherboard components.

This chapter contains the following topics:

- Section 8.1 “CPU Module” on page 8-1
- Section 8.2 “NVRAM/TOD” on page 8-4
- Section 8.3 “DIMM” on page 8-6
- Section 8.4 “PCI Card” on page 8-9
- Section 8.5 “PCI Riser Board” on page 8-13
- Section 8.6 “Motherboard” on page 8-15

8.1 CPU Module

To remove and replace the CPU module, proceed as follows.

8.1.1 Removing the CPU Module

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.



Caution – The static random access memory (SRAM) heatsinks are extremely fragile. Do not touch the SRAM heatsinks.

2. **If necessary, remove any PCI cards from PCI slots 1 and 3 to provide clearance.**
See Section 8.4.1 “Removing a PCI Card” on page 8-9.
3. **Remove the CPU module as follows (FIGURE 8-1):**
 - a. **Using a No. 2 Phillips screwdriver, remove the screw securing the hold-down brace to the riser. Remove the hold-down brace.**
 - b. **Using a No. 2 Phillips screwdriver, remove the screw securing the CPU module hold-down clip to the motherboard. Remove the CPU module hold-down clip.**
 - c. **Using your fingers, gently lift the CPU module evenly to loosen it from the motherboard CPU connectors MJ1 and MJ2.**
 - d. **Lift the CPU module upward from the motherboard CPU connectors until it clears the system chassis.**
 - e. **Place the CPU module on an antistatic mat.**

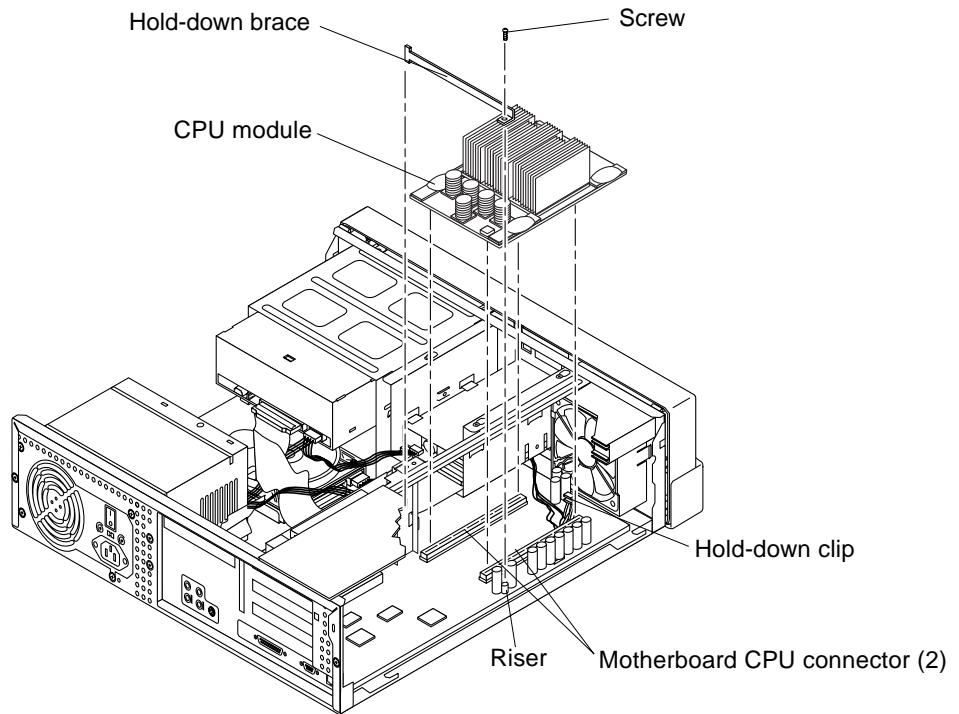


FIGURE 8-1 Removing and Replacing the CPU Module

8.1.2 Replacing the CPU Module

1. Replace the CPU module as follows (FIGURE 8-1):
 - a. Position the CPU module onto the motherboard CPU connectors MJ1 and MJ2.
 - b. Grasping the CPU module, gently press on the CPU module rear edges and then the front edges until the CPU module begins to seat.
 - c. Using both hands, align the CPU module, then press downward evenly on its edges until the CPU module is properly seated in the motherboard CPU connectors.
 - d. Push the hold-down clip forward over the edge of the CPU module.
 - e. Replace the hold-down clip. Using a No. 2 Phillips screwdriver, replace the screw securing the CPU module hold-down clip to the motherboard.
 - f. Replace the hold-down brace. Using a No. 2 Phillips screwdriver, replace the screw securing the hold-down brace to the riser.

2. Replace any PCI card(s) removed from slots 1 and 3.

See Section 8.4.2 “Replacing a PCI Card” on page 8-11.

Note – If you upgrade with a replacement CPU module that is faster than 420 MHz, *and* the system is using either the Solaris 2.5.1 or 2.6 operating environments, software patches are required for those Solaris releases to run at the faster CPU speed. You can order the software patch CDs using part number 704-6657 (for Solaris 2.5.1) or 704-6658 (for Solaris 2.6). Refer to the patch installation instructions in the CD-insert document included with the CDs.

3. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

8.2 NVRAM/TOD

To remove and replace the NVRAM/TOD, proceed as follows.

8.2.1 Removing the NVRAM/TOD

1. Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. Remove the NVRAM/TOD as follows (FIGURE 8-2):

a. Remove any PCI cards installed in PCI slots 1 and 3.

See Section 8.4.1 “Removing a PCI Card” on page 8-9.

b. Locate the NVRAM/TOD and carrier on the motherboard.

c. Grasp the NVRAM/TOD carrier at each end and pull it straight up, gently wiggling it as necessary.

3. Place the NVRAM/TOD and carrier on an antistatic mat.

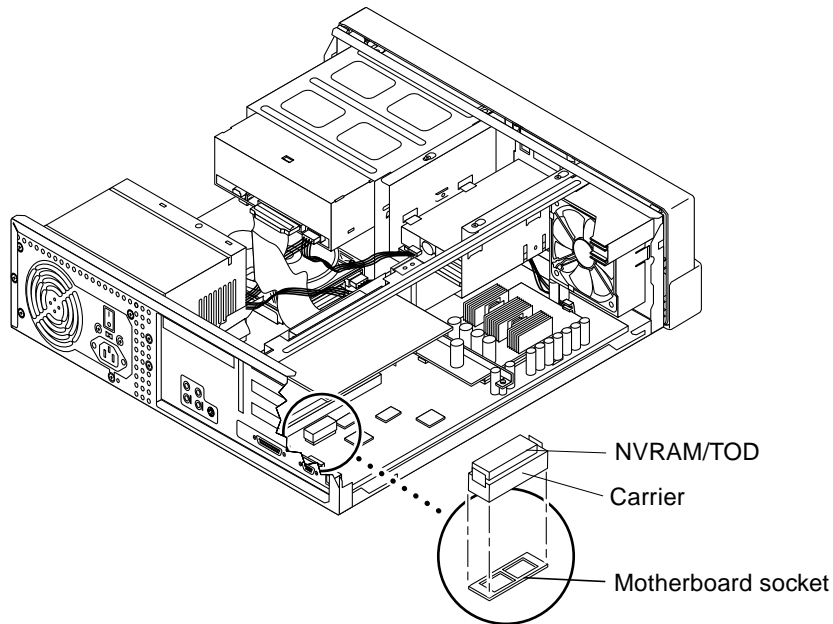


FIGURE 8-2 Removing and Replacing the NVRAM/TOD

8.2.2 Replacing the NVRAM/TOD

1. Replace the NVRAM/TOD as follows (FIGURE 8-2):
 - a. Position the NVRAM/TOD carrier on the motherboard.
 - b. Carefully insert the NVRAM/TOD carrier into the motherboard socket.

Note – The carrier is keyed so the NVRAM/TOD can be installed only one way.

- c. Push the NVRAM/TOD into the carrier until it is properly seated.
2. Replace any PCI card(s) removed from slots 1 and 3.
See Section 8.4.2 “Replacing a PCI Card” on page 8-11.
3. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

8.3 DIMM

To remove and replace a DIMM, proceed as follows.



Caution – DIMMs consist of electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or work environment can destroy the DIMM.



Caution – When removing a DIMM, an identical replacement is required. The replacement DIMM must be inserted into the same socket as the removed DIMM.



Caution – Each DIMM bank must contain 2 DIMMs of equal density (for example, two 32-Mbyte DIMMs) to function properly. Do not mix DIMM capacities in any bank. For best system performance, install 4 identical DIMMs in the 2 banks.

The following table identifies DIMM banks and slot pairs.

TABLE 8-1 DIMM Banks and Slot Pairs

Bank	Slot Pairs
0	DIMM1 and DIMM2
1	DIMM3 and DIMM4

8.3.1 Removing a DIMM



Caution – Handle DIMMs only by the edges. Do not touch the DIMM components or metal parts. Always wear a grounding strap when handling a DIMM.

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the diskette drive to provide clearance.**
See Section 7.1.1 “Removing the Diskette Drive” on page 7-1
3. **Locate the DIMM to be removed.**
4. **Push the ejection levers away from the DIMM (FIGURE 8-3).**

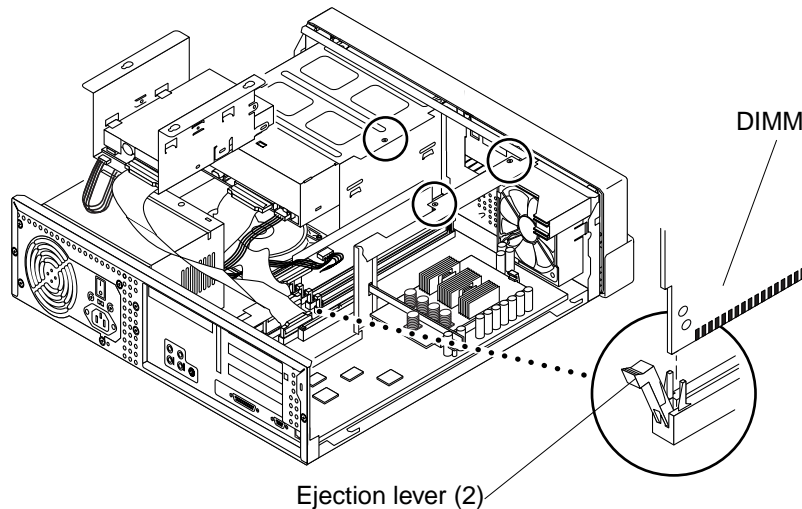


FIGURE 8-3 Removing and Replacing a DIMM

5. **Remove the DIMM from the motherboard connector.**
6. **Place the DIMM on an antistatic mat.**

8.3.2 Replacing a DIMM



Caution – Do not remove any DIMM from the antistatic container until you are ready to install it on the motherboard. Handle DIMMs only by their edges. Do not touch DIMM components or metal parts. Always wear a grounding strap when handling DIMMs.

1. **Remove the DIMM from the antistatic container.**
2. **Install the DIMM as follows: (FIGURE 8-3)**



Caution – The system *must* have two identical DIMMs installed in a bank. For best system performance, install four identical DIMMs in the two banks. TABLE 8-1 identifies DIMM banks and slot pairs.

- a. **Position the DIMM in the connector, ensuring that the notches on the bottom of the DIMM are aligned with the connector alignment bumps.**

Note – Bottom DIMM notches and connector alignment bumps are keyed to ensure proper DIMM orientation.



Caution – If the DIMM is not seated into its slot evenly, it can cause shorts that will damage the system. Ensure that all contacts engage at the same time by pressing evenly on the top corners of the DIMM—do *not* rock the DIMM into place. A clicking sound is heard when the DIMM is properly seated.

- b. **Press firmly on the DIMM top until the DIMM is properly seated.**
3. **Verify the ejection levers are closed toward the DIMM.**
 4. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

8.4 PCI Card

To remove and replace a PCI card, proceed as follows.

8.4.1 Removing a PCI Card

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the PCI card(s):**
 - Slots 1 and 3: Go to Step 3.
 - Slot 2: Go to Step 4.
3. **Remove the PCI card from PCI slots 1 or 3 as follows (FIGURE 8-4):**
 - a. **Using a No. 2 Phillips screwdriver, remove the screw securing the PCI card bracket tab to the chassis.**



Caution – To avoid damaging the card's connector do not apply force to only one end or one side of the card.

- b. **Grasp the two corners of the PCI card and pull the card straight out from the motherboard connector.**
- c. **Place the PCI card on an antistatic mat.**

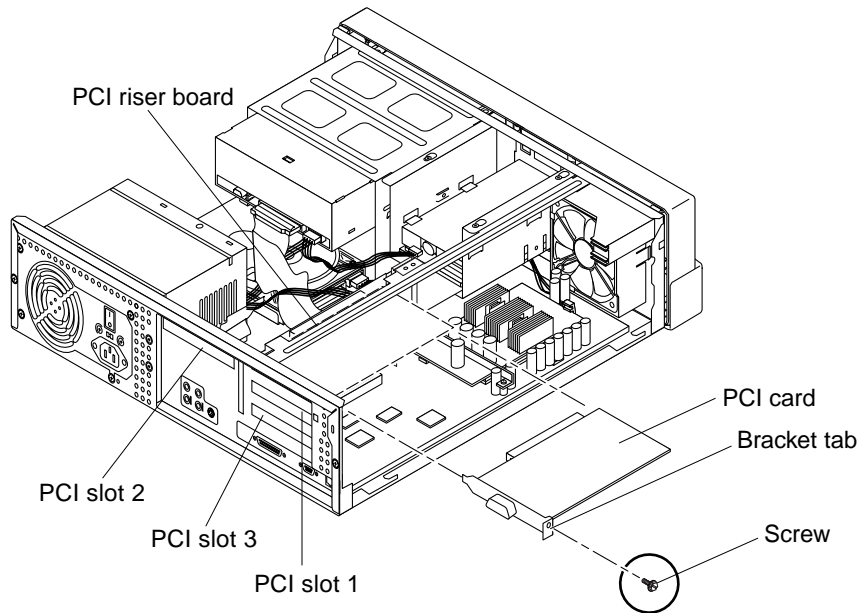


FIGURE 8-4 Removing and Replacing a PCI Card From PCI Slot 1 or 3

4. Remove the PCI card from slot 2 as follows (FIGURE 8-5):

- a. Using a No. 2 Phillips screwdriver, remove the screw securing the bracket tab adapter to the chassis.**
- b. Remove the bracket tab adapter.**



Caution – To avoid damaging the card's connector do not apply force to only one end or one side of the card.

- c. At the two corners of the card, pull the card from the PCI riser board connector.**
- d. Move the PCI card so that the card bracket tab clears the chassis back panel slot.**
- e. Remove the PCI card from the chassis.**
- f. Place the PCI card on an antistatic mat.**

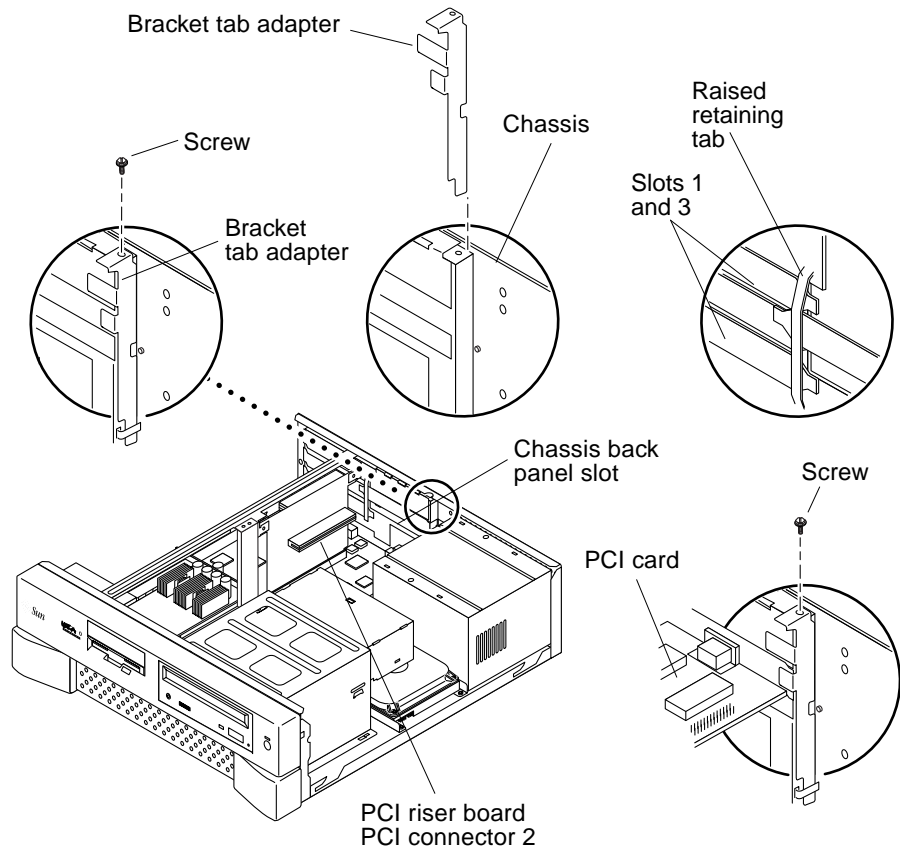


FIGURE 8-5 Removing and Replacing the PCI Card From PCI Slot 2

8.4.2 Replacing a PCI Card

Note – Read the PCI card product guide for information about jumper or switch settings, slot requirements, and required tools.

1. Replace the PCI card:

- Slots 1 or 3: Go to step 2.
- Slot 2: Go to step 3.

2. Replace the PCI card into PCI slot 1 or 3 as follows (FIGURE 8-4):

- a. Position the PCI card into the chassis.

- b. **Insert the PCI card connector so that it touches the associated PCI riser board connector.**



Caution – Support the riser card with the fingers of one hand, to insure full insertion of the PCI card into the PCI riser board.



Caution – The PCI card bracket tab end *must* be inserted under the raised retaining tab on the back of the system chassis (FIGURE 8-5).

- c. **Guide the PCI card bracket tab into the chassis back panel slot.**
 - d. **At the two corners of the card, push the card into the PCI riser board connector until the card is fully seated.**
 - e. **Using a No. 2 Phillips screwdriver, replace the screw securing the PCI card bracket tab to the system chassis.**
3. **Replace the PCI card into PCI slot 2 as follows (FIGURE 8-5):**
 - a. **Position the PCI card into the chassis.**
 - b. **Insert the PCI card connector so that it touches PCI riser board connector 2.**



Caution – The PCI card backplate end *must* be inserted *between* the card bracket tabs in slots 1 and 3 (opposite side of riser card) and the raised retaining tab on the back of the system chassis (FIGURE 8-5).

- c. **Guide the PCI card bracket tab into the chassis back panel slot.**



Caution – Support the riser card with the fingers of one hand, to insure full insertion of the PCI card into the PCI riser board.

- d. **At the two corners of the card, push the card into the PCI riser board connector until the card is fully seated.**
 - e. **Using a No. 2 Phillips screwdriver, replace the screw securing the PCI card bracket tab to the system chassis.**
4. **Connect all external cables to the PCI card.**
 5. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

8.5 PCI Riser Board

To remove and replace a PCI riser board, proceed as follows.

8.5.1 Removing the PCI Riser Board

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the PCI card(s) from the PCI riser board.**

See Section 8.4.1 “Removing a PCI Card” on page 8-9.

3. **Remove the PCI riser board as follows (FIGURE 8-6):**

- a. **Using a No. 2 Phillips screwdriver, remove the two screws securing the PCI riser board to the system chassis.**



Caution – To avoid damaging the PCI riser board’s connector, do not apply force to only one end or one side of the card.

- b. **At the two upper corners of the PCI riser board, pull the PCI riser board straight upward from the connector.**

- c. **Remove the PCI riser board from the chassis.**

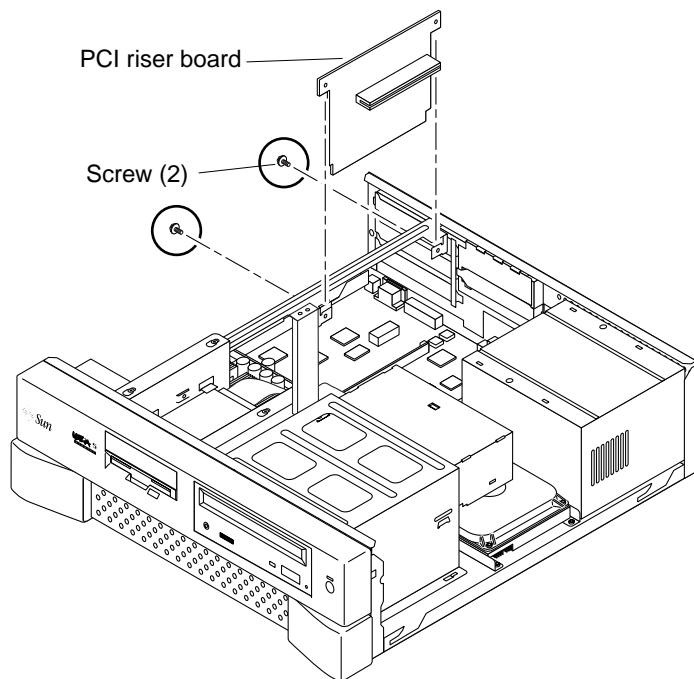


FIGURE 8-6 Removing and Replacing the PCI Riser Board

8.5.2 Replacing the PCI Riser Board

1. **Replace the PCI riser board as follows (FIGURE 8-6):**
 - a. **Position the PCI riser board into the chassis.**
 - b. **Position the PCI riser board connector so that it touches its associated connector on the motherboard.**
 - c. **At the two upper corners of the PCI riser board, push the board straight downward into the connector until the card is fully seated.**
 - d. **Using a No. 2 Phillips screwdriver, replace the two screws securing the PCI riser board to the system chassis.**
2. **Replace the PCI card(s) into the PCI riser board.**
See Section 8.4.2 “Replacing a PCI Card” on page 8-11.
3. **Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.**

8.6 Motherboard

To remove and replace a motherboard, proceed as follows.



Caution – Use an antistatic mat when working with the motherboard. An antistatic mat contains the cushioning needed to protect the underside components, to prevent motherboard flexing, and to provide antistatic protection.

8.6.1 Removing the Motherboard

1. **Power off the system, remove the system cover, and attach an antistatic wrist strap as described in Chapter 5.**



Caution – Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface.

2. **Remove the motherboard as follows (FIGURE 8-7 and FIGURE 8-8):**

- a. **Remove the power supply.**

See Section 6.1.1 “Removing the Power Supply” on page 6-1.

- b. **Remove the diskette drive (or optional secondary hard drive).**

See Section 7.1.1 “Removing the Diskette Drive” on page 7-1.

- c. **Disconnect the following from the motherboard:**

- Speaker cable connector (J18)
- CPU fan cable connector (J19)
- Power-on LED/software power-on cable connector (J17)
- Diskette drive cable assembly (J16)
- CD-ROM drive cable connector (J14)
- Hard drive cable connector (J15)
- Audio cable assembly (J9)
- Serial/parallel cable assembly (J7/J8)

- d. **Remove the following from the system:**

- i. **CPU module**

See Section 8.1.1 “Removing the CPU Module” on page 8-1.

ii. CPU fan assembly

See Section 6.4.1 “Removing the CPU Fan Assembly” on page 6-12.

iii. PCI card(s)

See Section 8.4.1 “Removing a PCI Card” on page 8-9.

iv. PCI riser board

See Section 8.5.1 “Removing the PCI Riser Board” on page 8-13.

v. PCI riser board support

vi. NVRAM/TOD with carrier

See Section 8.2.1 “Removing the NVRAM/TOD” on page 8-4.

Note – The NVRAM/TOD contains the system host identification (ID) and Ethernet address. If the same ID and Ethernet address are to be used on the replacement motherboard, remove the NVRAM/TOD from the motherboard and install it to the new motherboard after motherboard installation.

vii. DIMMs

See Section 8.3.1 “Removing a DIMM” on page 8-7.

e. Remove the motherboard as follows:

i. Disconnect the external cables.

ii. Using a No. 2 Phillips screwdriver, remove the seven screws securing the motherboard to the chassis (including the CPU standoff screw). Set the screws aside.



Caution – Handle the motherboard by the back panel or by the edges only.

iii. Lift the motherboard from the chassis.

iv. Place the motherboard on an antistatic mat.

Note – It might be necessary to slide the motherboard toward the chassis front before lifting it from the chassis.

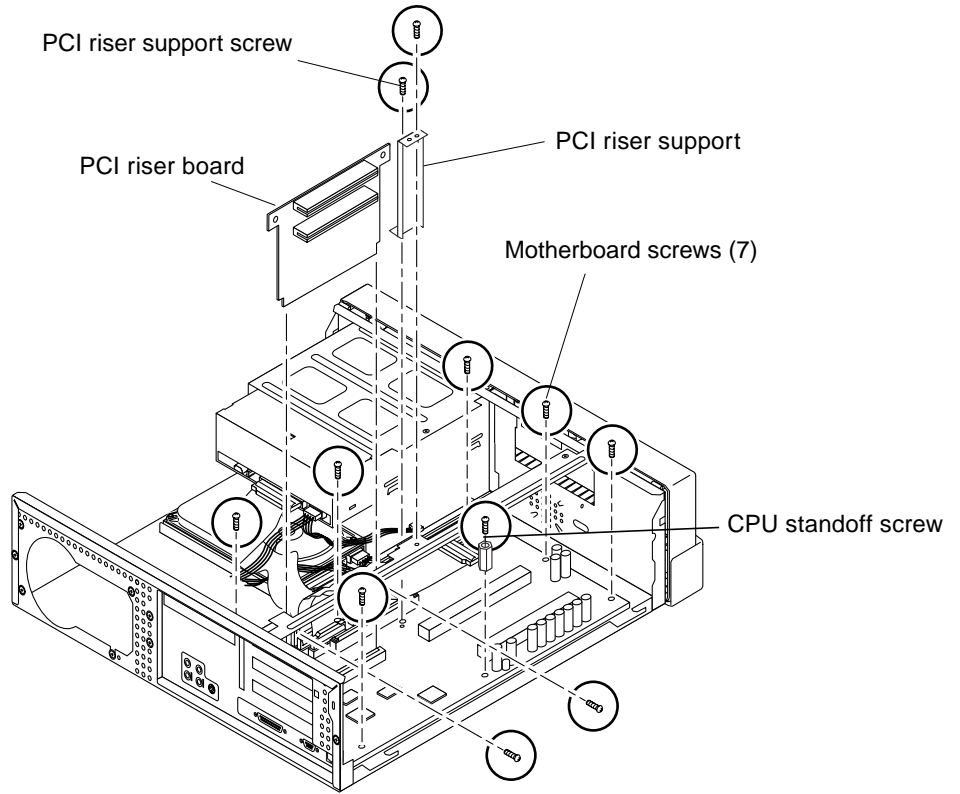


FIGURE 8-7 Removing and Replacing the Motherboard, Part 1

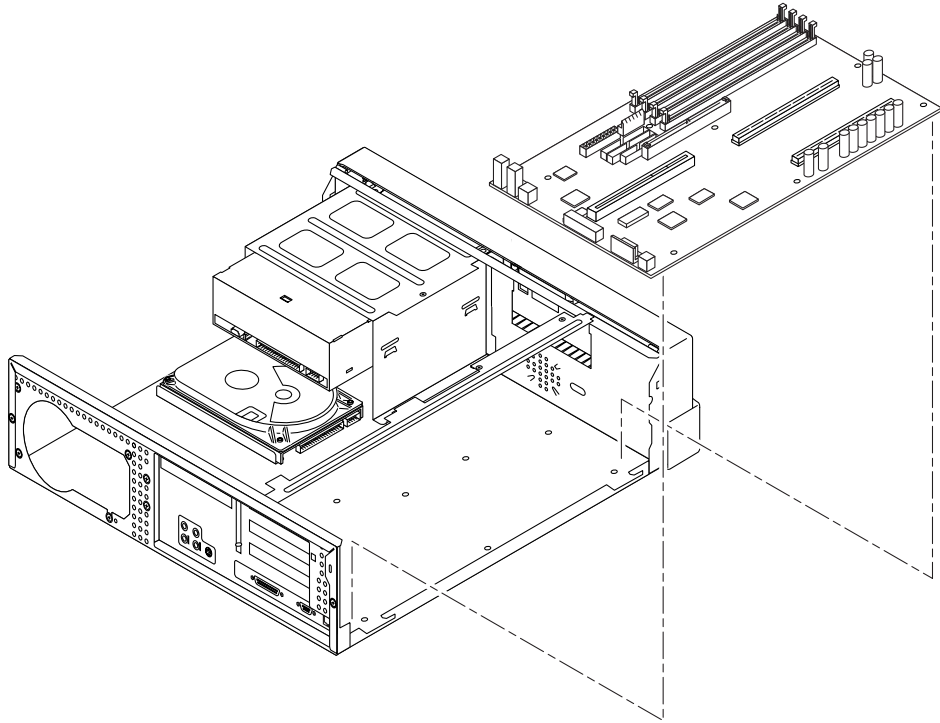


FIGURE 8-8 Removing and Replacing the Motherboard, Part 2

8.6.2 Replacing the Motherboard

Note – Jumpers JP3 and JP4 can be set to either RS-423 or RS-232 serial interface. The jumpers are preset for RS-423. RS-232 is required for digital telecommunication within the European Community.

1. Using long-nose pliers, set the motherboard serial port jumpers JP3 and JP4 (refer to the following table).

TABLE 8-2 Serial Port Jumper Settings

Jumper	Pins 1 + 2 Select	Pins 2 + 3 Select	Default Shunt on Pins
JP3	RS-232	RS-423	2-3
JP4	RS-232	RS-423	2-3

Note – Motherboard jumpers are identified as JP. Jumper pins are located immediately adjacent to the part number.

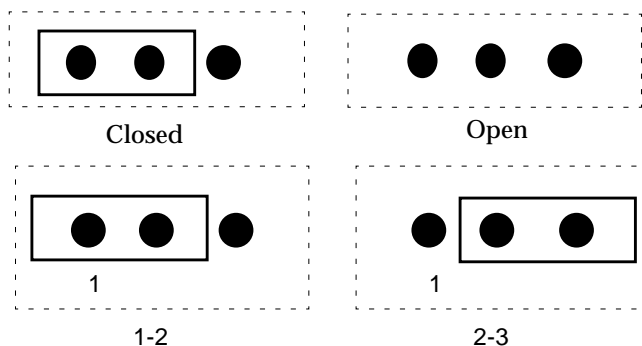


FIGURE 8-9 Identifying Jumper Pins

2. Replace the motherboard as follows (FIGURE 8-7 and FIGURE 8-8):

- a. Replace the motherboard as follows:



Caution – Handle the motherboard by the back panel or the edges only.

- i. Position the motherboard into the chassis.
 - ii. Using a No. 2 Phillips screwdriver, replace the seven screws securing the motherboard to the chassis (including the CPU standoff screw).
 - iii. Connect the external cables.
- b. Replace the following:
 - i. PCI riser board and support

See Section 8.5.2 “Replacing the PCI Riser Board” on page 8-14.

ii. DIMMs

See Section 8.3.2 “Replacing a DIMM” on page 8-8.

iii. NVRAM/TOD with carrier

See Section 8.2.2 “Replacing the NVRAM/TOD” on page 8-5.

iv. PCI card(s)

See Section 8.4.2 “Replacing a PCI Card” on page 8-11.

v. CPU fan assembly

See Section 6.4.2 “Replacing the CPU Fan Assembly” on page 6-13.

vi. CPU module

See Section 8.1.2 “Replacing the CPU Module” on page 8-3.

c. Connect the following to the motherboard:

- Speaker cable connector (J18)
- CPU fan cable connector (J19)
- Power-on LED/software power on cable connector (J17)
- Diskette drive cable assembly (J16)
- CD-ROM drive cable connector (J14)
- Hard drive cable connector (J15)
- Audio cable assembly (J9)
- Serial/parallel cable assembly (J7/J8)

Note – Verify that the cable connectors are oriented properly by aligning the connector keys.

3. Replace the power supply.

See Section 6.1.2 “Replacing the Power Supply” on page 6-3.

4. Replace the diskette drive (or optional secondary hard drive).

See Section 7.1.2 “Replacing the Diskette Drive” on page 7-3.

5. Detach the wrist strap, replace the system cover, and power on the system as described in Chapter 10.

6. Reset the #power-cycles NVRAM variable to zero as follows:

- a. Press the keyboard Stop and A keys after the system banner appears on the monitor.**

b. At the `ok` prompt, type:

```
ok% setenv #power-cycles 0
```

c. Verify that the `#power-cycles` NVRAM variable increments each time the system is power cycled.

Note – The Solaris operating environment Power Management software uses the `#power-cycles` NVRAM variable to control the frequency of automatic system shutdown (if automatic shutdown is enabled).

Illustrated Parts List

This chapter lists the authorized replaceable parts for the Ultra 5 system. FIGURE 9-1 illustrates an exploded view of the system. TABLE 9-1 lists the replaceable components. Numerical references illustrated in FIGURE 9-1 correlate to the numerical references listed in TABLE 9-1.

Consult your authorized Sun sales representative or service provider to confirm a part number before ordering a replacement part.

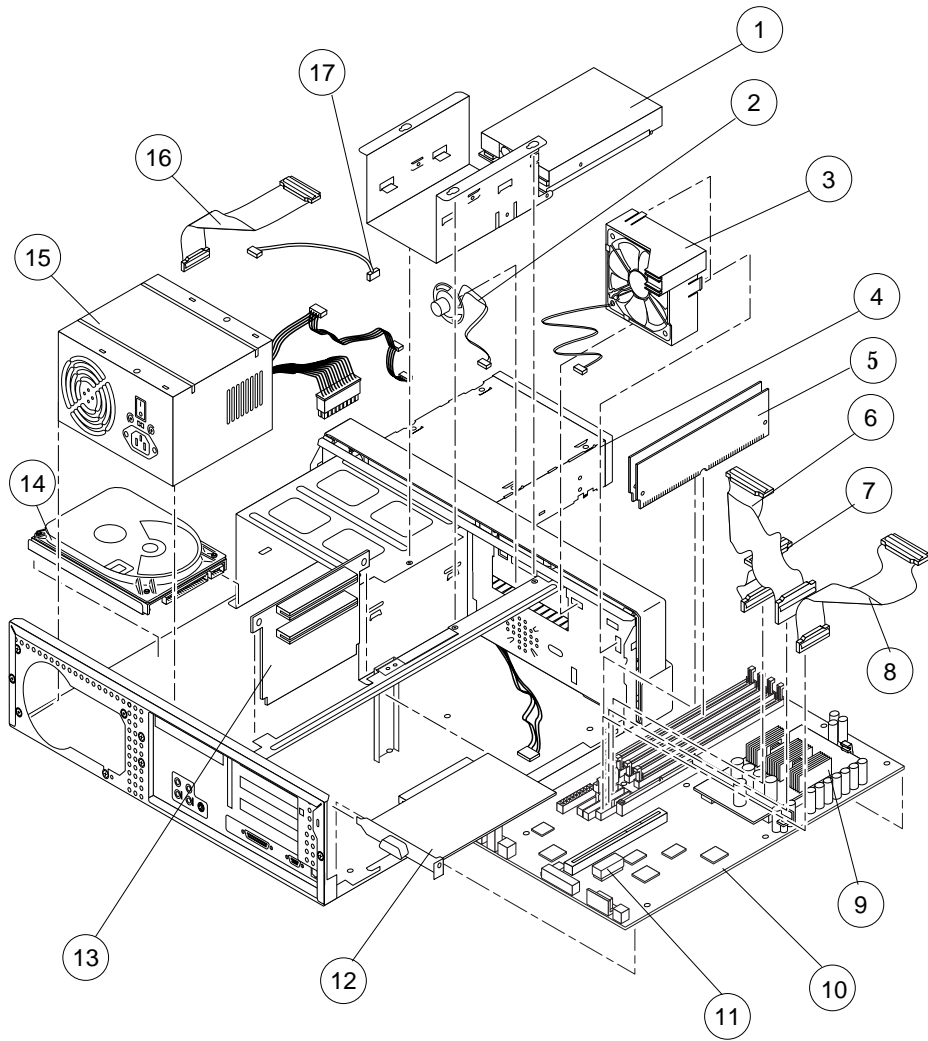


FIGURE 9-1 Ultra 5 System Exploded View

TABLE 9-1 Ultra 5 System Replaceable Components

Numerical Reference	Component	Description
1	Manual eject floppy	Diskette drive
2	Speaker assembly	System speaker
3	CPU fan assembly	CPU cooling fan
4	CD-ROM drive	CD-ROM drive
5	16-Mbyte DIMM	60-ns, 16-Mbyte DSIMM
5	32-Mbyte DIMM	60-ns, 32-Mbyte DSIMM
5	64-Mbyte DIMM	60-ns, 64-Mbyte DSIMM
5	128-Mbyte DIMM	60-ns, 128-Mbyte DSIMM
5	256-Mbyte DIMM	60-ns, 128-Mbyte DSIMM
5	32-Mbyte DIMM	50-ns, 32-Mbyte DSIMM
5	64-Mbyte DIMM	50-ns, 64-Mbyte DSIMM
5	128-Mbyte DIMM	50-ns, 128-Mbyte DSIMM
5	256-Mbyte DIMM	50-ns, 128-Mbyte DSIMM
6	Diskette drive cable assembly	Diskette drive cable. Part of service kit 370-3266
7	Hard drive cable assembly	Hard drive cable. Part of service kit 370-3266
8	Serial/parallel cable assembly	Serial/parallel cable. Part of service kit 370-3266
9	CPU module	270-MHz, 256-Kbyte external cache
9	CPU module	333-MHz, 2-Mbyte external cache
9	CPU module	360-MHz, 256-Kbyte external cache
9	CPU module	360-MHz, 2-Mbyte external cache
9	CPU module	440-MHz, 2-Mbyte external cache
10	Motherboard	System main logic board
11	NVRAM/TOD	Time of day, 48T59, with carrier
12	PCI card	Generic
13	PCI riser board	Expansion PCI riser board
14	Hard drive	Disk drive, 4.3-Gbyte, 5400 RPM
14	Hard drive	Disk drive, 8.4-Gbyte, 5400 RPM
14	Hard drive	Disk drive, 9.1-Gbyte, 7200 RPM

TABLE 9-1 Ultra 5 System Replaceable Components *(Continued)*

Numerical Reference	Component	Description
15	Power supply	Power supply, 200 watts
16	CD-ROM drive cable assembly	CD-ROM drive cable. Part of service kit 370-3266
17	Audio cable assembly	Audio subsystem cables
Not shown	Front bezel	System front bezel

Finishing Component Replacement

This chapter describes the activities you must do after you finish removing and replacing internal system components. This chapter also explains how to externally control standby operation.

This chapter contains the following topics:

- Section 10.1 “Replacing the System Cover” on page 10-1
- Section 10.2 “Powering On the System” on page 10-2

10.1 Replacing the System Cover

1. Remove the wrist strap from the system chassis and from your wrist.
2. Replace the Ultra 5 system cover as follows (FIGURE 10-1):
 - a. Position the system cover onto the system chassis. Slide the system cover toward the front of the system until the cover tabs lock.
 - b. Using a No. 2 Phillips-head screwdriver, replace the two screws securing the system cover to the chassis.

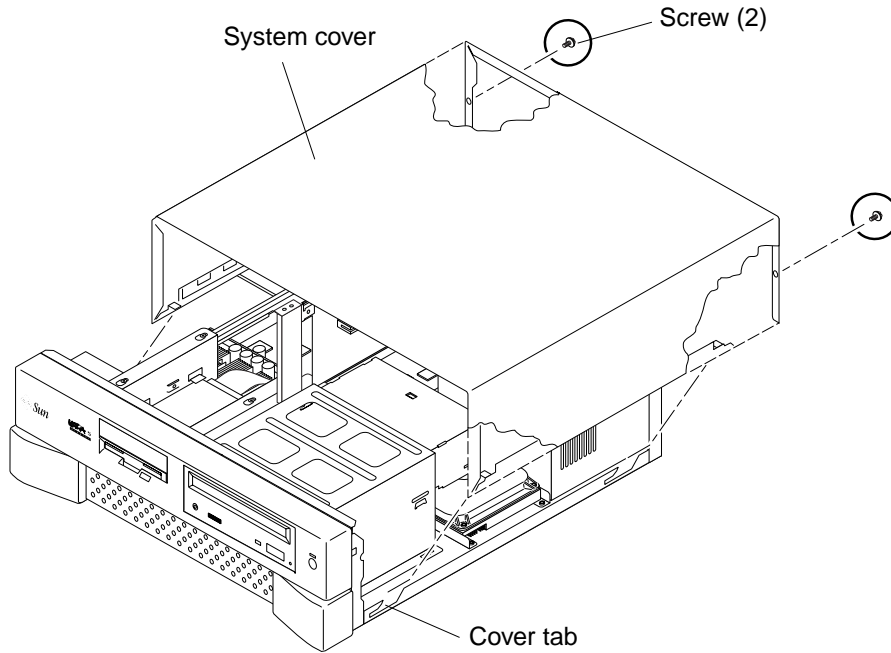


FIGURE 10-1 Replacing the System Cover

10.2 Powering On the System

To power on the system:



Caution – Plugging a 115V power cord into a 230V connector will severely damage the system.

1. Verify the voltage selector switch is set to the correct setting: 115V or 230V.
2. Connect the system power cord to the system and to an AC power outlet.
3. Reconnect and turn on power to any peripherals (so that the system can recognize the peripherals when it is powered on).
4. Set the power switch to the on position (FIGURE 10-2).

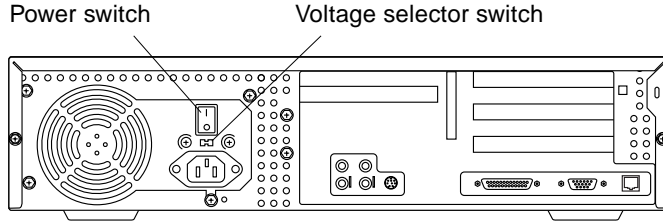


FIGURE 10-2 System Power Switch

5. Press the Standby switch (FIGURE 10-3), or press the Sun Type-5 keyboard Standby key (FIGURE 10-4) or the Sun I/O Type-6 keyboard Power key (FIGURE 10-5).

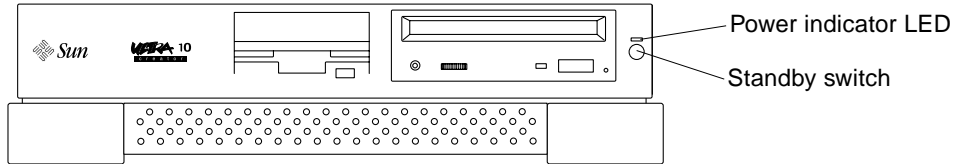


FIGURE 10-3 System Standby Switch

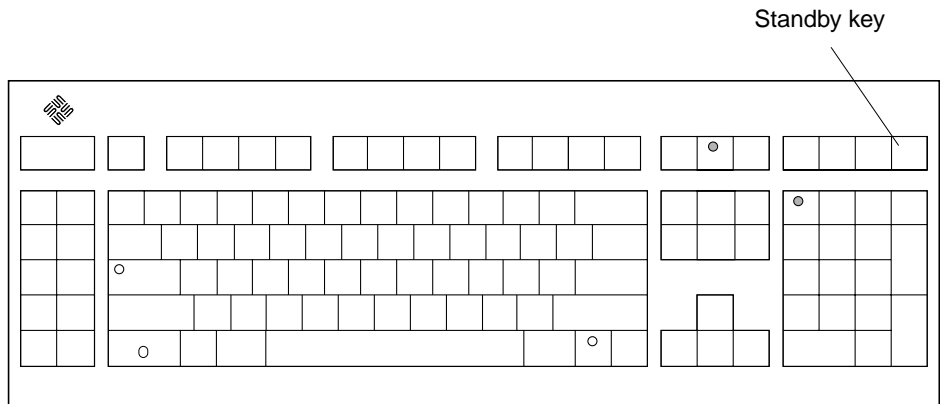


FIGURE 10-4 Sun Type-5 Keyboard

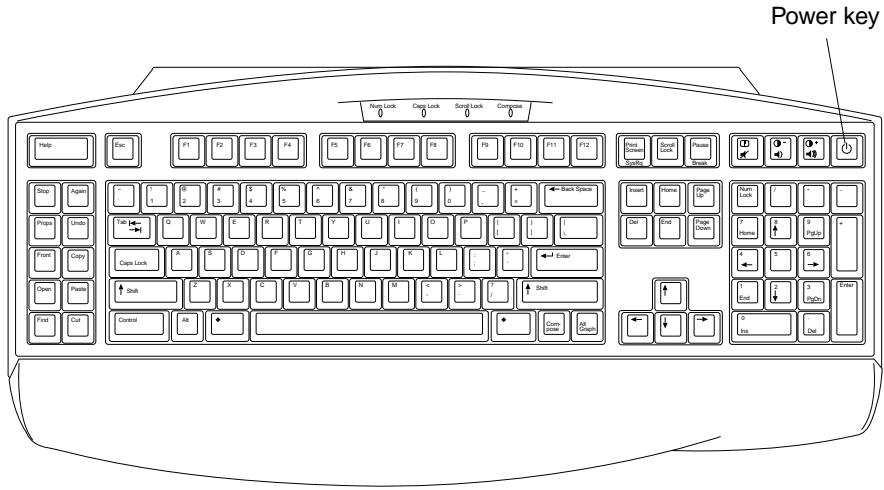


FIGURE 10-5 Sun I/O Type-6 Keyboard

6. Verify the following:

- a. The front panel power indicator LED is on.**
- b. The system fans are spinning.**

Product Specifications and Reference Information

This appendix provides product specifications for the Ultra 5 system.

- Section A.1 “Physical Specifications” on page A-1
- Section A.2 “Electrical Specifications” on page A-2
- Section A.3 “Modem Setup Specifications” on page A-2
- Section A.4 “Environmental Requirements” on page A-5
- Section A.5 “Reference Information” on page A-5

A.1 Physical Specifications

The following table lists the Ultra 5 physical specifications.

TABLE A-1 Ultra 5 Physical Specifications

Specification	U.S.A.	Metric
Height	4.31 in.	10.95 cm
Width	17.17 in.	43.60 cm
Depth	16.69 in.	42.40 cm
Weight (approximate)	39.70 lb.	18.00 kg

A.2 Electrical Specifications

The following table lists the electrical specifications for the Ultra 5 system.

TABLE A-2 Ultra 5 System Electrical Specifications

Parameter	Value
AC input	47 to 63 Hz, 90 to 132 VAC or 180 to 264 VAC, switch selectable
DC output	200W (maximum)
Output 1	+3.3 VDC, 14.0A
Output 2	+5.0 VDC, 22.0A
Output 3	+12.0 VDC, 6.0A
Output 4	-5.0 VDC, 0.5A
Output 5	-12.0 VDC, 0.8A
Output 6 (Standby)	+5.0 VDC, 0.2A

A.3 Modem Setup Specifications

- Section A.3.1 “Setting Up the Modem” on page A-2
- Section A.3.2 “Serial Port Speed Change” on page A-3
- Section A.3.3 “Modem Recommendations” on page A-4

A.3.1 Setting Up the Modem

Any modem that is compatible with CCITT V.24 can be connected to the system serial port. Modems can be set up to function in one of three ways:

- Dial out only
- Dial in only
- Bidirectional

To set up a modem:

1. **Become superuser and type** `admintool`.

```
% su
Password:#
admintool
```

2. **In the Admintool window, select Serial Port Manager.**

3. **Select Port a or Port b for your modem connection.**

4. **Select Edit.**

The Serial Port Manager: Modify Service window is displayed.

5. **Choose the Expert level of detail.**

6. **From the Use Template menu, choose one of the following:**

- Modem - Dial-out only
- Modem - Dial-in only
- Modem - Bidirectional

7. **Select Apply.**

8. **Set your modem auto-answer switch to one of the following:**

- Off - Dial-out only
- On - dial-in only
- On - Bidirectional

A.3.2 Serial Port Speed Change

To change the speed of a serial port, edit the `/etc/remote` file as follows:

1. **Become superuser, and type** `cd /etc`.

```
% su
Password:#
cd /etc
```

2. **Type** `vi remote`.

3. Type `tip speed device-name`.

Typical speeds are 9600, 19200 to 38400 bps.

The device name is the serial port name—for example, `/dev/tty[a,b]` or `/dev/term/[a,b]`.

4. Press Esc and type `wq` **to save your file change(s) and to exit from the** `vi` **text editor.**

A.3.3 Modem Recommendations

A.3.3.1 Cable

For a modem-to-host (system) connection, use an RS-423/RS-232 straight-through cable with DB-25 male connectors at both ends.

A.3.3.2 Modem Switch Settings (AT Commands)

- Enable transmit flow control (AT&H1) [suggested setting]
(Required for sending binary/8-bit data.)
- Set link rate to fixed
(Will not track modem data rate, AT&Bn; n = menu choice in modem manual.)
- Set display result codes (ATQ0)
- Set verbal result codes (ATV1)
- Set result code subset (ATXn; n = option choice)
- Save settings in NVRAM (AT&W)

Note – The above settings are meant as helpful guidelines only. These guidelines may change depending on site requirements and the chosen modem.

For additional information about modem switch settings, see the manual that came with the modem.

A.4 Environmental Requirements

The following table lists environmental requirements for the Ultra 5 system.

TABLE A-3 Ultra 5 System Environmental Requirements

Environmental	Operating	Non-operating
Temperature	40 to 95 degrees F (5 to 35 degrees C)	-4 to 140 degrees F (-20 to 60 degrees C)
Humidity	80% (max) noncondensing at 95 degrees F (35 degrees C)	95% noncondensing at 140 degrees F (60 degrees C)
Altitude	10,000 ft (3 km)	40,000 ft (12 km)

A.5 Reference Information

This section contains the following reference information:

- Section A.5.1 “CD-ROM Drive Cabling Configuration” on page A-5
- Section A.5.2 “Hard Drive Cabling Configuration (One Drive)” on page A-6
- Section A.5.3 “Hard Drive Cabling Configuration (with Optional Secondary Drive)” on page A-6
- Section A.5.5 “Jumper Settings” on page A-7
- Section A.5.6 “CD Handling and Use” on page A-8

A.5.1 CD-ROM Drive Cabling Configuration

The following block diagram shows the cabling for the CD-ROM drive.

- CD-ROM data cable: connects to motherboard connector J14
- CD-ROM audio cable: connects to motherboard connector J9

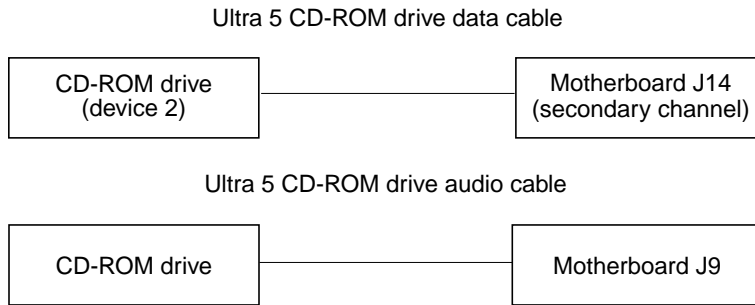


FIGURE A-1 CD-ROM Drive Cabling Configuration

A.5.2 Hard Drive Cabling Configuration (One Drive)

The Ultra 5 primary hard drive cable connects to motherboard connector J15. The following block diagram shows the cabling for the hard drive.



FIGURE A-2 Hard Drive Cabling Configuration (One Drive)

A.5.3 Hard Drive Cabling Configuration (with Optional Secondary Drive)

The Ultra 5 can support an optional secondary hard drive. An optional cable with three connectors is shipped with the secondary drive and is connected as follows:

- Hard drive cable: connects to motherboard connector J15
- If two hard drives are installed, the cable assembly connection is as shown in the following block diagram

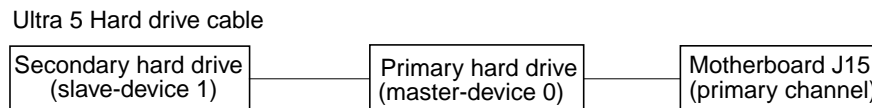


FIGURE A-3 Hard Drive Cabling Configuration (with Optional Secondary Drive)

A.5.4 Hard Drive Cabling Configuration (With Two Mirrored Drives)

The following diagram shows the drive cabling configuration when the system contains two mirrored hard drives:

- Primary channel—One hard drive jumpered as master
- Secondary channel—One hard drive jumpered as master

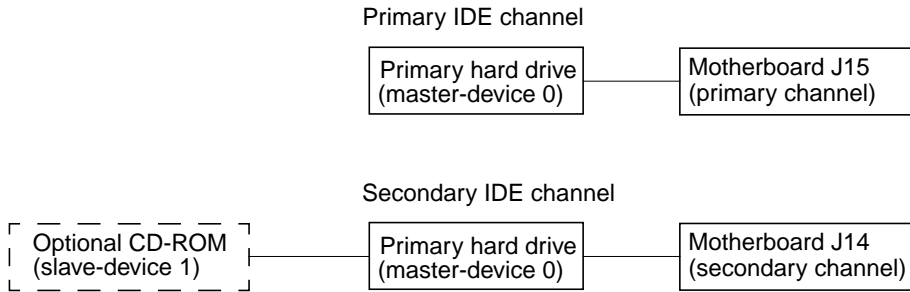


FIGURE A-4 Hard Drive Mirroring Configuration

Note – The two hard drives that are mirrored cannot be on the same channel. Both hard drives must be jumpered as the master device on two separate channels.

Note – If a CD-ROM drive is included in an Ultra 5 system with this hard drive mirroring configuration, the CD-ROM drive must be jumpered as a slave device on either the primary or the secondary channel.

For more information on hard drive mirroring, see Section 7.2.4 “Hard Drive Mirroring” on page 7-11.

A.5.5 Jumper Settings

Prior to installing a CD-ROM drive or hard drive in an Ultra 5 system, verify that the drive’s back panel mode-select jumper is set as follows:

- Set the CD-ROM drive jumper (located on the CD-ROM drive back panel) to MA
- Set a hard drive jumper to CS

A.5.6 CD Handling and Use

The following topics are discussed in this section.

- Inserting a CD into the CD-Rom drive
- Ejecting a CD from the CD-ROM drive
- Cleaning the CD-ROM drive
- Handling and storing CDs

A.5.6.1 Inserting a CD into the CD-ROM Drive

1. **After the system is powered on, push the eject button to open the drive tray.**

It may be necessary to unmount the CD before manually ejecting it. The CD can also be ejected by using software commands. Refer to the peripherals handbook that corresponds with your operating environment.

2. **Place the CD (label side up) into the tray.**

Ensure that the CD is properly set into the recessed area of the tray.

3. **If the drive is being installed in a vertical position, slide the two bottom tabs on the tray toward each other to hold the CD.**

A.5.6.2 Ejecting a CD From the CD-ROM Drive

To eject a CD, press the eject button on the front of the CD-ROM drive.

If the motorized eject mechanism does not operate, insert a thin, stiff wire (such as a paper clip) into the hole next to the eject button to eject the CD.

A.5.6.3 Cleaning the CD-ROM Drive

If the CD-ROM drive cannot read a CD, the cause may be a dirty CD. Follow these guidelines to clean a CD:



Caution – Do not use solvents such as benzene, paint thinner, antistatic aerosol spray, or abrasive cleaners to clean CDs.

- Use a soft, clean, lint-free, dry cloth.
- Clean the *non-labeled* side of the CD.
- Wipe the CD *radially* from the center to the outside.
- Use professional cleaning kits.

A.5.6.4 Handling and Storing CDs

Follow these guidelines when handling and storing CDs:

- Handle CDs only by their edges; avoid touching CD surfaces.
- Do not write on CDs with permanent marking pens.
- Do not use CDs in high-dust environments.
- Keep CDs out of direct sunlight, extreme sources of heat or cold, and away from dust and moisture.
- Make sure CDs are at room temperature before using them.
- Store CDs in storage boxes so that they remain clean and free of dust.

Signal Descriptions

This appendix describes the Ultra 5 motherboard connector signals and pin assignments.

- Section B.1 “Power Supply Connectors” on page B-2
- Section B.2 “Keyboard/Mouse Connector” on page B-4
- Section B.3 “Twisted-Pair Ethernet Connector” on page B-5
- Section B.4 “Serial Port A Connector” on page B-7
- Section B.5 “Serial Port B Connector” on page B-9
- Section B.6 “Parallel Port Connector” on page B-10
- Section B.7 “Audio Connectors” on page B-12
- Section B.8 “Video Connector” on page B-13

B.1 Power Supply Connectors

There are two power supply connectors on the motherboard. The Ultra 5 motherboard uses a standard ATX style connector (J12).

FIGURE B-1 illustrates the J12 connector configuration and TABLE B-1 lists the pin assignments.

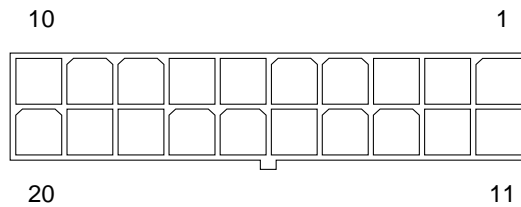


FIGURE B-1 Power Supply Connector J12 Pin Configuration

TABLE B-1 Power Supply Connector J12 Pin Assignments

Pin	Signal	Description
1	+3.3V	+3.3 VDC
2	+3.3V	+3.3 VDC
3	Gnd	Chassis ground
4	+5V	+5 VDC
5	Gnd	Chassis ground
6	+5V	+5 VDC
7	Gnd	Chassis ground
8	PWR_OK	Power okay
9	5VSB	
10	+12V	+12 VDC
11	+3.3V	+3.3 VDC
12	-12V	-12 VDC
13	Gnd	Chassis ground
14	PS_ON	Power supply on
15	Gnd	Chassis ground

TABLE B-1 Power Supply Connector J12 Pin Assignments *(Continued)*

Pin	Signal	Description
16	Gnd	Chassis ground
17	Gnd	Chassis ground
18	-5V	-5 VDC
19	+5V	+5 VDC
20	+5V	+5 VDC

B.2 Keyboard/Mouse Connector

The keyboard/mouse connector is a DIN-8 type connector located on the motherboard back panel. The following figure illustrates the keyboard/mouse connector configuration and the following table lists the pin assignments.

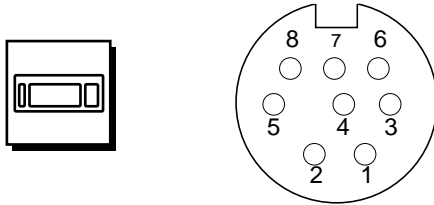


FIGURE B-2 Keyboard/Mouse Connector Pin Configuration

TABLE B-2 Keyboard/Mouse Connector Pin Assignments

Pin	Signal	Description
1	Gnd	Chassis ground
2	Gnd	Chassis ground
3	+5V	+5 VDC
4	Mse-rxd	Mouse receive data
5	Kbd-txd	Keyboard out
6	Kbd-rxd	Keyboard in
7	Kbd-pwk	Keyboard power on
8	+5V	+5 VDC

B.3 Twisted-Pair Ethernet Connector

The twisted-pair Ethernet (TPE) connector is an RJ-45 type connector located on the motherboard back panel. The following figure illustrates the TPE connector configuration and the following table lists the pin assignments.



Caution – Connect only TPE-type cable into the TPE connector.

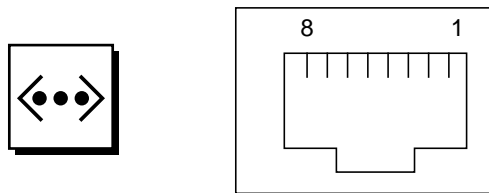


FIGURE B-3 TPE Connector Pin Configuration

TABLE B-3 TPE Connector Pin Assignments

Pin	Signal	Description
1	tpe0	Transmit data +
2	tpe1	Transmit data -
3	tpe2	Receive data +
4	Common mode termination	Termination
5	Common mode termination	Termination
6	tpe3	Receive data -
7	Common mode termination	Termination
8	Common mode termination	Termination

B.3.1 TPE Cable-Type Connectivity

The following types of TPE cables can be connected to the TPE connector.

- For 10BASE-T applications, unshielded twisted-pair (UTP) cable:
 - Category 3 (UTP-3, “voice grade”)
 - Category 4 (UTP-4)
 - Category 5 (UTP-5, “data grade”)
- For 100BASE-T applications, UTP cable, UTP-5, “data grade”

B.3.2 External UTP-5 Cable Lengths

The following table lists TPE UTP-5 types, application, and maximum lengths.

TABLE B-4 TPE UTP-5 Cables

Cable Type	Application(s)	Maximum Length (Metric)	Maximum Length (US)
UTP-5, “data grade”	10BASE-T or 100BASE-T	100 meters	109 yards

B.4 Serial Port A Connector

The serial port A connector is a DB-25 type connector located on the motherboard back panel. The serial port A connector provides both synchronous and asynchronous serial communications. The following figure illustrates the serial port A connector configuration and the following table lists the pin assignments.

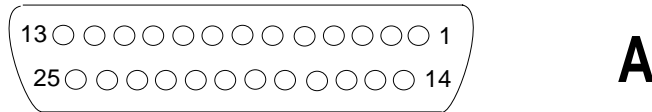


FIGURE B-4 Serial Port A Connector Pin Configuration

TABLE B-5 Serial Port A Connector Pin Assignments

Pin	Signal	Description
1	NC	Not connected
2	TXD_A	Transmit data A
3	RXD_A	Receive data A
4	RTS_A	Read to send A
5	CTS_A	Clear to send A
6	DSR_A	Data set ready A
7	Gnd	Signal ground
8	DCD_A	Data carrier detect A
9	NC	Not connected
10	NC	Not connected
11	NC	Not connected
12	NC	Not connected
13	NC	Not connected
14	NC	Not connected

TABLE B-5 Serial Port A Connector Pin Assignments *(Continued)*

Pin	Signal	Description
15	RTXC_A	Transmit clock A
16	NC	Not connected
17	RXC_A	Receive clock A
18	NC	Not connected
19	NC	Not connected
20	DTR_A	Data terminal ready A
21	NC	Not connected
22	NC	Not connected
23	NC	Not connected
24	TXCA	Data terminal ready A
25	NC	Not connected

B.5 Serial Port B Connector

The serial port B connector is a DB-9 type connector located on the serial/parallel connector back panel. The serial port B connector provides asynchronous serial communications. The following figure illustrates the serial port B connector configuration and the following table lists the pin assignments.

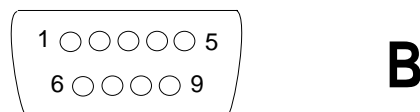


FIGURE B-5 Serial Port B Connector Pin Configuration

TABLE B-6 Serial Port B Connector Pin Assignments

Pin	Signal	Description
1	CD	Carrier detect
2	RD	Receive data
3	TD	Transmit data
4	DTR	Data terminal ready
5	GND	Ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator

B.6 Parallel Port Connector

The parallel port connector is a DB-25 type connector located on the serial/parallel connector back panel. The following figure illustrates the parallel port connector configuration and the following table lists the connector pin assignments.

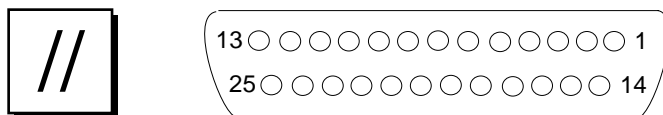


FIGURE B-6 Parallel Port Connector Pin Configuration

TABLE B-7 Parallel Port Connector Pin Assignments

Pin	Signal	Description
1	Data_Strobe_L	Set low during forward channel transfers to latch data into peripheral device. Set high during reverse channel transfers.
2 to 9	Data[0..7]	The main data bus for the parallel port. Data0 is the least significant bit (LSB). Are not used during reverse channel transfers.
10	ACK_L	Driven low by the peripheral device to acknowledge data byte transfer from host during forward channel transfer. Qualifies data being transferred to host in reverse channel transfer.
11	BUSY	Driven high to indicate the peripheral device is not ready to receive data during forward channel transfer. Used to send Data3 and Data7 during reverse channel transfer.
12	PERROR	Driven high by peripheral device to indicate an error in the paper path during forward channel transfer. Used to send Data2 and Data6 during reverse channel transfer.

TABLE B-7 Parallel Port Connector Pin Assignments (*Continued*)

Pin	Signal	Description
13	SELECT_L	Indicates the peripheral device is on-line during forward channel transfer. Used to send Data1 and Data5 during reverse channel transfer.
14	AFXN_L	Set low by the host to drive the peripheral into auto-line feed mode during forward channel transfer. During reverse channel transfer, set low to indicate host can receive peripheral device data and then set high to acknowledge receipt of peripheral data.
15	ERROR_L	Set low by the peripheral device to indicate an error during forward channel transfer. In reverse channel transfer, set low to indicate peripheral device has data ready to send to the host. Used to send Data0 and Data4.
16	INIT_L	Driven low by the host to reset peripheral.
17	PAR_IN_L	Set low by the host to select peripheral device for forward channel transfer. Set high to indicate bus direction is from peripheral to host.
18	Signal ground	Signal ground
19	Signal ground	Signal ground
20	Signal ground	Signal ground
21	Signal ground	Signal ground
22	Signal ground	Signal ground
23	Signal ground	Signal ground
24	Signal ground	Signal ground
25	Signal ground	Signal ground

B.7 Audio Connectors

The audio connectors are located on the motherboard backpanel. These connectors use EIA standard 0.125-inch (3.5-mm) jacks. The following figure illustrates each audio connector configuration and the following table lists each connector line assignment.

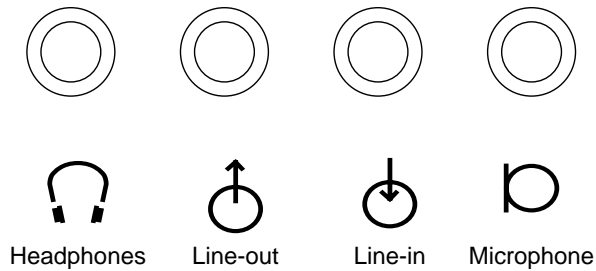


FIGURE B-7 Audio Connector Configuration

TABLE B-8 Audio Connector Line Assignment

Component	Headphones	Line-Out	Line-In	Microphone
Tip	Left channel	Left channel	Left channel	Left channel
Ring (center)	Right channel	Right channel	Right channel	Right channel
Shield	Ground	Ground	Ground	Ground

B.8 Video Connector

The video connector is a 15-pin mini D-sub connector located on the motherboard backpanel. The following figure illustrates the video connector configuration and the following table lists the video connector pin assignment.

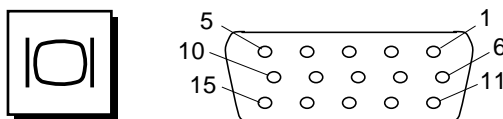


FIGURE B-8 Video Connector Pin Configuration

TABLE B-9 Video Connector Pin Assignments

Pin	Signal	Description
1	Red	Red video signal
2	Green	Green video signal
3	Blue	Blue video signal
4	Gnd	Ground
5	NC	Not connected
6	Gnd	Ground for red video signal
7	Gnd	Ground for green video signal
8	Gnd	Ground for green video signal
9	NC	Not connected
10	Gnd	Ground
11	Gnd	Ground
12	SDA	Bidirectional data

TABLE B-9 Video Connector Pin Assignments (*Continued*)

Pin	Signal	Description
13	Horizontal sync	Horizontal synchronizing signal
14	Vertical sync	V. clock
15	SCL	Data clock

Functional Description

This appendix provides a functional description of the Ultra 5 system.

- Section C.1 “System” on page C-1
- Section C.2 “Clocking” on page C-27
- Section C.3 “Address Mapping” on page C-29
- Section C.4 “Interrupts” on page C-31
- Section C.5 “Power” on page C-35
- Section C.6 “Motherboard” on page C-36
- Section C.7 “Jumper Descriptions” on page C-37
- Section C.8 “Enclosure” on page C-40

C.1 System

The Ultra 5 system is an UltraSPARC port architecture (UPA)-based uniprocessor machine that uses peripheral component interconnect (PCI) as the I/O bus. The CPU module, APB ASIC (advanced PCI bridge), and UPA graphics communicate with each other using the UPA64S and PCI protocols. The RISC ASIC routes interrupts to the CPU module.

This section discusses the following topics:

- Section C.1.1 “CPU Module” on page C-3
- Section C.1.2 “PCI-IDE Interface” on page C-4
- Section C.1.3 “Memory Architecture” on page C-10
- Section C.1.4 “PCI Riser Board” on page C-15
- Section C.1.5 “ASICs” on page C-19
- Section C.1.6 “EBus2 Devices” on page C-21
- Section C.1.7 “Power and Standby Switching” on page C-26

The following figure shows a functional block diagram of the system unit.

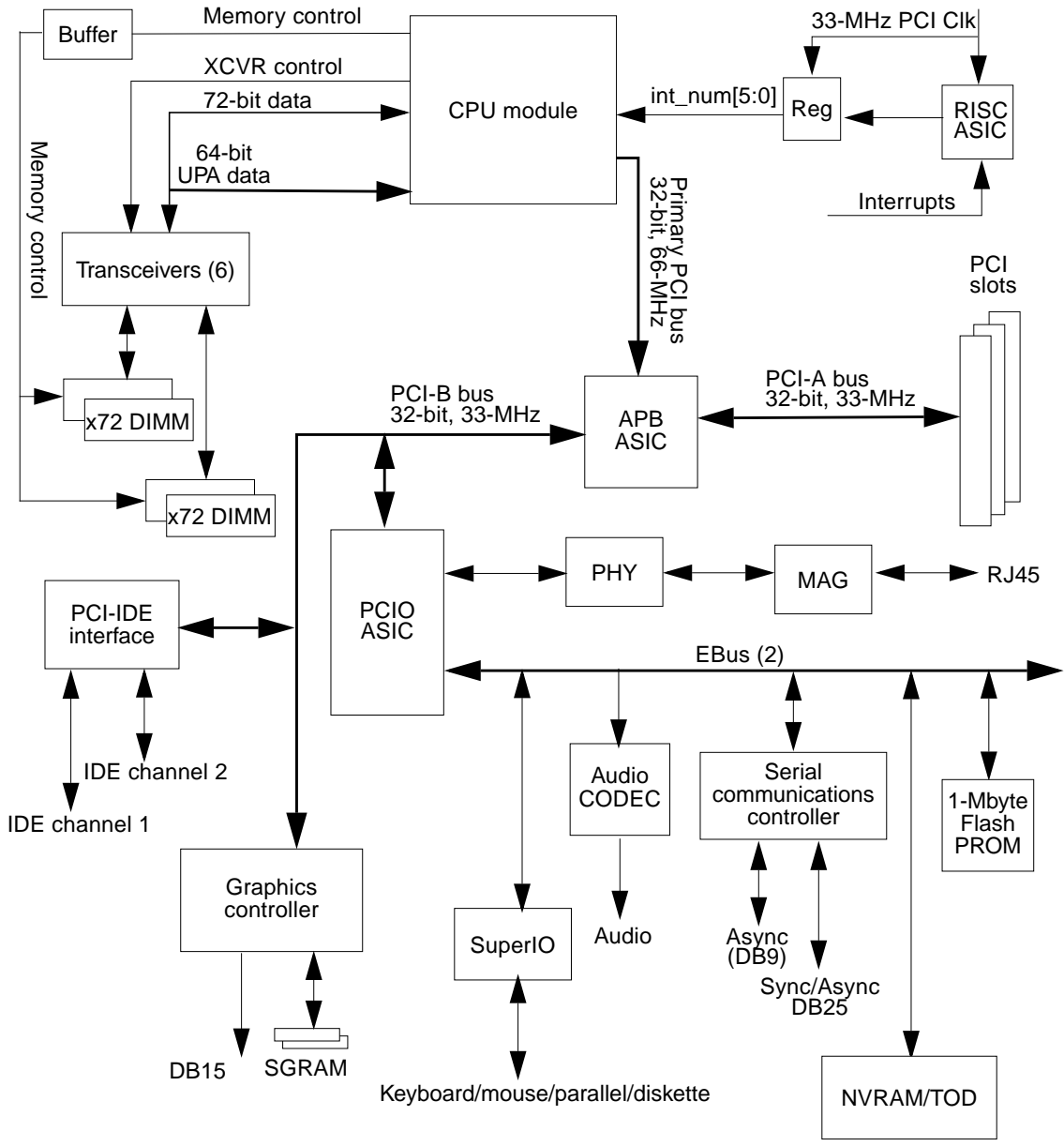


FIGURE C-1 System Functional Block Diagram

C.1.1 CPU Module

The system CPU module is the UltraSPARC-III processor. The CPU module is a high-performance, highly-integrated superscalar processor implementing the SPARC-V9 64-bit RISC architecture. The CPU module is capable of sustaining the execution of up to four instructions per cycle, even in the presence of conditional branches and cache misses. This sustained performance is supported by a decoupled prefetch and dispatch unit with instruction buffer. The CPU module supports both 2D and 3D graphics, as well as image processing, video compression and decompression, and video effects via the sophisticated visual instruction set (VIS). VIS provides high levels of multimedia performance, including real-time video compression/decompression and two streams of MPEG-2 decompression at full broadcast quality with no additional hardware support. The CPU module characteristics and associated features include:

- SPARC-V9 architecture compliant
- Binary compatible with all SPARC application code
- Snooping or directory-based protocol support
- Four-way superscalar design with nine execution units
 - Four integer execution units
 - Three floating-point execution units
 - Two graphics execution units
- Selectable little-endian or big-endian byte ordering
- 64-bit address pointers
- 16-Kbyte non-blocking data cache
- 16-Kbyte instruction cache with single cycle branch following
- Power management
- Software prefetch instruction support
- Multiple outstanding requests

The Ultra 5 system may contain a 270-MHz, 333-MHz, 360-MHz, or 440-MHz CPU module. The following table identifies the cache and SRAM for each module.

TABLE C-1 Ultra 5 CPU Module Cache and SRAM

Module	Second-Level Cache	Data SRAMs	TAG SRAMs
270-Mhz	256-KByte	2 - 32K x 36	1 - 32K x 36k
333-Mhz	2-Mbyte	4 - 256K x 18	1 - 64K x 18
360-Mhz	256-Kbyte	2 - 32K x 36	1 - 64K x 18
360-Mhz	2-Mbyte	4 - 256K x 18	1 - 64K x 18
440-MHz	2-Mbyte	2 - 256K x 36	1 - 256K x 18

C.1.2 PCI-IDE Interface

The 32-bit, 66-MHz PCI bus is interfaced through a connector to the motherboard. This interface operates at 66 MHz and interfaces to the APB ASIC. There are three PCI buses: primary PCI bus, secondary PCI bus A, and secondary PCI bus B. This section discusses the following topics.

- Section C.1.2.1 “Primary PCI Bus” on page C-4
- Section C.1.2.2 “Secondary PCI Buses” on page C-5
- Section C.1.2.3 “APB ASIC” on page C-5
- Section C.1.2.4 “PCIO ASIC” on page C-5
- Section C.1.2.5 “10-/100-Mbit Ethernet” on page C-5
- Section C.1.2.6 “EBus2 Interface” on page C-6
- Section C.1.2.7 “EIDE Interface” on page C-7
- Section C.1.2.8 “PCI-Based Graphics” on page C-9

C.1.2.1 Primary PCI Bus

The CPU module interfaces to the APB ASIC through the primary PCI bus. The primary PCI bus is a 32-bit, 66-MHz bus. The primary PCI bus is 3.3-VDC bus only, and there cannot be a 5-VDC device residing on this bus. In the Ultra 5 systems, the primary PCI bus is a point-to-point bus between the CPU module and the APB ASIC. There are no other devices or slots on the primary PCI bus.

C.1.2.2 Secondary PCI Buses

The secondary PCI buses are designated as PCI bus A and PCI bus B.

Bus A is a 33-MHz, 32-bit bus that interfaces between the APB ASIC and the PCI slots, with no motherboard device communications. PCI bus A is a 5-VDC-only bus and the only supported boards are 5-VDC type.

PCI bus B is also a 33-MHz, 32-bit bus. Unlike PCI bus A, PCI bus B does not interface to any PCI slots; however, it does communicate with motherboard devices. The motherboard devices residing on PCI bus B include:

- APB ASIC
- PCIO ASIC
- PCI-based graphics controller
- PCI-IDE interface

C.1.2.3 APB ASIC

Refer to Section C.1.5.1 “APB” on page C-19.

C.1.2.4 PCIO ASIC

Refer to Section C.1.5.2 “PCIO” on page C-20.

C.1.2.5 10-/100-Mbit Ethernet

The Ethernet channel engine within the PCIO ASIC provides a buffered full-duplex DMA engine and a media access controller (MAC) function. The descriptor-based DMA engine contains independent transmit and receive channels, each with 2 Kbytes of on-chip buffering. The MAC provides a 10-Mbps or a 100-Mbps CSMA/CD protocol based upon a network interface conforming to IEEE 802.3, proposed IEEE 802.30, and Ethernet specifications. The following figure shows a functional block diagram of the 10-/100-Mbit Ethernet.

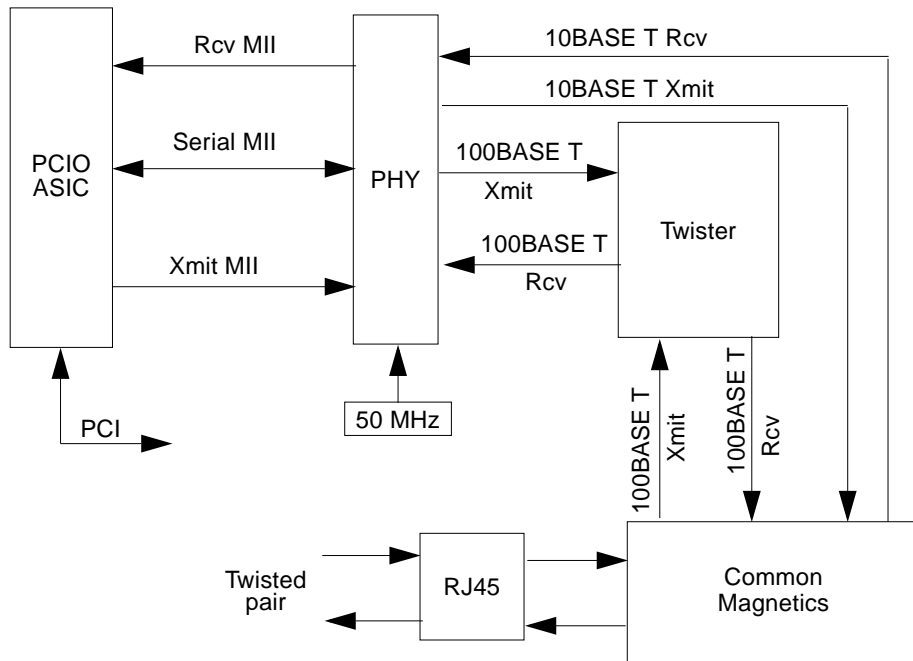


FIGURE C-2 10-/100-Mbit Ethernet Functional Block Diagram

C.1.2.6 EBus2 Interface

The PCIO ASIC provides the EBus2 interface to connect as many as eight 8-bit devices. The following devices reside on the EBus2:

- Audio CODEC
- SuperIO
- Serial communications controller
- NVRAM/TOD
- Flash PROM

Up to eight single- or multi-function Intel-style 8-bit devices can be accommodated. Four internal DMA engines can be attached to any of the 8-bit devices, buffering data streams in 128-byte FIFOs for each channel.

The EBus2 channel engine provides access to several general purpose AUXIO (auxiliary IO) lines, which are used to control miscellaneous system functions.

C.1.2.7 EIDE Interface

The enhanced integrated drive electronics (EIDE) interface is a hard drive interface that is also called an ATA bus interface. With the advent of faster hard drives, the definition of the EIDE interface has been expanded to include new operating PIO and DMA modes. The five PIO modes, numbered zero through four, offer increasingly faster interface speeds, with the higher-numbered mode being the faster. PIO modes 0, 1, and 2 correspond to the EIDE interface as originally defined. PIO mode 3 defines a maximum transfer rate of 11.1 Mbytes per second and PIO mode 4 defines a maximum transfer rate of 16.67 Mbytes per second. Additional DMA modes have also been defined with Multiword DMA wired 0 corresponding to the original DMA interface and DMA modes 1 and 2 being faster transfer rates. Multiword DMA mode 2 is the same speed as the new PIO mode 4.

The following figure shows the EIDE interface functional block diagram.

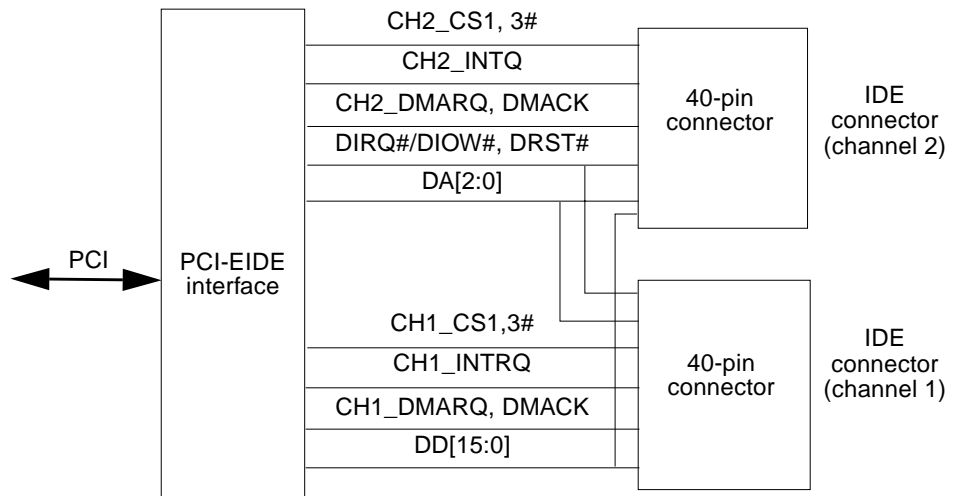


FIGURE C-3 EIDE Interface Functional Block Diagram

Cable Electrical Requirements (With Optional Secondary Hard Drive)

In Ultra 5 systems with an optional secondary hard drive, automatic cable selection of a master and a slave hard drive is allowed without the need to change drive jumpers. An ATA cable is used to interface the host with the hard drives. Device 0 must be installed on the connector nearest on the cable to the host and device 1 must be installed on the connector farthest from the host.

Cable Labeling (With Optional Secondary Hard Drive)

The ATA cable and/or connectors on the cable are clearly marked to indicate which connector should be connected to the slave device, master device, and motherboard (following figure).

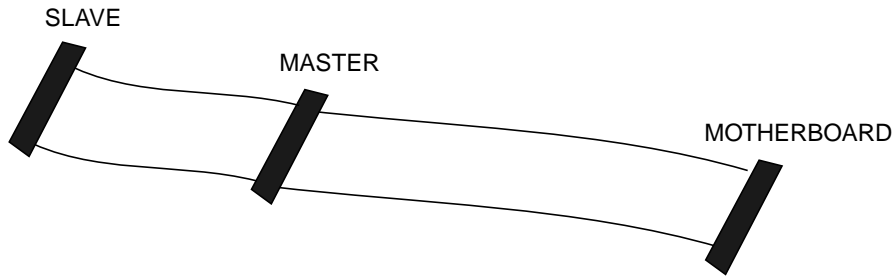


FIGURE C-4 EIDE Cable Labeling (With Secondary Hard Drive)

Configuration Support

FIGURE C-5 shows the Ultra 5 ATA cable configuration and FIGURE C-6 shows the Ultra 5 ATA cable configurations when an optional secondary hard drive is installed.

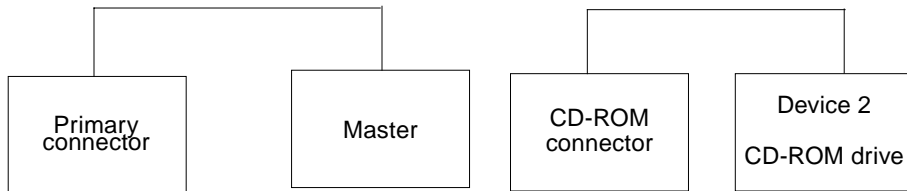


FIGURE C-5 Supported Ultra 5 Configuration

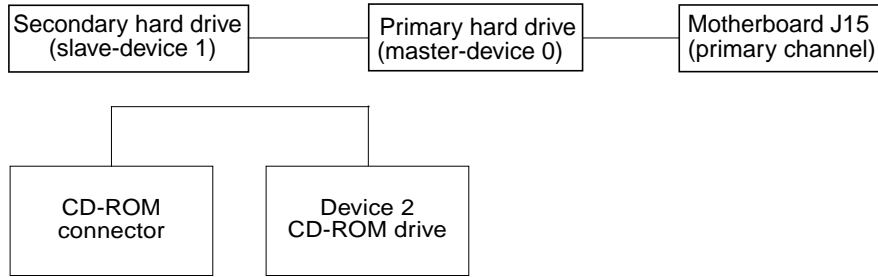


FIGURE C-6 Supported Ultra 5 Configuration (With Secondary Hard Drive)

C.1.2.8 PCI-Based Graphics

The system has an on-board PCI-based graphics controller. The graphics controller uses either 2-Mbytes SGRAM or 4-Mbytes SGRAM as the graphics memory. The on-board graphics connector is a standard DB15 VGA connector. The PGX graphics controller provides 8-bit graphics with 2-Mbytes SGRAM. The PGX24 graphic controller provides 24-bit graphics with 4-Mbytes SGRAM.

The following two figures show a functional block diagram of the PGX and the PGX24 PCI-based graphics.

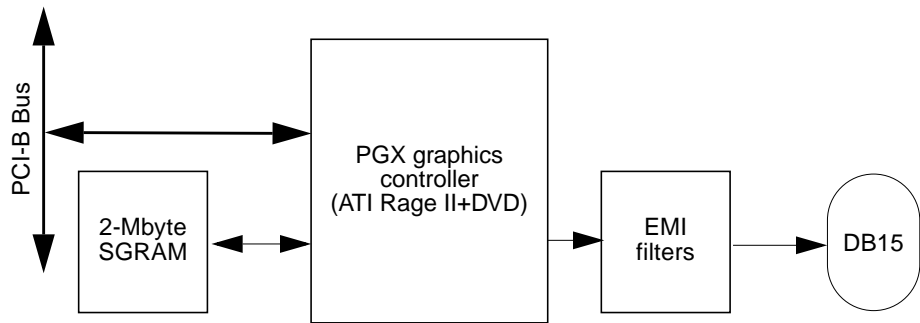


FIGURE C-7 PCI-Based Graphics Functional Block Diagram (PGX)

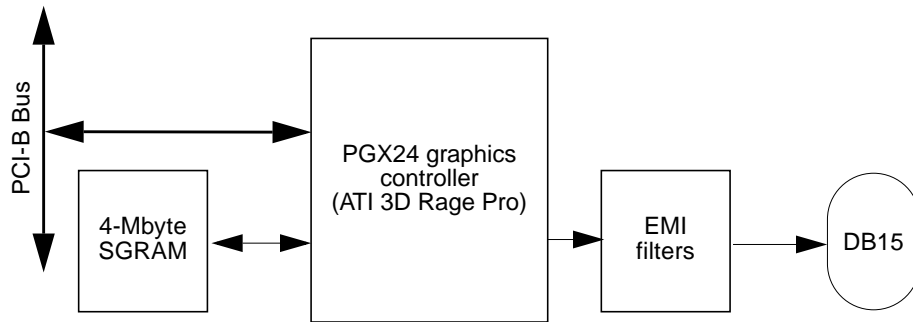


FIGURE C-8 PCI-Based Graphics Functional Block Diagram (PGX24)

C.1.3 Memory Architecture

The memory architecture uses the 168-pin JEDEC standard extended data out (EDO) 3.3-VDC buffered DIMMs. The memory controller unit (MCU) is embedded within the CPU module. All memory addressing and control are driven from the CPU module to the motherboard and then buffered before being gated to the DIMM DRAMs (assuming buffered DIMMs). The data path on the DRAM side is 144 bits (2-bit x 72-bit) wide, and data is multiplexed to 72 bits wide on the processor side by using the transceiver switches.

The interface between the CPU module MCU and the system memory subsystem consists of the following:

- A 12-bit multiplexed row-column address
- Two column address select (CAS) lines
- Eight row address select (RAS) lines
- One write enable (WE) line
- Support for 60-ns EDO DRAMs

Up to four DIMMs can be installed. Having only four DIMM connectors requires a stacked and dual-bank DIMM architecture to achieve the 1-Gbyte capacity.

All memory transfers have error checking code (ECC). The MCU performs ECC generation and checking. The following figure is a functional block diagram of the memory interface.

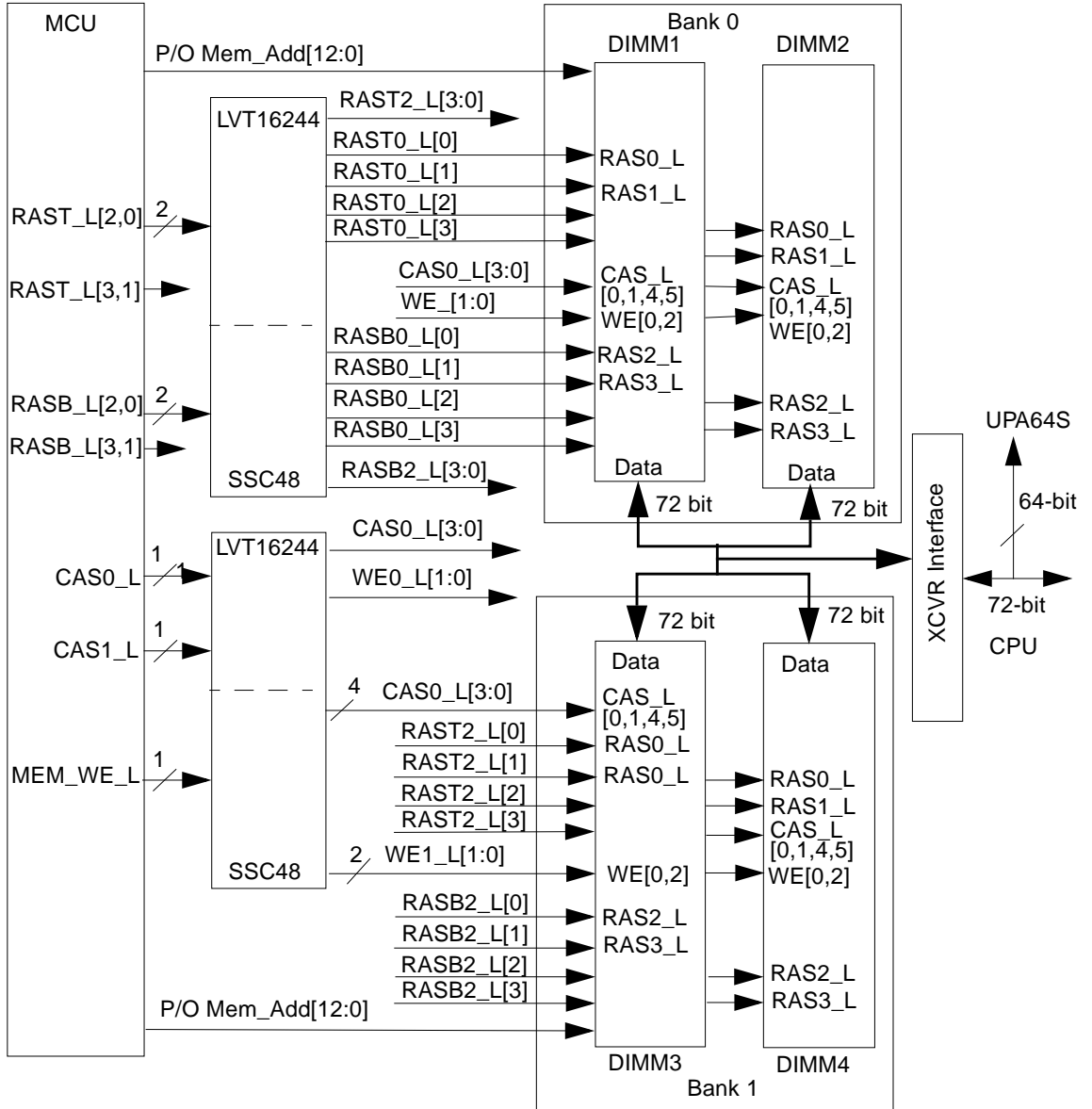


FIGURE C-9 Memory Interface Functional Block Diagram

C.1.3.1 DIMM Memory Configuration



Caution – If the system memory is configured with 16-Mbyte DIMMs, and the system memory is being upgraded with anything other than 16-Mbyte DIMMs, you must remove all 16-Mbyte DIMMs and replace them with the memory upgrade.

An additional mode in the MCU supports 11-bit column addressing. Since the total available address bits in the MCU is constant (1-Gbyte maximum addressable), the maximum number of DIMM pairs in this mode is halved in 11-bit column address mode (4 DIMMs). The MCU can only be programmed in 11-bit column address or 10-bit column address mode (16-Mbyte DIMM memory size), therefore the two types of DIMMs cannot be mixed. If 16-Mbyte DIMMs (10-bit column address) are installed and you wish to upgrade with 11-bit column address DIMMs, then the 10-bit DIMMs must be removed and replaced with 11-bit column address DIMMs. The following table lists memory DIMM configurations.

TABLE C-2 Memory DIMM Configuration

Sun Part Number	DIMM Configuration	Number of DRAMs on Module	DIMM Memory Size	Bank Memory Size (2 DIMMs)	Fully Loaded (2 banks, 4 DIMMs)	Column Address Bits
370-3211	2-Mbyte x 72	9	16-Mbyte*	32-Mbyte	64-Mbyte	10*
370-3198	4-Mbyte x 72	18	32-Mbyte	64-Mbyte	128-Mbyte	11
370-3199	8-Mbyte x 72	9	64-Mbyte	128-Mbyte	256-Mbyte	11
370-3200	16-Mbyte x 72	18	128-Mbyte	256-Mbyte	512-Mbyte	11
370-3201	32-Mbyte x 72	36	256-Mbyte	512-Mbyte	1 Gbyte	11

*. Do not mix with other DIMM memory size. Do not mix DIMMs that have 10 column address bits with DIMMs that have 11 column address bits.

C.1.3.2 DIMM Characteristics

The DIMMs used in the system have the following characteristics:

- JEDEC standard 168-pin DIMM
- Support ECC (x72)
- Single 3.3-VDC +/- 0.3-VDC power supply
- LVTTTL-compatible input and outputs
- All inputs are buffered with exception of RAS_L
- CAS_L before RAS_L refresh capability

C.1.3.3 Memory Address Assignment

The system memory spans a 1-Gbyte region, starting at physical address 0x000.0000.0000. The system has four DIMM sockets that accept 16-Mbyte to 256-Mbyte DIMMs. DIMMs must be installed in pairs. If the same size pair of DIMMs are not installed, software configures them to the lower size DIMM. Address mapped to memory must be cacheable. Transfers between any port and memory is done in 64-byte cache line size. Non-cacheable accesses to memory are not supported and are treated as an error. Parameters that effect the address assignment of each DIMM module are DIMM size and in which bank (bank 0 or bank 1) the DIMM is installed.

PA[28:27] are used as the DIMM-pair select. PA[29] is used as an upper stack or a lower stack select; 0 is bottom stack and 1 is the upper stack. DIMMs that contain a single bottom stack must have PA[29] set to 0 (lo) to be accessed. The way that PA[29:27] maps into RASx_L is listed in the following table. TABLE C-4 lists the memory address range based on installed DIMMs.

TABLE C-3 PA Map Into RASx_L Signals

PA[29:27]	RASx_L Asserted	PA[29:27]	RASx_L Asserted
000	RASB_L[0]	100	RAST_L[0]
010	RASB)L[2]	110	RAST_L[2]

TABLE C-4 Memory Address Range Based on Installed DIMMs

DIMM Bank Number	DIMM Size	DIMM Pair Size	Address Range	Notes
0	16 Mbyte	32 Mbyte	0x0000.0000 - 0x01FF.FFFF	
0	32 Mbyte	64 Mbyte	0x0000.0000 - 0x03FF.FFFF	
0	64 Mbyte	128 Mbyte	0x0000.0000 - 0x07FF.FFFF	
0	128 Mbyte	256 Mbyte	0x0000.0000 - 0x0FFF.FFFF	
0	256 Mbyte	512 Mbyte	0x2000.0000 - 0x2FFF.FFFF	
1	16 Mbyte	32 Mbyte	0x1000.0000 - 0x11FF.FFFF	
1	32 Mbyte	64 Mbyte	0x1000.0000 - 0x13FF.FFFF	

TABLE C-4 Memory Address Range Based on Installed DIMMs (*Continued*)

DIMM Bank Number	DIMM Size	DIMM Pair Size	Address Range	Notes
1	64 Mbyte	128 Mbyte	0x1000.0000 - 0x17FF.FFFF	
1	128 Mbyte	256 Mbyte	0x1000.0000 - 0x1FFF.FFFF	
1	256 Mbyte	512 Mbyte	0x3000.0000 - 0x3FFF.FFFF	

Note – If the system memory is configured with 16-Mbyte DIMMs, and the system memory is being upgraded with anything other than 16-Mbyte DIMMs, you must remove all 16-Mbyte DIMMs and replace them with the memory upgrade.

C.1.3.4 Transceivers

The system motherboard transceivers are a hub of all data transfers among memory, CPU module, and the UPA graphics. The transceivers are bit-sliced so that six parts are required to implement the memory subsystem.

C.1.4 PCI Riser Board

Because of the space limitations to the system enclosures, a PCI riser board is present in the systems. The PCI riser board supports a maximum of three PCI cards.

C.1.4.1 Connector Definition

The PCI riser board uses the PCI 64-bit standard connector with revised pinout for additional power needed to support three PCI cards. The following table lists the PCI riser board pin summary.

TABLE C-5 PCI Riser Board Pin Summary

Pin Type	Number of Pins	Current Rating
Gnd	38	N/A
+5V	18 + 4 + 3 = 25	26 amp (max)
+12V	1 + 2 = 3	2 amp (max)
-12V	1	1 amp (max)

- Current rating is 1 ampere at 30°C for each pin.
- Pinout follows the 64-bit 5-VDC PCI specification (with modifications for additional power).
- The IDSEL pin for each PCI slot is reserved.

C.1.4.2 PCI Riser Board Pin Assignment

The following table lists the PCI riser board pin assignments.

TABLE C-6 PCI Riser Board Pin Assignment

Pin Number	Signal	Pin Number	Signal
A1	TRST_L	A9	Reserved
A2	+12V	A10	+5V
A3	TMS	A11	Reserved
A4	TDI	A12	Gnd
A5	+5V	A13	Gnd

TABLE C-6 PCI Riser Board Pin Assignment (*Continued*)

Pin Number	Signal	Pin Number	Signal
A6	INTA1_L	A14	Reserved
A7	INTC1_L	A15	RST_L
A8	+5V	A16	+5V
A17	GNT1_L	A43	PAR
A18	Gnd	A44	AD15
A19	Reserved	A45	Not connected
A20	AD30	A46	AD13
A21	Not connected	A47	AD11
A22	AD28	A48	Gnd
A23	AD26	A49	AD9
A24	Gnd	A50	Key
A25	AD24	A51	Key
A26	IDSEL1	A52	C/BE0_L
A27	Not connected	A53	Not connected
A28	Gnd	A54	AD6
A29	AD20	A55	AD4
A30	Gnd	A56	Gnd
A31	AD18	A57	AD2
A32	AD16	A58	AD0
A33	Not connected	A59	+5V
A34	FRAME_L	A60	REQ64_L
A35	Gnd	A61	+5V
A36	TRDY_L	A62	+5V
A37	Gnd	A63	Gnd
A38	STOP_L	A64	+5V
A39	Not connected	A65	+12V

TABLE C-6 PCI Riser Board Pin Assignment (Continued)

Pin Number	Signal	Pin Number	Signal
A40	SDONE	A66	+5V
A41	SBO_L	A67	+12V
A42	Gnd	A68	Not connected
A69	Gnd	B2	TCK
A70	INTA2_L	B3	Gnd
A71	REQ2_L	B4	TDO
A72	Gnd	B5	+5V
A73	REQ3_L	B6	+5V
A74	INTA3_L	B7	INTB1_L
A75	+5V	B8	INTD1_L
A76	INTA4_L	B9	PRSNT1_L
A77	REQ4_L	B10	Reserved
A78	Gnd	B11	PRSNT2_L
A79	Not connected	B12	Gnd
A80	INTC2_L	B13	Gnd
A81	Gnd	B14	Reserved
A82	INTC3_L	B15	Gnd
A83	GNT2_L	B16	CLK1
A84	+5V	B17	Gnd
A85	GNT3_L	B18	REQ1_L
A86	INTC4_L	B19	+5V
A87	Gnd	B20	AD31
A88	+5V	B21	AD29
A89	GNT4_L	B22	Gnd
A90	Gnd	B23	AD27
A91	+5V	B24	AD25
A92	Reserved	B25	Not connected

TABLE C-6 PCI Riser Board Pin Assignment (*Continued*)

Pin Number	Signal	Pin Number	Signal
A93	Gnd	B26	C/BE3_L
A94	Reserved	B27	AD23
B1	-12V	B28	Gnd
B29	AD21	B52	AD8
B30	AD19	B53	AD7
B31	Not connected	B54	Not connected
B32	AD17	B55	AD5
B33	C/BE2_L	B56	AD3
B34	Gnd	B57	Gnd
B35	IRDY_L	B58	AD1
B36	Not connected	B59	+5V
B37	DEVSEL_L	B60	ACK64_L
B38	Gnd	B61	+5V
B39	LOCK_L	B62	+5V
B40	PERR_L	B63	Reserved
B41	Not connected	B64	Gnd
B42	SERR_L	B65	IDSEL4
B43	Not connected	B66	IDSEL2
B44	C/BE1_L	B67	Gnd
B45	AD14	B68	IDSEL3
B46	Gnd	B69	+5V
B47	AD12	B70	+5V
B48	AD10	B71	INTD2_L
B49	Gnd	B72	Not connected

TABLE C-6 PCI Riser Board Pin Assignment (*Continued*)

Pin Number	Signal	Pin Number	Signal
B50	Key	B73	INTD3_L
B51	Key	B74	Gnd
B75	INTD4_L	B85	Gnd
B76	CLK2	B86	Gnd
B77	INTB2_L	B87	+5V
B78	Gnd	B88	+5V
B79	+5V	B89	+5V
B80	CLK3	B90	+5V
B81	INTB3_L	B91	Gnd
B82	Gnd	B92	Reserved
B83	INTB4_L	B93	Reserved
B84	CLK4	B94	Gnd

C.1.5 ASICs

System ASICs include APB, PCIO, and RISC.

C.1.5.1 APB

The advanced PCI bridge (APB) ASIC provides a connection path between the primary PCI bus and the two secondary PCI buses. APB features include:

- 32-bit memory addressing for PIO, 64-bit memory addressing (DACs) for DMA
- 16-bit I/O addressing
- Full concurrences for primary and secondary PCI interfaces
- 72-byte FIFO data buffering on each of the DMA and PIO paths
- Arbitration/prioritization
- PIO reads and writes are in non-cacheable memory space

C.1.5.2 PCIO

The PCI-to-EBus/Ethernet controller (PCIO) ASIC interfaces to the PCI bus and implements three major functions:

- 10-/100-Mbit Ethernet media access controller (MAC)
- Asynchronous 8-bit EBus2 interface
- Four dedicated DMA channels:
 - Parallel port
 - Audio capture/record
 - Audio playback
 - Diskette

A PCIO ASIC interrupt router directs the channel engine interrupts to the appropriate device. EBus2 interrupts (only those associated with a DMA channel) are assigned to INTA# and Ethernet interrupts are assigned to INTB#. In PC card mode, this is in add-in mode. The PCIO ASIC has separate interrupt lines for each internal device. INTA# becomes `ent_irq_1`, INTB# is unused, INTC# becomes `pport_irq_1`, and INTD# becomes `fpv_irq_1`. Interrupts from the audio capture are routed to `audio_cap_irq_1` while interrupts from audio playback are routed to `audio_pb_irq_1`.

In the motherboard mode, interrupts from external EBus2 devices not associated with DMA channels (for example, keyboard and mouse) are connected directly to the system interrupt controller (RISC) ASIC.

C.1.5.3 RISC

The reset, interrupt, scan, and clock (RISC) ASIC combine the five reset conditions into three signals to the CPU module. Based on these signals, the CPU module sets the proper control register bit to enable the software to identify the source of the reset. The following figure shows the system reset functional block diagram. The five reset conditions include:

- POWER_GOOD from power supply
- Scan control
- Button POR
- Button XIR
- Scan XIR

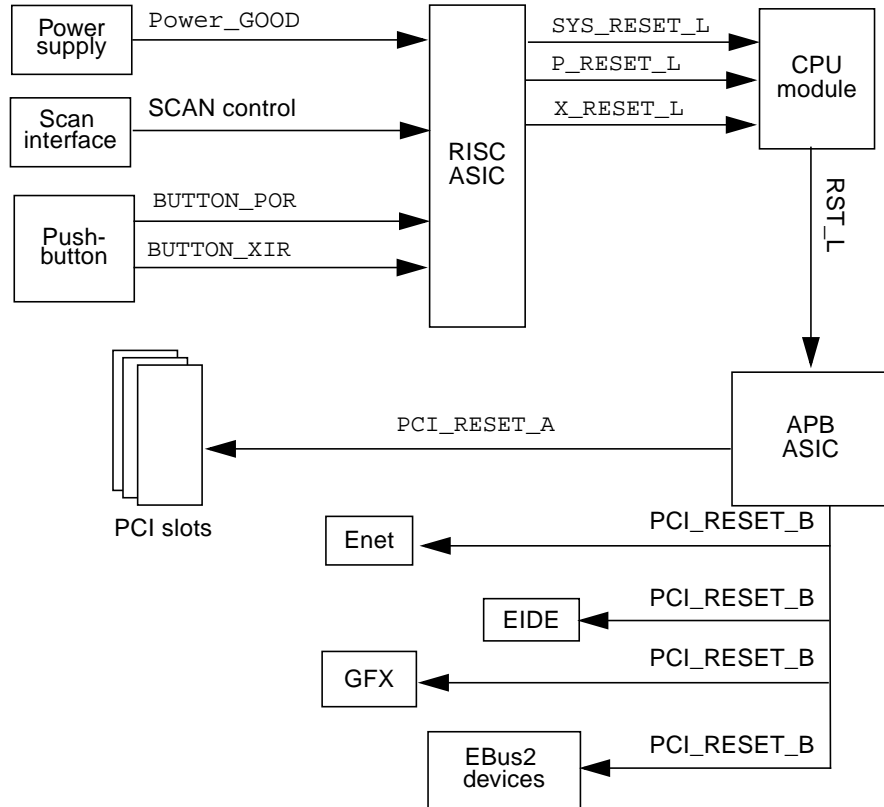


FIGURE C-10 System Reset Functional Block Diagram

C.1.6 EBus2 Devices

The devices described in the sections below interface to the EBus2 within PCIO ASIC. The EBus2 is a slave interface that provides slave cycles on the EBus2. The EBus2 slave interface provides eight chip selects. The slave cycle timing(s) on the EBus2 is programmable. Timing control is provided for 7 address ranges that correspond to the EB_CS1 through EB_CS7 address ranges. This section discusses the following topics.

- Section C.1.6.1 “SuperIO” on page C-22
- Section C.1.6.2 “Serial Communications Controller” on page C-23
- Section C.1.6.3 “Flash PROM” on page C-23
- Section C.1.6.4 “NVRAM/TOD” on page C-24
- Section C.1.6.5 “Audio” on page C-24

C.1.6.1 SuperIO

The SuperIO is a chip device that provides the following functions:

- On-chip diskette controller
- Two standard 16550 UARTs used for the serial mouse and keyboard
- Parallel port
- Mixed voltage support
- 100-pin PQFP

Serial Ports/Keyboard and Mouse

The on-chip serial ports are used as the mouse and keyboard devices because the system does not have fast and synchronous serial ports. The following figure is a functional block diagram of the serial port.

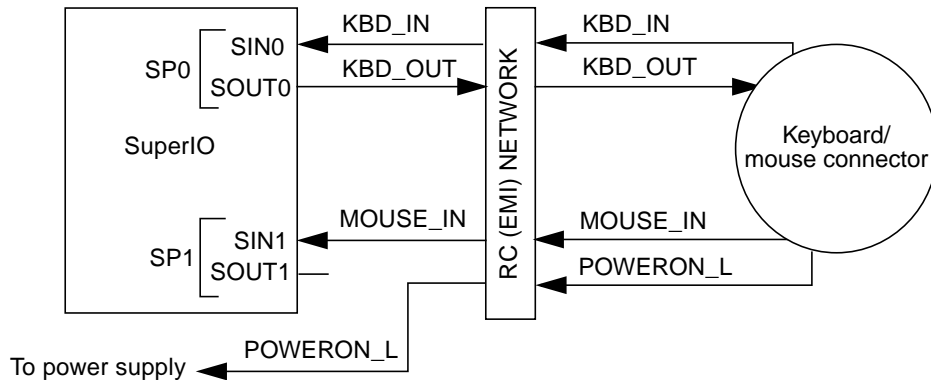


FIGURE C-11 Standard Serial Port Functional Block Diagram

Parallel Port

- IEEE 1284-compatible parallel port

All five modes supported:

- Compatible mode
- Nibble mode
- Byte mode
- ECP
- EPP

One legacy DMA channel is supported

C.1.6.2 Serial Communications Controller

The Siemens serial communications controller enables a two-channel increased throughput because of 32-byte first-in-first-out (FIFO) architecture. Serial port A (DB25 connector) is fully synchronous/asynchronous, while serial port B (DB9 connector) is asynchronous only. The serial communications controller has 64-byte buffering on both input and output. Therefore, the serial ports take less CPU bandwidth. Interrupts are driven when the buffer is half full. The controller has a dedicated crystal that enables using integer dividers to achieve exact baud rates in most cases. The serial communications controller supports rates up to 921.6 Kbaud. The limitation is the line drivers, which support up to 460.8 Kbaud.

The serial communications controller operates up to 430 Kbaud in asynchronous mode. Synchronous mode operation is up to 460 Kbaud with external clocks.

The line drivers used are compatible with RS232 and RS423 protocols and are set with a jumper on the motherboard. The slew rate of the line drivers is programmable. The system slew rates are set at 10 VDC per microsecond for baud rates greater than 100 Kbaud, and at 5 VDC per microsecond for baud rates less than 100 Kbaud. The following figure is a functional block diagram of the communications controller serial ports.

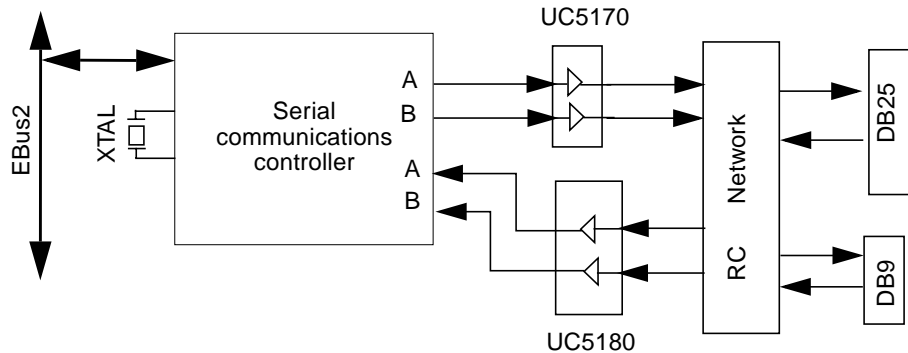


FIGURE C-12 Communications Controller Serial Ports Functional Block Diagram

C.1.6.3 Flash PROM

The flash PROM is an 8-Mbit, 5.0 VDC, 1-Mbyte by 8-bit flash memory. The 1 Mbyte of data is divided into 16 sectors of 64 Kbytes of flexible erase capability. This device is designed to be programmed in-system with the standard system 5.0 VDC VCC supply. 12.0 VDC Vpp is not required for program or erase operations. The flash PROM is also programmed in a standard EPROM programmer. The flash PROM has an access time of approximately 120 nanoseconds.

The flash PROM is divided into two halves, the open boot PROM (OBP) half, and the power-on self-test (POST)/open boot diagnostic (OBDiag) half. There are two physical jumpers on the motherboard. One jumper is used to enable either ROMBO or the on-board flash. The second jumper protects the flash prom from accidental writes to the flash PROM.

C.1.6.4 NVRAM/TOD

The non-volatile RAM/time of day (NVRAM/TOD), is an 8K x 8 nonvolatile static RAM and real-time clock. The programmable alarm output is used for turning the system on when Energy Star is enabled and the system has turned itself off. The following figure shows the NVRAM/TOD functional block diagram.

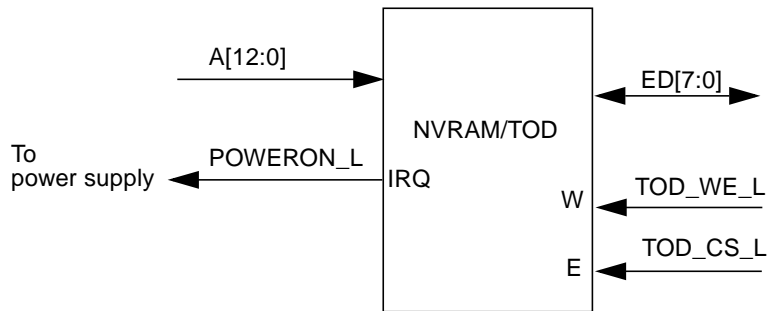


FIGURE C-13 NVRAM/TOD Functional Block Diagram

C.1.6.5 Audio

The system audio consists of a single-chip CODEC, integrated amplifier, and supporting analog circuitry.

The CODEC is a single-chip stereo, analog-to-digital and digital-to-analog converter based on delta-sigma conversion technique. The microphone input specifications are designed for the SunMicrophone II or equivalent. The following figure shows a functional block diagram of the system audio circuit. TABLE C-7 lists the audio input electrical specifications and TABLE C-8 lists the audio output electrical specifications.

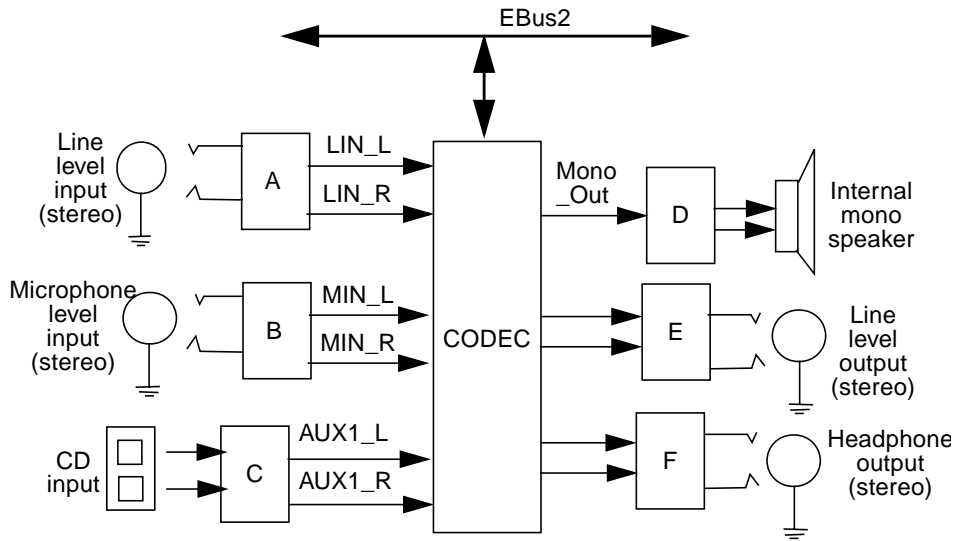


FIGURE C-14 Audio Circuit Functional Block Diagram

TABLE C-7 Audio Input Electrical Specification

Parameter (Rec=50, Mon, Play=100)	Min	Nom	Max	Unit
Input voltage at microphone jack input that results in full scale digital output	66.9	70.4	77.4	mV (p-p)
Input voltage at line-in jack that results in full scale digital output	6.00	6.54	6.99	V (p-p)
Microphone input impedance	1.5	2.21	2.5	Kohm
Microphone input capacitance	200	220	240	pF
Line-in input impedance	8.7	9.16	9.62	Kohm
Line-in input capacitance	200	220	240	pF

TABLE C-8 Audio Output Electrical Specification

Parameter OLB= 1 (Rec=50, Mon, Play=100)	Min	Nom	Max	Unit
Output voltage at line out that results from a full scale digital signal (ATTN= 0dB)	2.60	2.8	3.20	V (p-p)

TABLE C-8 Audio Output Electrical Specification (Continued)

Parameter OLB= 1 (Rec=50, Mon, Play=100)	Min	Nom	Max	Unit
Output voltage at headphone out that results from a full scale digital signal (ATTN= 10.5 dB)	1.55	1.67	1.91	V (p-p)
Headphone output impedance	15	16	1.0K	ohm
Line-out output impedance	207	220	233	ohm

C.1.7 Power and Standby Switching

The system has one power switch and two standby switches. These switches include the power switch, the front panel standby switch, and the Type-5 keyboard Standby key (or the Sun I/O Type-6 keyboard Power key).

C.1.7.1 Power Switch

The power switch is located on the system rear, on the power supply. When set to off, the system is completely off with no power.

C.1.7.2 Front Panel Standby Switch

The front panel standby switch turns on the system if the power supply on/off switch is set to on and the system has been previously placed in the standby mode.

The front panel standby switch can also be used to halt the operating system and place the system in standby mode.

C.1.7.3 Keyboard Standby/Power Key

The keyboard Standby/Power key turns on the system if the power switch is set to on and the system has been previously placed in the standby mode.

The keyboard Standby/Power key can also be used to suspend the operating system and place the system in the standby mode if the Energy Star power management software (dtpower) has been installed.

C.2 Clocking

There are five system clock domains: CPU, second level cache SRAMs, UPA, PCI, and miscellaneous clocks for the various IO devices.

C.2.1 CPU and UPA Clocking

The CPU and UPA clocks are generated using a frequency synthesizer on the CPU module. The synthesizer output frequency is divided by four, before being driven to the CPU and SRAMs. In addition, one synthesizer output frequency is divided by six and is gated to the CPU module and to the UPA graphics slot as the UPA clock.

C.2.2 PCI Clock Generation

All PCI clocks are generated on the motherboard. Additionally, two 66-MHz PCI clocks are gated to the CPU module through the module connector. TABLE C-9 lists the generated PCI clocks.

The motherboard supports two different PCI clock generators; the ICW48C60-422G clock generator or the CY2254A-2 clock generator. TABLE C-10 and TABLE C-11 list the PCI clock generator frequency select bits for the ICW48C60-422G and the CY2254A-2 PCI clock generators, respectively.

TABLE C-9 PCI Clocks

Component	66 MHz	33 MHz
CPU module	2	
APB	1	1
PCI expansion slots		2
RISC		1
PCIO		1

TABLE C-9 PCI Clocks (Continued)

Component	66 MHz	33 MHz
IDE		1
ATI PCI based VGA		1
Total number of PCI clocks	3	7

TABLE C-10 PCI Clock Generator Frequency Select (ICW48C60-422G)

SEL0	SEL1	SEL2	R%EF1:2	CPUx (60/66 MHz)	PCIx (30/33)
0	0	0	14.318 MHz	50 MHz	25 MHz
0	1	0	14.318 MHz	60 MHz	30 MHz
1	0	0	14.318 MHz	66 MHz	33 MHz
1	1	0	14.318 MHz	66 MHz	33 MHz

TABLE C-11 PCI Clock Generator Frequency Select (CY2254A-2)

SEL0	SEL1	OE	R%EF1:2	CPUx (60/66 MHz)	PCIx (30/33)
0	0	1	14.318 MHz	50 MHz	25 MHz
0	1	1	14.318 MHz	60 MHz	30 MHz
1	0	1	14.318 MHz	66 MHz	33 MHz
1	1	1	14.318 MHz	55 MHz	27.5 MHz

C.3 Address Mapping

This section provides the overview of address partitioning and software-visible registers and their respective functionality. The physical address associated with each of these registers is listed, along with a brief description of the register. For further details on the description of the registers and chips functionality refer to the respective chip specification.

- Section C.3.1 “Port Allocations” on page C-29
- Section C.3.2 “PCI Address Assignments” on page C-30

C.3.1 Port Allocations

The following table lists the system port allocations. The CPU module divides the physical address space among:

- Main memory (DRAM)
- PCI (which is further subdivided into the primary PCI bus (PCI-A) and the secondary PCI bus (PCI-B bus) when the APB ASIC is used).

TABLE C-12 Port Allocations

Address Range in PA<40:0>	Size	Port Access	Access Type
0x000.0000.0000 - 0x000.3FFF.FFFF	1 Gbyte	Main memory	Cacheable
0x000.4000.0000 - 0x1FF.FFFF.FFFF	Do not use	Undefined	Cacheable
0x1FC.0000.0000 - 0x1FD.FFFF.FFFF	8 Gbytes	UPA graphics	Non-cacheable
0x1FE.0000.0000 - 0x1FF.FFFF.FFFF	8 Gbytes	CPU IO	Non-cacheable

C.3.2 PCI Address Assignments

The following table lists the PCI address assignments.

TABLE C-13 PCI Address Assignments

Address Range in PCI Address	Size	PCI Space Addressed	Notes
0x8000.0000 - 0xBFFF.FFFF	1 Gbyte	Primary PCI DVMA space	CPU module DVMA register (equals 0x30)
0x4000.0000 - 0x7FFF.FFFF	1 Gbyte	PCI bus A memory space	PCI slots APB ASIC register (equals 0xc)
0x40.0000 - 0x7f.ffff	4 Mbytes	PCI bus A I/O space	PCI slots
0x0000.0000 - 0x3FFF.FFFF 0xC000.0000 - 0xFFFF.FFFF	2 Gbytes	PCI bus B memory space	Onboard PCI bus APB ASIC B register (equals 0xc3)
0x00.0000 - 0x3f.FFFF 0xC0.0000 - 0xFF.FFF	8 Mbytes	PCI bus B I/O space	

C.3.2.1 PCI Bus A Address Assignments

PCI bus A has all the PCI slots and the address is programmable by the OpenBoot Prom (OBP).

C.3.2.2 PCI Bus B Address Assignments

The PCI bus B address assignments are as follows:

- PCIO ASIC registers
- Boot PROM

PCIO ASIC Registers

The PCIO ASIC is a PCI client and the address can be reprogrammed by software during boot only. Therefore, instead of providing absolute addresses for each of the registers, only offset addresses, relative to a base address, are given.

The PCIO ASIC is a multifunction PCI device and its configuration space has three base address pointers:

- Boot PROM
- EBus2 (function 0)
- Ethernet (function 1)

Boot PROM

The PCIO ASIC is strapped so that the red mode trap address is:

- UPA: 0x1FF.F000.0000
- PCI: 0xF000.0000
- EBus2: 0x00.0000

The following table lists the boot and flash PROM address assignments.

TABLE C-14 Boot PROM/Flash PROM Address Assignments

Offset	Register Description	Type	Size
0x00.0000 - 0xFF.FFFF	Flash Prom/EPROM	R	1 or 4 bytes

C.4 Interrupts

All interrupts are delivered to the CPU module through a packet-write scheme that provides 24 bytes of data to the CPU module. Level sensitive software-acknowledge interrupts, which would typically be communicated through dedicated interrupt lines, are converted into interrupt packets and delivered to the CPU module.

The output of `INT_NUM` is registered externally and synchronized to the PCI clock before being transferred to the CPU module. The following figure shows the interrupt scheme block diagram and the following table summarizes the interrupt routing.

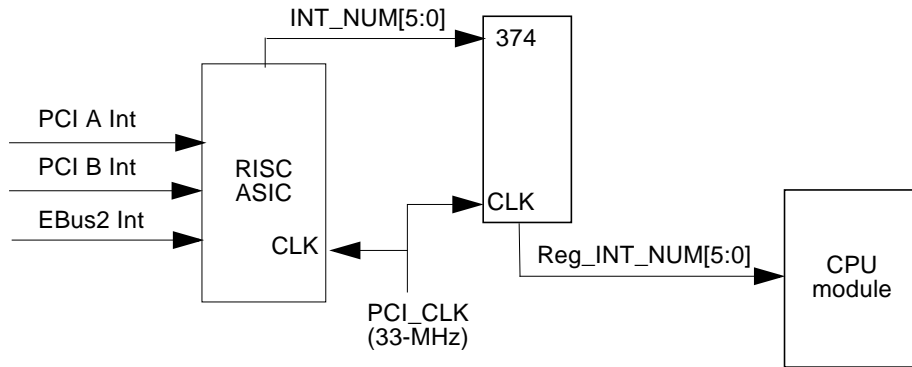


FIGURE C-15 Interrupt Scheme Block Diagram

TABLE C-15 Interrupt Routing

RISC Pin	Interrupt	Int/Ext	Source	INT_NUM (from RISC)	Type	Offset	Priority
SB0_INTREQ7	Not used	Ext	PCI	0x07	Level	0x00	7
SB0_INTREQ5	Not used	Ext	PCI	0x05	Level	0x01	5
SB2_INTREQ5	Not used	Ext	PCI	0x05	Level	0x02	5
SB0_INTREQ2	Not used	Ext	PCI	0x02	Level	0x03	2
SB1_INTREQ7	Not used	Ext	PCI	0x0F	Level	0x04	7
SB1_INTREQ5	Not used	Ext	PCI	0x0D	Level	0x05	5
SB3_INTREQ5	Not used	Ext	PCI	0x1D	Level	0x06	5
SB1_INTREQ2	Not used	Ext	PCI	0x0A	Level	0x07	2
SB2_INTREQ7	Not used	Ext	PCI	0x17	Level	0x08	6
NO RISC PIN	Not used	Ext	PCI	0x38	Level	0x09	5
NO RISC PIN	Not used	Ext	PCI	0x10	Level	0x0A	2
SB1_INTREQ2	Not used	Ext	PCI	0x12	Level	0x0B	1
NO RISC PIN	Not used	Ext	PCI	0x18	Level	0x0C	6
NO RISC PIN	Not used	Ext	PCI	0x39	Level	0x0D	5

TABLE C-15 Interrupt Routing (Continued)

RISC Pin	Interrupt	Int/Ext	Source	INT_NUM (from RISC)	Type	Offset	Priority
NO RISC PIN	Not used	Ext	PCI	0x00	Level	0x0E	2
SB3_INTREQ2	On Board PCI GFX	Ext	PCI	0x1A	Level	0x0F	1
SB0_INTREQ6	PCI A slot 0, INTA#	Ext	PCI	0x06	Level	0x10	6
SB0_INTREQ4	PCI A slot 0, INTB#	Ext	PCI	0x04	Level	0x11	4
SB0_INTREQ3	PCI A slot 0, INTC#	Ext	PCI	0x03	Level	0x12	3
SB0_INTREQ1	PCI A slot 0, INTD#	Ext	PCI	0x01	Level	0x13	1
SB1_INTREQ6	PCI A Slot 1, INTA#	Ext	PCI	0x0E	Level	0x14	6
SB1_INTREQ4	PCI A slot 1, INTB#	Ext	PCI	0x0C	Level	0x15	4
SB1_INTREQ3	PCI A slot 1, INTC#	Ext	PCI	0x0B	Level	0x16	3
SB1_INTREQ1	PCI A slot 1, INTD#	Ext	PCI	0x09	Level	0x17	1
SB2_INTREQ6	PCI A Slot 2, INTA#	Ext	PCI	0x16	Level	0x18	6
SB2_INTREQ4	PCI A slot 2, INTB#	Ext	PCI	0x14	Level	0x19	4
SB2_INTREQ3	PCI A slot 2, INTC#	Ext	PCI	0x13	Level	0x1A	3
SB2_INTREQ1	PCI A slot 2, INTD#	Ext	PCI	0x11	Level	0x1B	1
SB3_INTREQ6	PCI A Slot 3, INTA#	Ext	PCI	0x1E	Level	0x1C	6
SB3_INTREQ4	PCI A slot 3, INTB#	Ext	PCI	0x1C	Level	0x1D	4
SB3_INTREQ3	PCI A slot 3, INTC#	Ext	PCI	0x1B	Level	0x1E	3
SB3_INTREQ1	PCI A slot 3, INTD#	Ext	PCI	0x19	Level	0x1F	1
SCSI_INT	IDE	Ext	OBIO	0x20	Level	0x20	3
ETHERNET_INT	Ethernet	Ext	OBIO	0x21	Level	0x21	3
PARALLEL_INT	Parallel Port	Ext	OBIO	0x22	Level	0x22	2
AUDIO_INT	Audio Capture/Rec	Ext	OBIO	0x24	Level	0x23	8
SB3_INTREQ7	Audio Playback	Ext	OBIO	0x1F	Level	0x24	7

TABLE C-15 Interrupt Routing (Continued)

RISC Pin	Interrupt	Int/Ext	Source	INT_NUM (from RISC)	Type	Offset	Priority
Power_FAIL_INT	Power Fail	Ext	OBIO	0x25	Level	0x25	8
KEYBOARD_INT	IDE Channel 2 (Not used)	Ext	OBIO	0x28	Level	0x26	7
FLOPPY_INT	Diskette	Ext	OBIO	0x29	Level	0x27	8
SPARE_INT	Spare hardware	Ext	OBIO	0x2A	Level	0x28	2
SKEY_INT	Keyboard	Ext	OBIO	0x2B	Level	0x29	4
SMOU_INT	Mouse	Ext	OBIO	0x2C	Level	0x2A	4
SSER_INT	Serial Ports	Ext	OBIO	0x2D	Level	0x2B	7
	Reserved					0x2C - 0x2D	
	Uncorrectable ECC	Int	ECC		Level	0x2E	8
	Correctable ECC	Int	ECC		Level	0x2F	8
	PCI Bus Error	Int	PBM		Level	0x30	8
	Reserved	Int				0x31 - 0x32	
Graphics1_INT	Graphics	Ext	UPA64	0x23	Pulse	FROM INR	5
Graphics1_INT	Graphics (Not used)	Ext	UPA64	0x26	Pulse	FROM INR	5
	No Interrupt	Ext	NONE	0x3F	N/A	N/A	N/A

C.5 Power

This section discusses the following topics:

- Section C.5.1 “Onboard Voltage Regulator” on page C-35
- Section C.5.2 “Power Supply Memory” on page C-35

C.5.1 Onboard Voltage Regulator

The onboard voltage regulator meets VRM8.1 specifications. The output of the voltage regulator is programmed by the module. The module drives VID[3:0], which asks the regulator to generate the correct core voltage for the CPU module core voltage and SRAM IO.

C.5.2 Power Supply Memory

The system remembers the state that it was in before a power failure or accidental power cord removal. This circuit is implemented on the motherboard. A latching relay circuit on the motherboard performs this function.

C.5.3 Power Management

To meet EPA Energy Star requirements, the system power consumption is lower than 30 watts.

In-system software monitors system activity, and based on the system control settings, system software saves the machine state (including the memory) onto the hard drive and halts the operating system. The system software then turns off the power supply.

Based on the setting of the NVRAM/TOD, which has an alarm clock, the system is turned on automatically if the alarm is set. This is done by having the interrupt out of the NVRAM/TOD directly connected to the power supply. The power supply requires a `power_off` signal for the system software to be able to write to a bit within a register and have the power supply shut down.

C.6 Motherboard

The following figure illustrates a block diagram of the system motherboard.

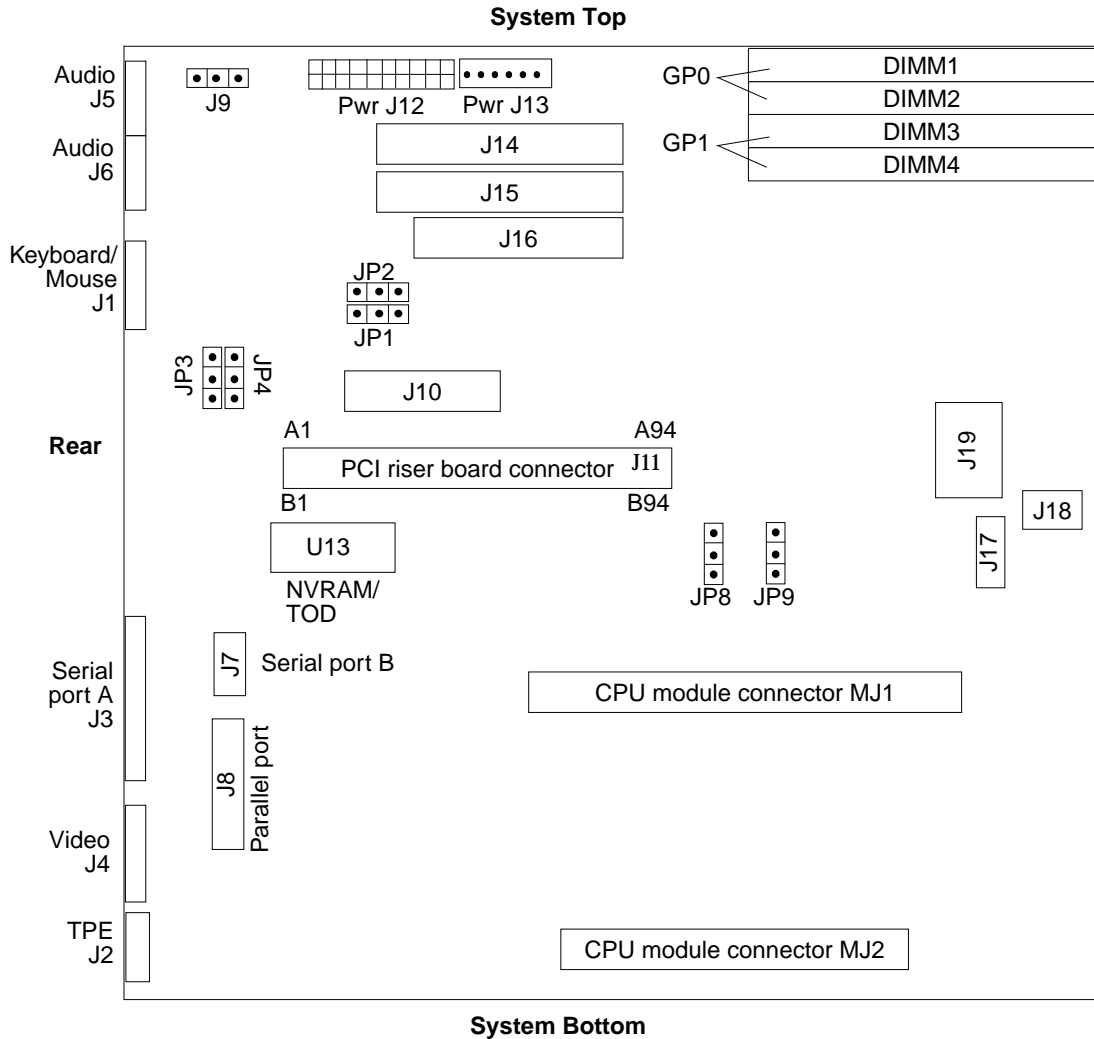


FIGURE C-16 Motherboard Block Diagram

C.7 Jumper Descriptions

Jumper configurations can be changed by setting jumper switches on the motherboard. The motherboard's jumpers are preset at the factory.

A jumper switch is *closed* (sometimes referred to as shorted) with the plastic cap inserted over two pins of the jumper. A jumper is *open* with the plastic cap inserted over one or no pin(s) of the jumper. The following figure shows the different jumper settings that are used on the motherboard.

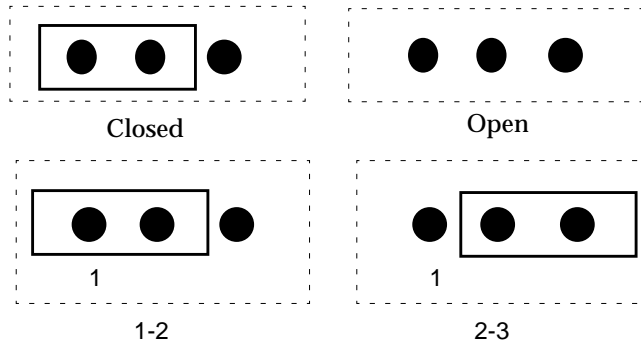


FIGURE C-17 Selected Jumper Settings

Jumper descriptions include brief overviews of serial port jumpers, flash PROM jumpers, and additional system board jumper and connector blocks.

Jumpers are identified on the system board by J designations. Jumper pins are located immediately adjacent to the J designator. Ensure that the serial port jumpers are set correctly.

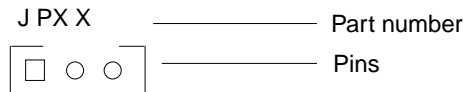


FIGURE C-18 Identifying Jumper Pins

C.7.1 Serial Port Jumpers

Serial port jumpers JP3 and JP4 can be set to either RS-423 or RS-232 serial interface. The jumpers are preset for RS-423. RS-232 is required for digital telecommunication within the European Community. The following table identifies serial port jumper settings. If the system is being connected to a public X.25 network, the serial-port-mode jumper setting may need to change from RS-423 to RS-232 mode. The following figure illustrates the JP3/JP4 jumper settings for RS-423 (default) interface.

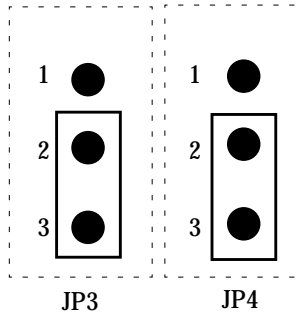


FIGURE C-19 JP3/JP4 Jumper Settings for RS-423 Interface

TABLE C-16 Serial Port Jumper Settings

Jumper	Pins 1-2 Select	Pins 2-3 Select	Default Jumper on Pins
JP3	RS-232	RS-423	2-3
JP4	RS-232	RS-423	2-3

To change the serial port jumper setting from RS-423 (default) to RS-232, refer to Section 8.6.2 “Replacing the Motherboard” on page 8-18.

C.7.2 Flash PROM Jumpers

Flash PROM jumpers JP1 and JP2 are used for reprogramming specific code blocks and remote programming of the flash PROM. The following figure illustrates the JP1/JP2 jumper settings (default) for the flash PROM and the following table identifies the flash PROM jumper settings. The default shunt settings of jumpers JP1 and JP2 are 1-2. Placing the shunt on pins 2 and 3 enables reprogramming of the flash PROM.

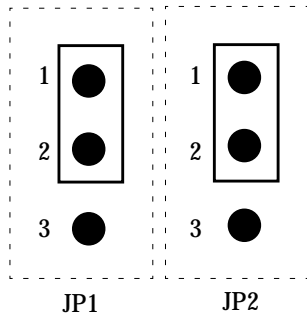


FIGURE C-20 JP1/JP2 Jumper Settings for the Flash PROM

TABLE C-17 Flash PROM Jumper Settings

Jumper	Pins 1-2 Select	Pins 2-3 Select	Default Jumper on Pins
JP1	To onboard PROM	To ROMBO	1-2
JP2	Disable (default)	Enable	1-2

C.8 Enclosure

The system uses an enclosure that reflects style, ergonomics, serviceability, functionality, versatility, and quality. Physical orientation allows for a rack-mount, desktop, or under-desk installation. The enclosure design complies with all necessary environmental and regulatory specifications.

The Ultra 5 enclosure houses:

- One 3.5-inch (8.89-cm) diskette drive
- One 1.6-inch (4.064-cm) CD-ROM drive
- One 3.5-inch (8.89-cm) hard drive bay
(an optional secondary hard drive can be installed in place of the diskette drive)
- One plug-in UltraSPARC module
- Four DIMMs
- Three PCI slots

Software Notes

Note – Systems with PGX24 graphics have "PGX24" or "Series 3" printed on the serial number label that is affixed to the system front bezel.

D.1 PGX24 8-Bit or 24-Bit Graphics

The PGX24 offers PCI-based onboard 8-bit or 24-bit graphics. Selected features of the PCI-based onboard 8-bit or 24-bit graphics are described in the following paragraphs. (Also included is an m64 driver installation procedure that is required for systems running either the Solaris 2.5.1 Hardware: 11/97 or Solaris 2.6 5/98 operating environments.) Software support for PGX24 is included with Solaris 7.

Software support for version 2.5.1 Hardware: 11/97 or version 2.6 5/98 requires an update, which is included on the *Sun Ultra 5 Software Supplement* CD (704-6625). For patch installation instructions, refer to this appendix or the instructions in the CD-insert document included with that CD.

D.1.1 What Does 8-Bit or 24-Bit Frame Buffer Refer To?

The 8-bit or 24-bit graphics describes the number of graphics bits available to store the information for each pixel on the screen. The Ultra 5 onboard PGX24 graphics supports 8-bit or 24-bit colormapping. In contrast, the earlier Ultra 5 onboard PGX graphics only support 8-bit colormapping.

D.1.2 The Difference Between 8-Bit Mode and 24-Bit Mode on Ultra 5 Onboard Graphics

When in 8-bit mode, an 8-bit colormap is available. A main drawback of the 8-bit mode is colormap flashing. Because of the low number of colors, each application typically uses all the colors in the map. If two applications assigned different colors to the map, when one application is pulled into the foreground, the color map is changed and the colors of all the other open application windows change (i.e., flash) to use those in the map of the application just pulled into the foreground. The visual classes available for the 8-bit mode are: PseudoColor, StaticGray, StaticColor, GrayScale, TrueColor, and DirectColor. The 8-bit mode provides 256-different-colors availability at one time. All of the applications that run on previous Ultra 5 on-board frame buffers (PGX) are available.

When in 24-bit mode, a 24-bit colormap is available. The visual class available is TrueColor. The 24-bit mode provides up to 16.7 million different colors available at one time. The large number of colors available eliminate the colormap flashing. However, some of the applications that assume an 8-bit colormap do not initialize in 24-bit mode.

D.1.3 How to Install PGX24 Graphics Software on Solaris 2.5.1 HW:11/97

To load the Solaris 2.5.1 HW:11/97 PGX24 graphics software patch, patch 103792-15, proceed as follows:

1. **Become super-user on the system.**
2. **Go to the directory that contains the patch by typing**

```
# ./cdrom/sun_ultra_5_10_series_hw_ab/Patches/103792-15
```

3. **Install the patch by typing**

```
# ./installpatch .
```

4. **Reboot the system.**
5. **Become super-user on the system.**

6. Set the PGX24.graphics mode to 24-bit by typing

```
# m64config -depth 24 -res 1152x900x66
```

7. Either log out or exit the windowing system, then restart the windowing system.

When the windowing system starts up, the display the display will be in 24-bit mode.

Note – Software patches may be updated after the release of this product. You may contact Sun Enterprise Services, or go to the Sun Online Support Tools webpage, <http://www.sun.com/service/online/>, to obtain the latest software patch.

D.1.4 How to Install PGX24 Graphics Software on Solaris 2.6 5/98

To load the Solaris 2.6 5/98 PGX24 graphics software patch, patch 105362-13, proceed as follows:

- 1. Become super-user on the system.**
- 2. Go to the directory that contains the patch by typing**

```
# ./cdrom/sun_ultra_5_10_series_hw_ab/Patches/105362-13
```

3. Install the patch by typing

```
# ./installpatch .
```

- 4. Reboot the system.**
- 5. Become super-user on the system.**
- 6. Set the PGX24.graphics mode to 24-bit by typing**

```
# m64config -depth 24 -res 1152x900x66
```

7. Either log out or exit the windowing system, then restart the windowing system.

When the windowing system starts up, the display the display will be in 24-bit mode.

Note – Software patches may be updated after the release of this product. You may contact Sun Enterprise Services, or go to the Sun Online Support Tools webpage, <http://www.sun.com/service/online/>, to obtain the latest software patch.

D.1.5 Which Mode is Running?

The output of the command:

```
% /usr/sbin/m64config -propt
```

tells you this information. `depth 8` means that 8-bit mode is initialized. Likewise, `depth 24` means that the 24-bit mode is active. The default setting is 8-bit mode.

D.1.6 Changing From One Mode to the Other

1. Exit the window system.

2. Enter the command:

```
% /usr/sbin/m64config -res <current resolution> -depth <8/24>
```

3. Check the current resolution by entering:

```
% /usr/sbin/m64config -prconf
```

4. Example 1 - To change from 8-bit to 24-bit mode:

```
% /usr/sbin/m64config -res 1152x900x66 -depth 24
```

5. *Example 2 - To change from 24-bit to 8-bit mode:*

```
% /usr/sbin/m64config -res 1152x900x66 -depth 8
```

Note – The `-res` option needs to be specified although the resolution is not changing.

Note – The maximum resolution supported by the 24-bit mode is 1152x900x76.

6. Restart the window system or reboot the machine.

D.2 Solaris 2.5.1 and 2.6 Software Upgrades for Systems Faster Than 420 MHz

If your system CPU speed is faster than 420 MHz, or if you upgrade with a replacement CPU module that is faster than 420 MHz, *and* your system is using either the Solaris 2.5.1 or 2.6 operating environments, software patches are required for those Solaris releases to run at the faster CPU speeds.

Systems with CPU speed faster than 420 MHz have the patch CDs shipped with them from the factory.

If you upgrade to a CPU faster than 420 MHz, you can order the software patch CDs using part number 704-6657 (for Solaris 2.5.1) or 704-6658 (for Solaris 2.6).

Refer to the installation instructions included with the CDs in the *Solaris 2.5.1 and 2.6 for 420+ MHz Systems Installation Guide*.

Glossary

- address** A unique location within computer or peripheral memory. Reference made to an address is usually for retrieving or storing data.
- APB** Advanced PCI bridge. A PCI-to-PCI bridge ASIC that features a connection path between a 32-bit bus operating at speeds up to 66 MHz on the primary interface and two 32-bit, 5 Vdc or 3.3 Vdc, PCI buses (each operating at 33 MHz), on the secondary interface.
- ASIC** Application-specific integrated circuit.
- ASP** Authorized service provider.
- AUXIO** Auxiliary IO. General purpose lines used to control miscellaneous system functions.
- boot** A term used to identify the process of reading initial software into the computer.
- boot PROM** In Sun workstations, contains the PROM monitor program, a command interpreter used for booting, resetting, low-level configuration, and simple test procedures.
- CAS** Column address select.
- CDE** Common Desktop Environment.
- CD-ROM** Compact disc read-only memory.
- DBZ** Double buffer with Z.
- DCE** Data communication equipment. An external modem.
- default** A preset value that is assumed to be correct unless changed by the user.
- DIMM** Dual in-line memory module. A small printed circuit card that contains dynamic random access memory chips.
- DMA** Direct memory address.

DOC	Department of communications.
dpi	Dots per inch.
DRAM	Dynamic random-access memory. A read/write dynamic memory in which the data can be read or written in approximately the same amount of time for any memory location.
DTAG	Dual tag or data tag.
DTE	Data terminal equipment.
EBus	Extension bus.
ECC	Error checking code.
EDO	Extended data out.
EIDE	Enhanced IDE.
EMI	Electrostatic magnetic interference. Electrical phenomena that directly or indirectly contributes to a degradation in performance of an electronic system.
Ethernet	A type of network hardware that provides communication between systems connected directly together by transceiver taps, transceiver cables, and various cable types such as coaxial, twisted-pair, and fiber-optic.
FBC	Frame buffer controller. An ASIC responsible for the interface between the UPA and the 3DRAM. Also controls graphic draw acceleration.
FCC	Federal communications commission.
FIFO	First-in-first-out.
flash PROM	Flash programmable read-only memory.
Gbyte	Gigabyte.
GUI	Graphical user interface.
IDC	Insulation displacement connector.
IDE	Integrated drive electronics.
I/O	Input/output.
JTAG	IEEE standard 1149.1.
Kbyte	Kilobyte.
LAN	Local area network.
LED	Light-emitting diode.
MAC	Media access controller.

Mbyte	Megabyte.
MBps	Megabyte per second.
Mbps	Megabit per second.
MCU	Memory controller unit.
MHz	Megahertz.
MII	Media independent interface.
ns	Nanosecond.
NVRAM	Non-volatile random access memory. Stores system variables used by the boot PROM. Contains the system hostID number and Ethernet address.
OBP	OpenBoot PROM. A routine that tests the network controller, diskette drive system, memory, cache, system clock, network monitoring, and control registers.
PCI	Peripheral component interconnect. A high-performance 32- or 64-bit-wide bus with multiplexed address and data lines.
PCIO	PCI-to-EBus/Ethernet controller. An ASIC that bridges the PCI bus to the EBus, enabling communication between the PCI bus and all miscellaneous I/O functions, as well as the connection to slower on-board functions.
PCMCIA	Personal Computer Memory Card International Association.
PID	Process ID.
POR	Power-on reset.
POST	Power-on self-test. A series of tests that verify motherboard components are operating properly. Initialized at system power-on or when the system is rebooted.
RAMDAC	RAM digital-to-analog converter. An ASIC responsible for direct interface to 3DRAM. Also provides onboard phase-lock loop (PLL) and clock generator circuitry for the pixel clock.
RAS	Row address select.
RC	Resistive-capacitive.
RISC	Reset, interrupt, scan, and clock. An ASIC responsible for reset, interrupt, scan, and clock.
SB	Single buffer.
SDRAM	Synchronous DRAM.
SGRAM	Synchronous graphics RAM.

SRAM	Static random access memory.
Standby switch	Controls the standby state of the system.
STP	Shielded twisted-pair.
SunVTS	A diagnostic application designed to test hardware.
TIP connection	A connection that enables a remote shell window to be used as a terminal to display test data from a system.
TPE	Twisted-pair Ethernet.
TOD	Time of day. A timekeeping intergrated circuit.
TTL	Transistor-transistor logic.
UPA	UltraSPARC port architecture. Provides processor-to-memory interconnection.
UTP	Unshielded twisted-pair.
VCCI	Voluntary control council for interference.
VIS	Visual instruction set.
Vrms	Volts root-mean-square.

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