SunHSI/P™ User's Guide

THE NETWORK IS THE COMPUTER™

Sun Microsystems, Inc.
901 San Antonio Road
Palo Alto, CA 94303-4900 USA
650 960-1300 Fax 650 969-9131

Part No. 805-6943-10
November 1998, Revision A

Send comments about this document to: docfeedback@sun.com

Please
Recycle

Adobe PostScript

Regulatory Compliance Statements

Your Sun product is marked to indicate its compliance class:

- Federal Communications Commission (FCC) — USA
- Department of Communications (DOC) — Canada
- Voluntary Control Council for Interference (VCCI) — Japan

Please read the appropriate section that corresponds to the marking on your Sun product before attempting to install the product.

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.

DOC Class B Notice - Avis DOC, Classe B

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

EEC Electromagnetic Compatibility Directive

CE The product(s) described in this manual conform to the **EU 89/336/EEC Electromagnetic Compatibility Directive, ammended by 92/31/EEC and 93/68/EEC.**

The products described in this manual are:

SunHSI/P, High Speed Interface (HSI) adapter for PCI applications

The product identified above comply with the **EU 89/336/EEC Electromagnetic Compatibility Directive** by meeting the applicable EU standards.

WARNING NOTICE

In order to comply with the EU 89/336/EEC Electromagnetic Compatibility Directive, shielded cables must be used with this product.

VCCI 基準について

第一種VCCI基準について

第一種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、第一種情報装置です。これらの製品には、下記の項目が該当します。

この装置は、第一種情報装置(商工業地域において使用されるべき情報装置)で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会(VCCI)基準に適合しております。したがって、本製品を、住宅地域または住宅地域に隣接した地域でご使用になりますと、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。

取り扱い説明書に従って正しくお取り扱いください。

第二種VCCI基準について

第二種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、第二種情報装置です。これらの製品には、下記の項目が該当します。

この装置は、第二種情報装置(住宅地域または住宅地域に隣接した地域において使用されるべき情報装置)で住宅地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会(VCCI)基準に適合しております。しかし、本製品を、ラジオ、テレビジョン受信機に近接してご使用になりますと、受信障害の原因となることがあります。

取り扱い説明書に従って正しくお取り扱いください。

Declaration of Conformity

Compliance ID: PTI-334

Product Name: SunHSI/P Adapter

This equipment 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.

EMC

In addition this equipment complies with the following requirements of the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/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 (Class D)

Supplementary Information

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

/S/

Dennis P. Symanski DATE

Manager, Product Compliance

Sun Microsystems, Inc.
901 San Antonio Road, M/S UMPK15-102
Palo Alto, CA 94303, USA
Tel: 650-786-3255
Fax: 650-786-3723

/S/

John Shades DATE

Quality Assurance Manager

Sun Microsystems Scotland, Limited
Springfield, Linlithgow
West Lothian, EH49 7LR
Scotland, United Kingdom
Tel: 0506 670000
Fax: 0506 760011

Contents

Figures

Tables

Preface

Introduction

This document provides information for users of the SunHSI/P™, high speed serial interface (HSI) adapter for PCI applications. Instructions include installation, setup, and use of the SunHSI/P adapter and software, and is intended to be used by either first-time or experienced users.

If you have just acquired this product, review the introductory sections and follow the guidelines for installation and getting started.

More information regarding the technology used in the design of this product can be found in “Related Documentation” on page xviii.

How This Book Is Organized

The manual is organized as follows:

Chapter 1 provides an introduction and general overview of the SunHSI/P adapter. It is intended as a quick summary of SunHSI/P features and provides a framework for the rest of the document.

Chapter 2 details how to configure and install the SunHSI/P adapter hardware.

Chapter 3 details how to install the SunHSI/P adapter software.

Chapter 4 provides a detailed description of SunHSI/P architecture and functional blocks.

Appendix A describes the features and specifications about the SunHSI/P Adapter hardware.

Appendix B lists the PCI pin assignments.

Appendix C gives information on the Pin Outs on the various connectors and how to create null modem adapters for the SunHSI/P Adapter hardware.

Appendix D describes the `hsip_init` options required for T1 and CEPT compatibility.

Appendix E defines the operating modes used by the SunHSI/P software.

Appendix F provides an overview of the SunVTS™ diagnostic software.

The **Glossary** is a list of words and phrases found in this book and their definitions.

Using UNIX Commands

This document may not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

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

Typographic Conventions

TABLE P-1 Typographic Conventions

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

Shell Prompts

TABLE P-2 Shell Prompts

Shell	Prompt
C shell	*machine_name*%
C shell superuser	*machine_name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

Related Documentation

The following documents provide additional information regarding the technology used for the SunHSI/P product.

- PCI Local Bus Specification; Revision 2.1, 1995. PCI Special Interest Group; P. O. Box 14070, Portland, OR 97214.
- MC68360 Quad Integrated Communications Controller, User's Manual; M68360UM/AD; Motorola Incorporated. Motorola Literature Distribution; P.O. Box 20912; Phoenix, AZ 85036.
- M68000 Family Programmer's Reference Manual; M6800PM/AD. Motorola Incorporated, 1989. Motorola Literature Distribution; P.O. Box 20912; Phoenix, AZ 85036.
- PCI Bus Interface and Clock Distribution Chips; Product Catalog 1995. PLX Technology; 625 Clyde Avenue; Mountain View, CA 94043.

Sun Documentation on the Web

The `docs.sun.com`[sm] 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.

CHAPTER 1

Overview

Overview

The SunHSI/P, high speed serial interface (HSI) adapter for PCI applications, offers comprehensive “Plug N’ Play” compatibility with Solstice™ WAN software packages available through Sun. This is accomplished through the SunHSI/P software driver, a transparent interface that operates on the SunHSI/P and provides a compliant environment for the SunLink WAN packages that currently operate on similar Sun communication modules.

The SunHSI/P is an intelligent four port communication controller which includes an onboard CPU and memory dedicated to the WAN communication function. This architecture operates much more efficiently at high data rates than “unintelligent” WAN modules. Onboard intelligence allows the workstation/server to be off-loaded from many of the low level communication tasks that it must perform when there is no native intelligence on the controller.

The SunHSI/P comes with the RS-449 industry standard connectors (i.e. DB-37).

The protocols that operate with the SunHSI/P adapter include SNA 3270, SNA Peer-To-Peer, OSI, X.25, Internetwork Router (IR), PPP, Frame Relay, etc. The SunHSI/P adapter conforms to the Sun Synchronous Serial Driver Interface Specification and is supported under Solaris 2.5.1 Hardware: 4/97, 8/97, and 11/97, Solaris 2.6, and Solaris 7.

Features

- T1/E1 transfer speed simultaneously on all 4 ports
- Meets PCI local bus specification, rev. 2.1
- 32 bit data width, short form board
- 33MHz operating frequency with 5 V I/O signaling
- Full RS-449 support on all four ports
- Synchronous
- Programmable speed

For Assistance

For assistance in the United States, please call 1-800-USA-4SUN.

For information on how to get the latest patches and patch revisions, visit the SunSolve[sm] website at `http://sunsolve.sun.com`, or contact your local Sun service provider.

For additional information, access Sun on the World Wide Web at `http://www.sun.com` and select Sales and Service.

CHAPTER 2

Hardware Installation

Process

A simplified version of the installation process follows:

1. **Install the SunHSI/P adapter (see “SunHSI/P Adapter Installation” on page 5).**
2. **Power on your system.**
3. **Install the SunHSI/P Software (see Chapter 3).**
4. **Reboot your system.**
5. **Check to make sure that the hardware and software installation is complete and correct (see “Testing The Hardware And Software Install” on page 16).**

Configuring the SunHSI/P

Mechanical Layout

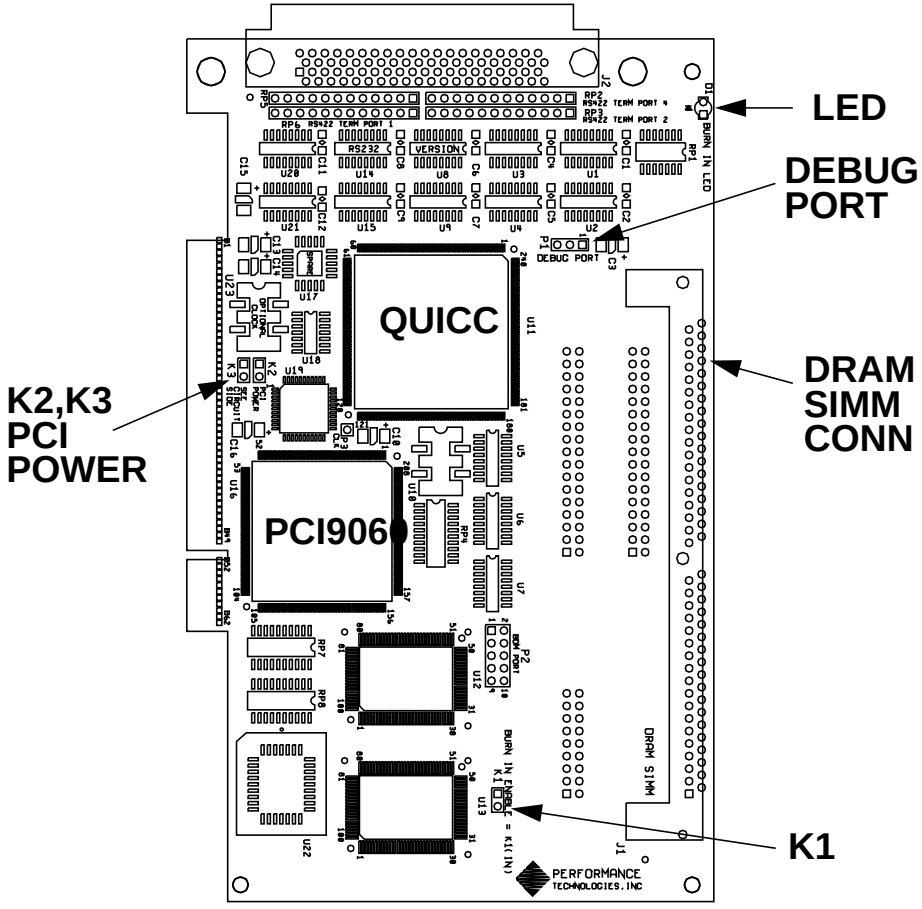

FIGURE 2-1 Mechanical Layout Drawing

SunHSI/P Adapter Installation

Caution – Electronic components on printed circuit boards are extremely sensitive to static electricity. Ordinary amounts of static electricity generated by your clothing or work environment can damage the electronic equipment. It is recommended that when installing the SunHSI/P in a system that anti-static grounding straps and anti-static mats are used to help prevent damage due to electrostatic discharge.

Note – Refer to your system installation or service manual for detailed instructions for the following steps.

1. **Power off your system, using the standard shut down procedures described in the** *Solaris Handbook for Sun Peripherals* **or your system service manual.**

   The *Solaris Handbook for Sun Peripherals* is shipped with the Solaris operating environment software and is available on the `http://docs.sun.com` website.

2. **Select an available 5 Volt PCI slot and remove the slot filler panel.**
3. **Slide the SunHSI/P into the PCI connector of the system unit. Make sure the front plate on the SunHSI/P card mounts flush with the chassis panel opening.**
4. **Install the front plate screw to secure the SunHSI/P card into the chassis. This also provides a chassis ground connection to the SunHSI/P.**
5. **Replace the cover.**
6. **Install the serial port cable assembly to the SunHSI/P connector.**
7. **Re-connect any cables from the peripheral devices.**

   This completes the hardware installation. At this point, turn power back on to the system and proceed to the Software Installation Instructions that have been provided.

SunHSI/P Cabling

The SunHSI/P adapter provides external connectivity through a passive cabling system. A “Hydra style” connector provides connectivity to four RS-449 devices via four DB-37 female connectors in a DTE configuration.

Note – Always use shielded twisted pair RS-449 cables with your SunHSI/P adapter.

RS-232 to RS-449 Connections

In order to connect RS-232 devices to the SunHSI/P adapter, you need to install an externally powered RS-449 to RS-232 interface converter to each DB-37 connector on which you intend to connect an RS-232 device. A converter is necessary because of incompatibilities between RS-232 and RS-449 signal levels.

To obtain an externally powered RS-232 to RS-449 interface converter, contact:

Black Box Corporation
`http://www.blackbox.com`

Note – Use only externally powered RS-449 devices with the SunHSI/P adapter.

CHAPTER 3

Installation of the SunHSI/P Software

This chapter describes how to install the SunHSI/P software. Software for unbundled products is distributed in the form of software packages. You will need to mount the distribution device (CD-ROM or file system), then using the `pkgadd(1m)` command to install the software packages, unmount the distribution device once the installation is complete.

You can use the `pkgadd` command to install software packages, to spool software packages for installation at a later date, or to remove software packages from your system. For more information see the *Solaris System Administration Guide*. When you have completed the installation of your software and run the post-installation script you will have created the software directories and files illustrated in FIGURE 3-1 and FIGURE 3-2.

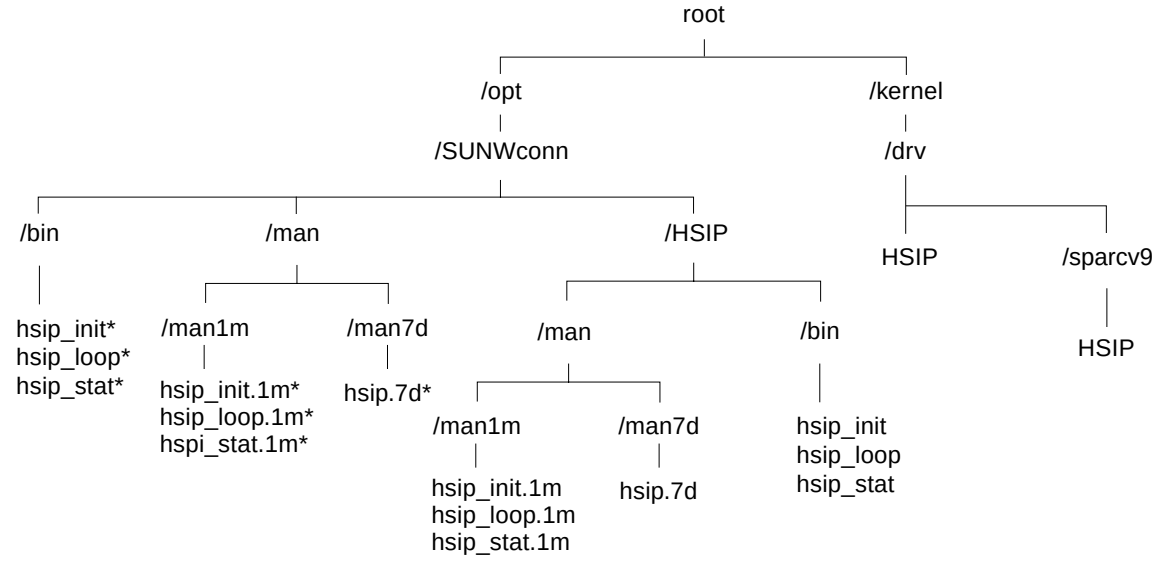

FIGURE 3-1 SunHSI/P Software Directories and Files

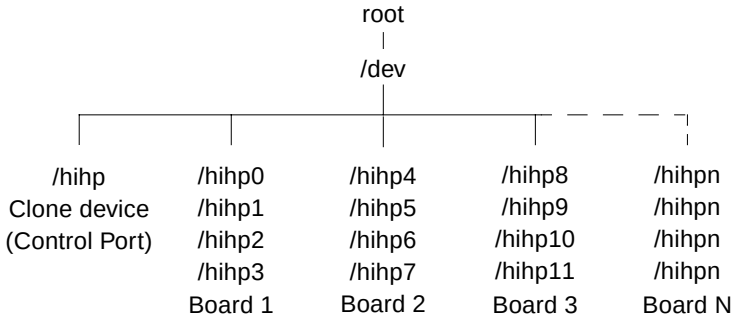

FIGURE 3-2 SunHSI/P Devices Created by the Postinstall Script

Before Installing the SunHSI/P Software

Verify the Software and Hardware Requirements

1. Does your system have any available 5V PCI slots?
2. Is your machine running the Solaris 2.5.1 Hardware: 4/97, 8/97, 11/97, Solaris 2.6, or the Solaris 7 operating environment?
3. The installation medium is a CD-ROM. Does your system have a CD-ROM drive?
4. What is the installation directory (default directory is `/opt`)?
5. Use the following commands to check for disk space:

```
hostname% df -k /opt
hostname% df -k /
```

TABLE 3-1 Required Free Space

SunHSI/P Package Name	Default Installation Directory	Approximate Space Required
SUNWhsip	/	1 Mbyte
SUNWhsipm SUNWhsipu	/opt	1 Mbyte total

6. Do you have the superuser password for both the system where the software is to be installed and the system with the CD-ROM drive, if different?

Removing Older Versions of the SunHSI/P Software

Caution – Do not overwrite any existing SunHSI/P software packages. If you install the SunHSI/P 2.0 software packages over existing SunHSI/P software packages, you will have two instances of the software packages. This may cause problems when installing or backing out of software patches.

Before installing the SunHSI/P 2.0 software on your system, check your system to see if previous versions of the SunHSI/P software are installed. If older SunHSI/P software exists (before version 2.0), you must remove this software before installing the new SunHSI/P 2.0 software.

1. **Use the** `pkginfo` **command to check the system for an older SunHSI/P software package:**

```
# /usr/bin/pkginfo | grep SUNWhsip
system   SUNWhsis    Sun HSI/P Driver for PCI
```

   - If you do not find any SunHSI/P packages, skip to the next section, “Installing and Mounting the CD-ROM” on page 11, to continue with the software installation.
   - If you do find a SunHSI/P package you must remove it as described in Step 2.

2. **As superuser (root), use the** `pkgrm` **command to remove the existing SunHSI/P software package:**

```
# /usr/sbin/pkgrm SUNWhsip
```

Installing and Mounting the CD-ROM

The SunHSI/P software is distributed on a CD-ROM. You must have access to either a local CD-ROM drive, or a driver that is accessible remotely via an existing network.

Note – Your target machine for *installing* the SunHSI/P software must always be a system running the Solaris 2.5.1 Hardware: 4/97, 8/97, 11/97, Solaris 2.6, or the Solaris 7 operating environment. You can use a remote SunOS 4.1.x system to provide the CD-ROM drive.

Mounting the CD-ROM from a Local CD Drive

Note – If your system is running either the Solaris 2.x or Solaris 7 environment, it is not necessary to mount the CD-ROM. Your system will mount the CD-ROM automatically by the volume management software.

Use the following steps to mount the CD-ROM from a local CD drive if it is not automatically mounted as `/cdrom`:

1. **If you have not done so, login as the superuser:**

   You must possess superuser privileges to invoke the `pkgadd` command. This means that all pre-installation scripts that are delivered as part of the software package will be executed with superuser privileges.

```
hostname% /usr/bin/su
Password: your root password
```

2. **Make the directory to mount the CD-ROM if it does not already exist:**

```
# mkdir /cdrom
```

3. **Mount the CD-ROM:**

```
# mount -F -o ro /dev/dsk/c0t6d0s0 /cdrom
```

Mounting the CD-ROM from a Remote Drive

To install the software on a system that does not have its own CD-ROM drive, you must perform some activities on the remote system (the system with the CD-ROM device) and some on the local system (the system that you are installing the software on). Be sure you follow the directions carefully.

Exporting from the Remote Machine

Because you are NFS-mounting the software from a remote CD-ROM, you must first export it from the remote system. The methods to do this are different on SunOS 4.1.x and Solaris 2.x systems. Both systems will require that you have the superuser password.

▼ Exporting from a Remote SunOS 4.1.x (Solaris 1.x) System

Perform the following steps on the remote system:

1. **On the remote system, login as root or change to be a superuser:**

   You must possess superuser privileges to invoke the following commands. This means that all pre-installation scripts that are delivered as part of the software package will be executed with superuser privileges.

```
hostname% /usr/bin/su
Password: your root password
```

2. **On the remote system, make the directory to mount the CD-ROM if it does not already exist:**

```
# mkdir /cdrom
```

3. **Mount the CD-ROM:**

```
# mount -r -t hsfs /dev/sr0 /cdrom
```

4. **Export the CD-ROM from the remote system:**

```
# exportfs -i /cdrom
```

5. **If they are not already running, start the NFS mount daemons by entering the following commands:**

```
# nfsd 8
# rpc.mountd &
```

6. **Check to see that the system is exporting the directory by entering the command** `exportfs`**. The screen should show the** `/cdrom` **directory:**

```
# exportfs
. . .
/cdrom
```

Go to "Mounting the Remote CD-ROM on the Local System" on page 14.

▼ Exporting from a Remote Solaris 2.x or Solaris 7 System

Perform the following steps on the remote system:

1. **On the remote system, login as root or change to be a superuser:**

   You must possess superuser privileges to invoke the following commands. This means that all pre-installation scripts that are delivered as part of the software package will be executed with superuser privileges.

```
hostname% /usr/bin/su
Password: your root password
```

2. **If they are not already running, start the NFS mount daemons by entering the following commands:**

```
# /usr/lib/nfs/nfsd -a 16
# /usr/lib/nfs/mountd
```

3. **Export the CD-ROM directory from the remote system:**

```
# share -F nfs -o ro /cdrom/sunhsip_2_0
```

4. **Check to see that the system is exporting the directory by entering the command** `share`**. The screen should show the** `/cdrom/unnamed_cdrom` **directory:**

```
# share
. . .
-       /cdrom/sunhsip_2_0 ro " "
```

Go to "Mounting the Remote CD-ROM on the Local System" on page 14.

▼ Mounting the Remote CD-ROM on the Local System

1. **On the local system, login as root or change to be a superuser:**

   You must possess superuser privileges to invoke the following commands. This means that all pre-installation scripts that are delivered as part of the software package will be executed with superuser privileges.

```
hostname% /usr/bin/su
Password: your root password
```

2. **Make the directory to mount the CD-ROM if it does not already exist:**

```
# mkdir /cdrom/sunhsip_2_0
```

3. **Mount the CD-ROM:**

```
# mount -F nfs -o ro remote_system_name:/cdrom/sunhsip_2_0 /cdrom/sunhsip_2_0
```

Installing the SunHSI/P Driver

The SunHSI/P driver, utilities, and man pages are distributed in the standard Solaris pkgadd CD-ROM distribution format. The pkgadd utility loads the SUNWhsip, SUNWhsipm, and SUNWhsipu packages onto the system from the distribution media.

▼ To Install the SunHSI/P Driver

1. **Login as or change to be the superuser:**

   You must possess superuser privileges to invoke the following commands. This means that all pre-installation scripts that are delivered as part of the software package will be executed with superuser privileges.

```
hostname% /usr/bin/su
Password: your root password
```

2. **Using the** pkgadd **command, install the software packages:**

```
# pkgadd -d /cdrom/sunhsip_2_0/Product

The following packages are available:
  1  SUNWhsip      SunHSI/P Driver for PCI
                   (sparc) 2.0,REV=1998.xx.xx
  2  SUNWhsipm     SunHSI/P Man pages for PCI
                   (sparc) 2.0,REV=1998.xx.xx
  3  SUNWhsipu     SunHSI/P Utilities for PCI
                   (sparc) 2.0,REV=1998.xx.xx

Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]:
```

   Press the Return key to continue the installation of the driver software. The pkgadd utility may warn you that some scripts must be executed with super-user permissions. The correct response is "y".

▼ Rebooting the System

Once you have installed the software packages, follow the steps below to reboot the system using the “reconfigure” option.

1. **Halt the system.**

   Sync the hard disks and halt the system to enter monitor mode.

```
# /usr/sbin/sync
# /usr/sbin/halt
```

2. **Once the system is in the monitor command mode, perform the `boot` command with the “`-r`” option:**

```
ok boot -r
```

▼ Testing The Hardware And Software Install

To test the install of the hardware and software you can use the following command (replace *n* with the SunHSI/P port you wish to test):

```
# hsip_loop -c 100 -l 2048 -s 2048000 -t 1 hihpn
```

This will run an internal loopback test. For more information, see the `hsip_loop` man page (see “Viewing the Man Pages” on page 18).

Configuration

Use the SunHSI/P supplied system commands `hsip_init`, `hsip_loop` and `hsip_stat`. A short description of each command follows below. Please refer to their man pages to get more information on each command (see “Viewing the Man Pages” on page 18).

Note – You need to be superuser (root) in order to run the `hsip_init`, `hsip_stat` or `hsip_loop` utilities.

The `hsip_init` utility allows the user to modify some of the hardware operating modes common to synchronous serial lines. This can be useful in troubleshooting a link, or necessary for the operation of a communications package.

The `hsip_loop` command performs several loopback tests that are useful in exercising the various components of a serial communications link.

The `hsip_stat` command reports the event statistics maintained by the SunHSI/P device driver. The report may be a single snapshot of the accumulated totals, or a series of samples showing incremental changes. Prior to these it prints the device name being used to query a particular device.

Viewing the Man Pages

The following man pages are included with the SunHSI/P software:

- hsip(7d)
- hsip_init(1m)
- hsip_loop(1m)
- hsip_stat(1m)

If you cannot view these man pages, you need to add the /opt/SUNWconn/man/ directory to your MANPATH environment variable. Depending on the UNIX shell you are using, this variable may be defined in one of a number of startup files.

▼ To View the Man Pages in the C Shell Environment

1. **Examine your** $HOME/.login **and** $HOME/.cshrc **files to locate the** MANPATH **variable.**

2. **Using a text editor, add the following line to the end of the file containing the** MANPATH **variable.**

```
setenv MANPATH "/opt/SUNWconn/man/:$MANPATH"
```

   If neither of these files contain this variable, add the following line to the end of one of the files, or contact your system administrator for assistance.

```
setenv MANPATH "/opt/SUNWconn/man/"
```

3. **Use the** source **command on the file you edited to make the changes effective in your current window.**

   For example, if you added the MANPATH line to the .login file, you would type:

```
hostname% source $HOME/.login
```

Note – If you log out and then back into your system, you will update the MANPATH variable in all command windows and shells.

▼ To View the Man Pages in Bourne or Korn Shell Environments

1. **Using a text editor, add these two lines to the end of the** `$HOME/.profile` **file.**

```
MANPATH=/opt/SUNWconn/man:$MANPATH
export MANPATH
```

If this file did not already contain this variable, add the following two lines to the end of the file, or contact your system administrator for assistance.

```
MANPATH=/opt/SUNWconn/man
export MANPATH
```

2. **Make the changes effective in your current window.**

```
$ . $HOME/.profile
```

Note – If you log out and then back into to your system, you will update the `MANPATH` variable in all command windows and shells.

Removing the SunHSI/P Driver

To remove the SunHSI/P driver packages, use the `pkgrm` command:

```
# pkgrm SUNWhsip SUNWhsipu SUNWhsipm
```

This will remove the driver object and configuration files and inform the kernel. Again, you should re-boot the system.

Upgrading the SunHSI/P Driver

If it becomes necessary to upgrade to a newer version of the SunHSI/P packages, the following steps should be taken:

1. **Remove the old version of the SunHSI/P driver by running** `pkgrm`**:**

```
# pkgrm SUNWhsip SUNWhsipu SUNWhsipm
```

2. **Shut down and reboot the system using the** `boot -r` **command.**
3. **Use the** `pkgadd` **utility to load the new SunHSI/P driver. Refer to the previous section on running the** `pkgadd` **utility.**

Other Software Package Utilities

There are other useful utilities that can be run. The `pkginfo` command, can be used to see what software packages are presently installed on the system:

```
hostname% pkginfo
```

The `pkginfo` command can also be used to displays the packages parameter settings, such as the release level, installation directory, etc.:

```
hostname% pkginfo -l SUNWhsip SUNWhsipu SUNWhsipm
```

CHAPTER 4

Functional Description

The SunHSI/P, high speed serial interface (HSI) adapter for PCI applications provides four serial channel interfaces for high performance synchronous communications on a PCI host system. The design incorporates a Motorola MC68360 Quad Integrated Communications Controller (QUICC) and a PLX PCI9060 with DMA capability. Code storage and data buffering are provided by a DRAM array which is shared between the QUICC and the PCI9060.

Serial line electrical interfacing is available on-board providing voltage level adaptation to the RS-449 standard.

The frontplate interface connection on the SunHSI/P adapter uses an 80-pin amplimited receptacle containing the signals for all four ports. To provide an industry standard connection for each port, hydra style adapter cables are offered. Adapter cable wiring details for this cable is also provided.

The block diagram in FIGURE 4-1, demonstrates the major components of this design.

SunHSI/P Adapter Block Diagram

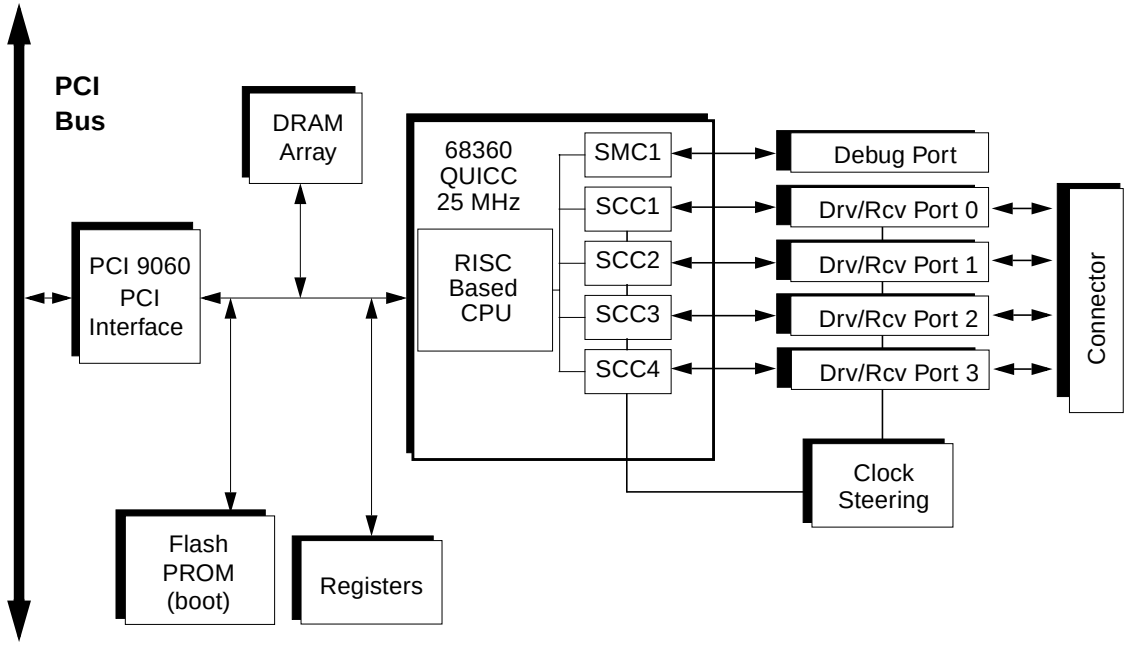

FIGURE 4-1 Block Diagram of a SunHSI/P Adapter

Line Drivers/Receivers

Line drivers and receivers provide electrical adaptation from TTL levels to the appropriate communications interface signal levels. Currently only the RS-449 interface is available.

RS-449

The six inputs for each port are electrically terminated with a resistor SIP of 120-ohms between the designated “A” and “B” circuits of each. Cabling is available with DB-37 DTE connectors (female) to provide an RS-449 interface.

Power Budget

Typical and maximum power consumption of the SunHSI/P adapter is described in TABLE 4-1.

TABLE 4-1 SunHSI/P Adapter Power Consumption

Board Type[1]	Voltage	Typical	Maximum
SunHSI/P	+5V	1.1A	1.75A
SunHSI/P	+12V	9.5mA	14mA
SunHSI/P	-12V	4.2mA	6mA

1. Includes a 4-MB DRAM SIMM for power consumption.

APPENDIX **A**

Features

MC68360

- CPU32+ Processor (4.5 MIPS at 25 MHz)
  - 32-Bit Version of the CPU32 Core (Fully Compatible with the CPU32)
  - Background Debug Mode
  - Byte-Misaligned Addressing
- Four General Purpose Timers
  - Superset of MC68302 Timers
  - Four 16-Bit Timers or Two 32-Bit Timers
- Two Independent DMAs (IDMAs)
  - Single Address Mode for Fastest Transfers
  - Buffer Chaining and Auto Buffer Modes
  - Automatically Performs Efficient Packing
- System Integration Module (SIM60)
  - Bus Monitor
  - Double Bus Fault Monitor
  - Software Watchdog
  - Periodic Interrupt Timer
  - Low Power Stop Mode
  - Breakpoint Logic Provides On-Chip Hardware Breakpoints
- Four Serial Communication Controllers (SCC)
  - HDLC/SDLC
  - Asynchronous HDLC
  - X.21

- Two Serial Management Controllers (SMC)
  - UART
  - Transparent
  - General Circuit Interface (GCI) Controller
- Communications Processor Module (CPM)
  - RISC Controller
  - 224 Buffer Descriptors
  - Supports Continuous Mode Transmission and Reception on All Serial Channels
  - 2.5 KBytes of Dual-Port RAM
  - 14 Serial DMA Channels
- Four Baud Rate Generators
  - Independent (can be connected to any SCC or SMC)
  - Allows Changes During Operation
  - Autobaud Support Option

PCI9060

- PCI Compliance Revision 2.1
- PCI Bus Master Transfers up to 132 MBps
- Two Independent DMA Channels
- Bi-Directional Chaining DMA Controller
- Four Bi-Directional FIFOs
- Eight 32-bit Mailboxes and Two 8-bit Doorbell Registers

Serial Ports

- Full RS-449 Support on All Four Ports
- Internal or External Serial Data Clocks
- Five Modem Control Signals per Port

Other Features

- Dual Ported Dynamic RAM SIMM Connector (supporting 1MB - 32MB DRAM)
- 128 Kbyte (1Mbit) Flash PROM (boot)
- Mechanical - Short Length, 5-V, 32-bit PCI Card

APPENDIX **B**

PCI Pin Assignments

In the following table '#' denotes an active low signal.

TABLE B-1 5V PCI Connections

Pin	Side B	Side A
1	-12V	TRST#
2	TCK	+12V
3	GND	TMS
4	TDO	TDI
5	+5V	+5V
6	+5V	INTA#
7	INTB#	INTC#
8	INTD#	+5V
9	PRSNT1#	RSVD
10	RSVD	+5V (I/O)
11	PRSNT2#	RSVD
12	GND	GND
13	GND	GND
14	RSVD	RSVD
15	GND	RST#
16	CLK	+5V (I/O)
17	GND	GNT#
18	REQ#	GND
19	+5V (I/O)	RSVD

TABLE B-1 5V PCI Connections *(Continued)*

Pin	Side B	Side A
20	AD[31]	AD[30]
21	AD[29]	+3.3V
22	GND	AD[28]
23	AD[27]	AD[26]
24	AD[25]	GND
25	+3.3V	AD[24]
26	C / BE[3]#	IDSEL
27	AD[23]	+3.3V
28	GND	AD[22]
29	AD[21]	AD[20]
30	AD[19]	GND
31	+3.3V	AD[18]
32	AD[17]	AD[16]
33	C / BE[2]#	+3.3V
34	GND	FRAME#
35	IRDY#	GND
36	+3.3V	TRDY#
37	DEVSEL#	GND
38	GND	STOP#
39	LOCK#	+3.3V
40	PERR#	SDONE
41	+3.3V	SBO#
42	SERR#	GND
43	+3.3V	PAR
44	C / BE[1]#	AD[15]
45	AD[14]	+3.3V
46	GND	AD[13]
47	AD[12]	AD[11]
48	AD[10]	GND
49	M66EN	AD[09]

TABLE B-1 5V PCI Connections *(Continued)*

Pin	Side B	Side A
50	Key	Key
51	Key	Key
52	AD[08]	C/BE[0]#
53	AD[07]	+3.3V
54	+3.3V	AD[06]
55	AD[05]	AD[04]
56	AD[03]	GND
57	GND	AD[02]
58	AD[01]	AD[00]
59	+5V (I/O)	+5V (I/O)
60	ACK64#	REQ64#
61	+5V	+5V
62	+5V	+5V

Note – +3.3V, RSVD, REQ64#, ACK64#, SBO#, SDONE, INTB#, INTC#, INTD#, TCK, TMS, and TRST# pins are not connected on the SunHSI/P adapter.

APPENDIX **C**

Null Modem Cable Requirements

A synchronous null modem cable is a specially-configured cable that simulates modems that are connected back-to-back. When the distance between the two host systems is not great, you may be able to use a null modem cable instead of a synchronous modem or a synchronous modem eliminator.

The maximum distance a null modem cable can work is determined by the specification for your serial port interface.

There are two steps you must perform to use a null modem cable for machine supplied clocking:

Run `hsip_init` (see “Configuring Internal or External Clocking” on page 34) so that the Sun system, in the absence of a synchronous modem, supplies clocking on the serial line.

Configure the cable for the null modem.

Note – You must run `hsip_init` each time you reboot your system.

Configuring Internal or External Clocking

To configure an RS-449 port to provide transmit clocking for itself as well as receive clocking for the other end of the link, set the `txc` (transmit clock) and `rxc` (receive clock) parameters in `hsip_init` to `baud` and `rxc`, respectively. For example, the following `hsip_init` command sets the data rate of the first SunHSI/P serial port to 9600 bps and sets the clocking as just described:

```
# hsip_init hihp0 9600 txc=baud rxc=rxc
```

You enter such a command at both ends of a link if both sides are supplying clocking.

In the situation in which you have Sun systems at both ends of a link and have one system supplying clocking for both sides, on the system that is not supplying the clocking, you enter:

```
# hsip_init hihp0 9600 txc=txc rxc=rxc
```

Building the Null Modem Cable

To build a null modem cable, you can configure your own cable or use a standard cable with an adapter box.

Note – Be sure to use shielded, twisted pair wire when building a null modem cable.

If you decide to use an adapter box, be sure to obtain an adapter that allows you to change the pin configurations. Pre-configured adapters generally do not work with synchronous protocols because they do not handle clock signals correctly.

RS-449 Null Modem Cable

TABLE C-1 and TABLE C-2 list the signals and names for RS-499 and X.21 circuits

TABLE C-1 RS-449 Signals

Circuit	Name	Direction
TxD	Transmit Data	To DCE
RxD	Receive Data	From DCE
TxC	Transmit Clock	To DCE
TxCI	Transmit Clock In	From DCE
RxC	Receive Clock	From DCE
RTS	Request to Send	To DCE
CTS	Clear to Send	From DCE
DCD	Data Carrier Detect	From DCE
DTR	Data Terminal Ready	To DCE
DSR	Data Set Ready	From DCE
SG	Signal Ground	

TABLE C-2 X.21 Signals

Circuit	Name	Direction
G	Signal Ground	
T	Transmit	To DCE
R	Receive	From DCE
C	Control	To DCE
I	Indication	From DCE
S	Signal Element Timing	From DCE
B	Byte Timing	From DCE

FIGURE C-1 illustrates a synchronous null modem cable that allows you to connect two Sun systems that each supply clocking, using the RS-449 interface. Each Sun supplies clocking on pins 17 and 35. The null modem cable routes this clocking to pins 8 and 26 on the opposite side to provide receive clocking.

Because the RS-449 interface is balanced, there are two pins for each signal. For example, Transmit Data (TxD), pins 4 and 22, is connected to Received Data (RxD), pins 6 and 24. This means that pin 4 is connected to pin 6 and pin 22 is connected to pin 24.

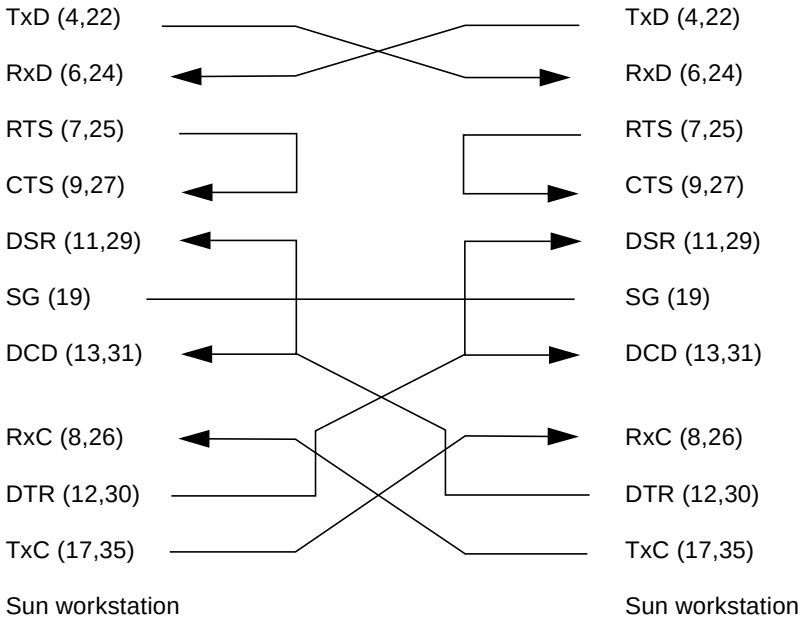

FIGURE C-1 Null modem Cable (Both Suns Supply Clocking)

FIGURE C-2 illustrates a synchronous null modem cable that allows you to another system, Sun or non-Sun, using the RS-449 interface. The Sun supplies both the transmit and receive clocks for the other system. Note that this null modem cable is not symmetrical.

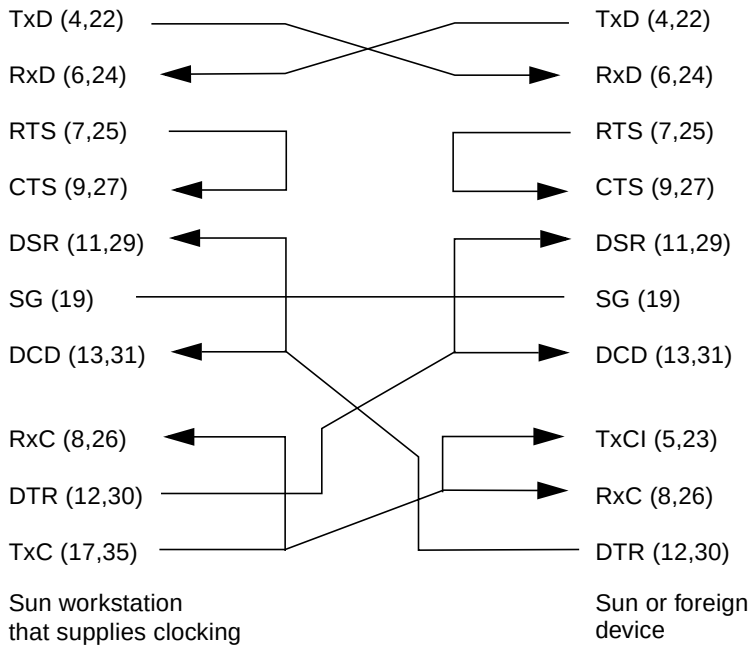

FIGURE C-2 Null modem Cable (Sun System Supplies Clocking for Both Sides)

X.21 to RS-449 Converter

FIGURE C-3 illustrates the pin connections required for an X.21 to RS-449 converter.

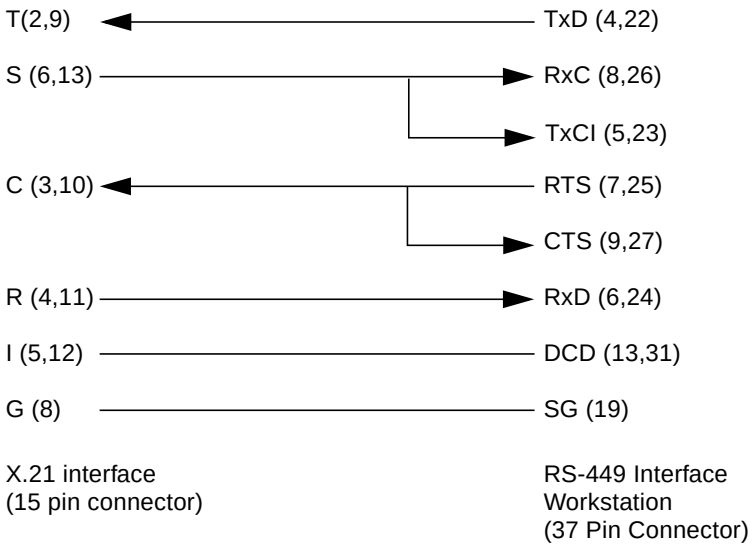

FIGURE C-3 X.21 to RS-449 Converter

When using an X.21 conversion you must perform the following `hsip_init` operation:

```
# hsip_init hihp0 9600 txc=txc rxc=rxc
```

Note – Both receive and transmit clock inputs (RxC and TxCI) need a clock signal if `txc` is set to `txc` and `rxc` is set to `rxc`.

RS-449 Cabling

A shielded, hydra style breakout cable providing four 37-pin, D-shell (DB-37) DTE connectors is available for the SunHSI/P version. The pin assignments for the cabling and connectors are shown in TABLE C-3, followed by a functional description of the signals in TABLE C-4.

TABLE C-3 RS-449 Connector Pin Assignments

80-Pin Amp. Pin No.	RS-449 Signal Name	RS-449 DB-37 Pin No.	Description
1	RxD1(A)	6	Port 1 Receive Data
2	RxD1(B)	24	Port 1 Receive Data
3	DTR1(A)	12	Port 1 Data Terminal Ready
4	DTR1(B)	30	Port 1 Data Terminal Ready
5	TxD1(A)	4	Port 1 Transmit Data
6	TxD1(B)	22	Port 1 Transmit Data
7	RTS1(A)	7	Port 1 Request To Send
8	RTS1(B)	25	Port 1 Request To Send
9	TxC1(A)	17	Port 1 Transmit Clock
10	TxC1(B)	35	Port 1 Transmit Clock
11	TxCI1(A)	5	Port 1 Transmit Clock In
12	TxCI1(B)	23	Port 1 Transmit Clock In
13	DCD1(A)	13	Port 1 Data Carrier Detect
14	DCD1(B)	31	Port 1 Data Carrier Detect
15	DSR1(A)	11	Port 1 Data Set Ready
16	DSR1(B)	29	Port 1 Data Set Ready
17	CTS1(A)	9	Port 1 Clear To Send
18	CTS1(B)	27	Port 1 Clear To Send
19	RxC1(A)	8	Port 1 Receive Clock
20	RxC1(B)	26	Port 1 Receive Clock
21	RxD2(A)	6	Port 2 Receive Data
22	RxD2(B)	24	Port 2 Receive Data
23	DTR2(A)	12	Port 2 Data Terminal Ready
24	DTR2(B)	30	Port 2 Data Terminal Ready

TABLE C-3 RS-449 Connector Pin Assignments *(Continued)*

80-Pin Amp. Pin No.	RS-449 Signal Name	RS-449 DB-37 Pin No.	Description
25	TxD2(A)	4	Port 2 Transmit Data
26	TxD2(B)	22	Port 2 Transmit Data
27	RTS2(A)	7	Port 2 Request To Send
28	RTS2(B)	25	Port 2 Request To Send
29	TxC2(A)	17	Port 2 Transmit Clock
30	TxC2(B)	35	Port 2 Transmit Clock
31	TxCI2(A)	5	Port 2 Transmit Clock In
32	TxCI2(B)	23	Port 2 Transmit Clock In
33	DCD2(A)	13	Port 2 Data Carrier Detect
34	DCD2(B)	31	Port 2 Data Carrier Detect
35	DSR2(A)	11	Port 2 Data Set Ready
36	DSR2(B)	29	Port 2 Data Set Ready
37	CTS2(A)	9	Port 2 Clear To Send
38	CTS2(B)	27	Port 2 Clear To Send
39	RxC2(A)	8	Port 2 Receive Clock
40	RxC2(B)	26	Port 2 Receive Clock
41	RxD3(A)	6	Port 3 Receive Data
42	RxD3(B)	24	Port 3 Receive Data
43	DTR3(A)	12	Port 3 Data Terminal Ready
44	DTR3(B)	30	Port 3 Data Terminal Ready
45	TxD3(A)	4	Port 3 Transmit Data
46	TxD3(B)	22	Port 3 Transmit Data
47	RTS3(A)	7	Port 3 Request To Send
48	RTS3(B)	25	Port 3 Request To Send
49	TxC3(A)	17	Port 3 Transmit Clock
50	TxC3(B)	35	Port 3 Transmit Clock
51	TxCI3(A)	5	Port 3 Transmit Clock In
52	TxCI3(B)	23	Port 3 Transmit Clock In
53	DCD3(A)	13	Port 3 Data Carrier Detect
54	DCD3(B)	31	Port 3 Data Carrier Detect

TABLE C-3 RS-449 Connector Pin Assignments *(Continued)*

80-Pin Amp. Pin No.	RS-449 Signal Name	RS-449 DB-37 Pin No.	Description
55	DSR3(A)	11	Port 3 Data Set Ready
56	DSR3(B)	29	Port 3 Data Set Ready
57	CTS3(A)	9	Port 3 Clear To Send
58	CTS3(B)	27	Port 3 Clear To Send
59	RxC3(A)	8	Port 3 Receive Clock
60	RxC3(B)	26	Port 3 Receive Clock
61	RxD4(A)	6	Port 4 Receive Data
62	RxD4(B)	24	Port 4 Receive Data
63	DTR4(A)	12	Port 4 Data Terminal Ready
64	DTR4(B)	30	Port 4 Data Terminal Ready
65	TxD4(A)	4	Port 4 Transmit Data
66	TxD4(B)	22	Port 4 Transmit Data
67	RTS4(A)	7	Port 4 Request To Send
68	RTS4(B)	25	Port 4 Request To Send
69	TxC4(A)	17	Port 4 Transmit Clock
70	TxC4(B)	35	Port 4 Transmit Clock
71	TxCI4(A)	5	Port 4 Transmit Clock In
72	TxCI4(B)	23	Port 4 Transmit Clock In
73	DCD4(A)	13	Port 4 Data Carrier Detect
74	DCD4(B)	31	Port 4 Data Carrier Detect
75	DSR4(A)	11	Port 4 Data Set Ready
76	DSR4(B)	29	Port 4 Data Set Ready
77	CTS4(A)	9	Port 4 Clear To Send
78	CTS4(B)	27	Port 4 Clear To Send
79	RxC4(A)	8	Port 4 Receive Clock
80	RxC4(B)	26	Port 4 Receive Clock

TABLE C-4 Functional Description of RS-449 Interface Signals

RS-449 Pin #	Signal Name	Function
1	Shield Ground	Allows tandem sections of shielded cable to retain continuity through the connector.
19	Signal Ground (SG)	Directly connects the DTE circuit ground to the DCE circuit ground, providing a path for DTE and DCE signal commons.
4 / 22	Transmit Data (TxD)	Used by the DTE to pass binary data to the DCE for transmission over the communications channel.
6 / 24	Receive Data (RxD)	Used by the DCE to pass binary data received from the communications channel to the DTE.
5 / 23	Transmit Clock in (TxCI)	Allows the DCE to transmit signal element timing to the DTE. This allows the DTE Transmit Data signal on circuit TxD to be in synchronization with On / Off transitions on this lead.
8 / 26	Receive Clock (RxC)	Transitions on this lead allow the DTE to time data received over circuit RxD.
17 / 35	Transmit Clock (TxC)	Allows the DTE to provide transmit timing information to the DCE so that it can synchronize with data arriving over the TxD lead.
7 / 25	Request to Send (RTS)	Used by the DTE to advise the DCE it wishes to transmit data.
9 / 27	Clear to Send (CTS)	Used by the DCE to advise the DTE that the DCE is ready to send data over the communications channel.
11 / 29	Data Set Ready (DSR)	Used to advise the DTE of the Ready status on the DCE. In most cases, it simply implies the unit is powered on.
12 / 30	Data Terminal Ready (DTR)	Used by the DTE to advise the DCE it is ready to transmit or receive.
13 / 31	Data Carrier Detect (DCD)	The DCE uses this lead to advise the DTE that an incoming signal on the communications channel is present. When first initialized it is an indication to the DTE to expect data momentarily.

APPENDIX **D**

`hsip_init` Options for T1 Compatibility

The version of the `hsip_init` command shipped with the SunHSI/P software has options that allow you to invert data and clock signals to accommodate the requirements of T1 or CEPT transmission equipment.

The `hsip_init` parameters that allow for inversion are:

- `txd` - transmit data signal
- `rxd` - receive data signal
- `txc` - transmit clock signal
- `rxc` - receive clock signal

The effect of the default settings for all of these parameters is that SunHSI/P software does *not* invert the data or clock signal controlled by the parameter. To invert a signal, you specify a setting of the form *param_name=-paramname*, for example, `txc=-txc`.

As an example, suppose you want to invert the transmit and receive data signals on the first SunHSI/P port (port 0) on the second SunHSI/P adapter in your system. To do so, enter the following command:

```
# hsip_init hihp4 txd=-txd rxd=-rxd
```

To invert both clock and data signals, enter:

```
# hsip_init hihp4 txd=-txd rxd=-rxd txc=-txc rxc=-rxc
```

The following section discusses the background and requirements for these inverted settings.

Inverted Settings

The reason for inverting data signals is distinct from the reason for inverting clock signals. The background for data signal inversion is explained first, then the background for clock signal inversion is explained.

Data Signal Inversion

The requirement for inverting data signals arises from the “ones density” problem you encounter with most T1 transmission lines in North America. The T1 transmission scheme uses a signaling mechanism known as Alternate Mark Inversion (AMI), in which one bits are represented by a positive or negative pulse, while zero bits are represented by the absence of a pulse. In this scheme, the polarity of each pulse must be the opposite of the polarity of the pulse which immediately preceded it. This signaling scheme makes it possible to embed a reference clock for the data into the data stream itself.

Various types of T1 transmission equipment, such as Data Service Units (DSU), Channel Service Units (CSU), repeaters, and various telephone central office equipment, must be able to keep a phase locked loop (PLL) circuit locked on to this reference clock. This PLL circuit uses the pulses generated when one bits are transmitted to lock the embedded clock to a local reference oscillator. To keep the PLL circuit locked on the extracted clock, a certain density of pulses (one bits) must be guaranteed. For North American T1 lines, the density requirement dictates that at least one out of every 16 bits must be a one (see *AT&T Technical Publication 62411*). Another way of stating this is that no more than 15 consecutive zero bits can occur anywhere in the data stream.

T1 lines were originally intended to carry voice traffic, wherein the digitized voice signals could be altered to meet the ones-density requirement by forcing every eighth bit of a voice channel to be a one. This practice introduces a small—but virtually inaudible—amount of distortion in the voice signal. Digital data streams between two computers are another matter, since the corruption of even one data bit causes a packet to be rejected. Note that in a typical data packet it is quite easy to produce bit patterns that violate the ones-density requirement. A random file could easily contain a sequence of bytes that would produce 16 or more consecutive zero bits if transmitted serially.

There are many different schemes for circumventing the ones-density requirement. The most common technique simply reserves every eighth bit of the signal for a “density bit” and forces this bit to be a one. Obviously, these bits are not available

for data transmission, which means that 12.5 percent of the bandwidth of the T1 line is wasted. When you consider that the lease cost for a coast-to-coast T1 line can be exceedingly expensive, this waste of bandwidth can be unacceptable.

There are alternatives. One of them uses a special code that transmission equipment can generate when using the AMI signalling scheme. This special code depends on the fact that two successive one bits that are represented by pulses of the same polarity result in a signal known as a “Bipolar Violation.” A CSU can be designed so that it will automatically replace any string of eight consecutive zeros with a special code pattern that contains two of Bipolar Violations. A compatible, receiving CSU recognizes this special code and converts it back to a pattern of eight zeros. This technique is known by the acronym B8ZS, which stands for Bipolar with 8-Zero Substitution.

All CEPT lines (the European equivalent of T1) mandate the use of a variant of B8ZS that holds the density requirement down to no more than three consecutive zeros. However, telephone companies in North America have been slow to adopt B8ZS, because it would entail a significant capital investment. Therefore, the B8ZS solution will not solve the ones-density problem in the short term.

An alternative to B8ZS—an alternative used by the SunHSI/P product—makes use of the fact that the HDLC framing rules specify that any data stream that contains five or more consecutive one bits requires that the transmitting end insert a zero bit after the fifth one bit. This guarantees that the HDLC flag pattern `01111110` (hex 7E) does not occur randomly inside a frame. The receiving end must automatically discard the zero bit that follows a pattern of five consecutive ones. So, HDLC framing, which is used by SunHSI/P, guarantees that, except for the flag pattern, in any set of six bits, at least one bit will be a zero. If you include the flag pattern, you can say that in any set of seven bits, at least one bit will be a zero.

By inverting the data signal with HDLC framing on both ends of a link, the HDLC zero insertion algorithm becomes a ones insertion algorithm. This guarantees that in any set of seven bits, at least one bit will be a one. Thus, the HDLC data stream meets the density requirements of North American T1 lines without sacrificing any bandwidth.

Clock Signal Inversion

The need to invert clock lines is separate from the need to invert data lines. Most computer, modem, and terminal vendors adhere to an industry standard specification known as RS-334. This specification defines the relationship between a data bit and a reference clock on a synchronous serial link. The specification also says that a device should transmit data with reference to the rising edge of the clock signal and that data should be received with reference to the falling edge of the clock signal.

When using long cables or cables not carrying a clock signal, a phase shift may occur causing a high number of errors. In such cases, inverting the clock signal may correct the phase shift. You may also need to invert the clock signal when connecting a SunHSI/P port to equipment not adhering to the RS-334 standard.

APPENDIX **E**

`hsip_init` Options for Operating Modes

This appendix describes the operating modes that can be set by the `hsip_init` utility.

The SunHSI/P driver operates in two main operating modes, the high-level data link control (HDLC) mode and the IBM (SDLC) mode. The HDLC mode always operates in a full-duplex, point-to-point fashion. While the IBM mode defaults to a full-duplex, point-to-point, operation, you can also set this mode to be either a half-duplex or a multi-point operation.

HDLC Mode

The default operating mode used by the SunHSI/P driver is the HDLC full-duplex protocol (`mode=fdx`). In this mode the transmitter is always enabled and it sends flag bytes continuously when it is not sending a data frame.

If no message is currently being transmitted, the driver will attempt to start sending its next message. At this point the driver indicates that it is busy transmitting, in order to prevent the transmission of another message concurrently. The driver also activates a mechanism that ensures that the transmit operation will not hang if the hardware is not responding.

When the transmission is completed, the busy mechanism previously set is cleared and the next message can be transmitted. If the transmission is hung, an abort sequence is sent instead of the cyclic redundancy check (CRC) so that the receiver will not interpret the frame as valid data. The message is discarded, and the output error statistic is incremented, which allows for a proper recovery by higher level protocols.

The received data is buffered until a complete frame has been received. If any error occurs during the reception of a frame, the appropriate statistic is incremented and the frame is discarded.

IBM (SDLC) Mode

This mode is designed to support IBM system network architecture (SNA) communications. It uses most of the same protocols used in HDLC mode, with two major exceptions:

- When the line is idle, instead of sending flag bytes, the transmitter is disabled.
- The request-to-send (RTS) and clear-to-send (CTS) signals are used to gate transmission.

IBM Full-Duplex Mode

When the SunHSI/P software is set to this mode (`mode=ibm-fdx`), the software uses a full-duplex point-to-point communication protocol. Both ends of the link are expected to have RTS and CTS signals asserted at all times when data is being exchanged. When starting a message transmission, the interface raises the RTS signal and expects the CTS signal to be asserted immediately. If this is not done, all messages currently queued for transmission are discarded, and the write operation returns an error.

If the CTS signal drops before the frame transmission is complete, the frame is discarded and the abort error statistic is incremented. If the transmission underruns, an abort sequence is *not* sent and the frame is silently discarded. The RTS signal remains asserted until the data transmission is complete.

IBM Half-Duplex Mode

Half-duplex is a sub-mode of the IBM mode (`mode=ibm-hdx`). Half-duplex mode operates in the same manner as full-duplex mode except that transmission cannot occur while receiving, and vice-versa. When a transmission is completed, the RTS signal is dropped. Dropping the RTS signal tells the remote station to begin transmitting if it wishes.

IBM Multi-Point Mode

In a multi-point configuration (`mode=ibm-mpt`), more than two stations “share” a link. This configuration is accomplished by designating one station as a primary station and the rest as secondary stations. In this mode, the port acts as a secondary station. The primary station arbitrates traffic on the link by polling the secondary stations, asking them all if they are ready to transmit.

If a secondary station has data to transmit, it will raise its RTS signal and check for CTS signals. When a CTS signal comes up the station may begin transmitting, following the same rules for RTS and CTS signals used in half-duplex mode. When the transmission is complete the secondary drops the RTS signal, which allows another station to respond to a poll and begin transmitting. The RTS signal cannot be dropped until the transmission is complete.

APPENDIX **F**

SunVTS Diagnostic Testing

The SunVTS™ software executes multiple diagnostic hardware tests from a single user interface and is used to verify the configuration and functionality of most hardware controllers and devices. The SunVTS software primarily operates from a user interface that allows you to control all aspects of the diagnostic test operation.

The `sunlink` diagnostic test, which is shipped with the SunVTS software, checks the functionality of SunHSI/P adapters. This test can be run from the SunVTS user interface, or it can be run from the command line. Refer to the *SunVTS Test Reference Manual* for more information about the `sunlink` test.

Note – Some of the `sunlink` tests require a RS-449 loopback plug, which can be ordered through Sun (part number: 540-1430).

Refer to the SunVTS documents for detailed information about the SunVTS software. These documents are available on the *Solaris on Sun Hardware AnswerBook*, which can viewed on the Sun Documentation website (`http://docs.sun.com/`).

TABLE F-1 SunVTS Documentation

Title	Description
SunVTS User's Guide	Describes the SunVTS environment; starting and controlling the various user interfaces.
SunVTS Test Reference Manual	Describes each SunVTS test; provides various test options and command-line arguments.
SunVTS Quick Reference Card	Provides an overview of `vtsui` interface features.

The main features of the SunVTS environment include:

- SunVTS kernel

  The SunVTS kernel (`vtsk`) controls all facets of the SunVTS environment. When activated, `vtsk` probes the hardware configuration of the system being tested and responds to commands from `vtsui` and `vtstty`. `vtsk` coordinates the operation of individual tests and manages the messages sent by these tests.

- SunVTS user interface

  The SunVTS graphical user interface (`vtsui`) operates on the windowing system. `vtsui` controls `vtsk` and allows you to set user options, start and stop tests, and read log files.

- SunVTS TTY interface

  The `vtstty` TTY user interface controls `vtsk` from either a command shell or a terminal attached to a serial port. Most options available in `vtsui` have equivalent options in `vtstty`.

Glossary

Bps	Bytes per second
bps	Bits per second
CPU	Central Processing Unit
DMA	Direct Memory Access, hardware controller block data transfers.
DMAC	Direct Memory Access Controller.
DRAM	Dynamic Random Access Memory
half-word	In this manual, this term indicates a 16-bit value
HDLC	High-Level Data Link Control
Lbus	Local Sun HSI onboard bus
MByte	Megabyte
MPU	Micro-Processor Unit
ms	Millisecond
PCI9060	PCI Bus Master Interface Chip
QUICC	Quad Integrated Communications Controller
reserved	The term used for bits, bytes, fields, code values, etc. that are set aside for future use
SCC	QUICC Serial Communications Controller
SDLC	Synchronous Data Link Control
SMC	QUICC Serial Management Controllers
word	In this manual, this term indicates a 32-bit value

xxh Numbers followed by lowercase h are hexadecimal values. All other numbers are decimal values To help with readability, large hexadecimal values use a '.' to indicate 16 bit (4 nibble) boundaries. In this document, the period does NOT indicate a decimal place in a hexadecimal number

Index

T

V

X