

Sun™ Quad FastEthernet™ PCI Adapter Installation and User's Guide



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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.

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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.

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Compliance ID: QFEPFI

Product Name: SUN QFE PCI

This product has been tested and complies with the following EMC and Safety standards:

EMC

EC – Europe

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

EN55022 / CISPR22 (1985)	Class A
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:

- EN60950/IEC950 (1993)

Supplementary Information

This product was tested and complies with all the requirements for the CE Mark when connected to a Sun workstation or server.

/ S /

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Manager, Product Compliance

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Preface

The *Sun Quad FastEthernet PCI Adapter Installation and User's Guide* provides installation instructions for the Sun™ Quad FastEthernet™ PCI Adapter. This manual also describes how to configure the Sun Quad FastEthernet driver software.

These instructions are designed for system administrators with experience installing similar hardware.

How This Book Is Organized

Chapter 1, “Product Overview,” describes the hardware and software features for the Sun Quad FastEthernet PCI adapter.

Chapter 2, “Installing the Adapter,” tells you how to install the Sun Quad FastEthernet PCI adapter into your system.

Chapter 3, “Configuring the Driver Software,” describes how to create and edit the device driver configuration files.

Appendix A, “Specifications,” lists the specifications for the Sun Quad FastEthernet PCI adapter.

Appendix B, “Interface Signals,” lists the pin descriptions.

Appendix C, “Configuring the Quad FastEthernet Device Driver Parameters,” describes how to configure the Quad FastEthernet (qfe) driver.

Appendix D, “Running Diagnostics Tests,” describes the diagnostic procedures for testing the Sun Quad FastEthernet PCI adapter.

Related Documents

The following documents contain topics that relate to the information in the *Sun Quad FastEthernet PCI Adapter Installation and User's Guide*.

Title	Part Number
Your system installation or service manual	(System dependent)
<i>Solaris 2.x Handbook for SMCC Peripherals</i>	(Release dependent)
<i>SunVTS User's Guide</i>	(Release dependent)
<i>Sun Quad FastEthernet 2.0 CD-Insert</i>	804-5901
<i>OpenBoot 3.x Command Reference Manual</i>	802-5837

UNIX Commands

This document may not include specific software commands or procedures. Instead, it may name software tasks and refer you to operating system documentation or the handbook that was shipped with your new hardware.

The type of information that you might need to use references for includes:

- Shutting down the system
- Booting the system
- Configuring devices
- Other basic software procedures

See one or more of the following:

- *Solaris 2.x Handbook for SMCC Peripherals* contains Solaris™ 2.x software commands.
- On-line AnswerBook™ for the complete set of documentation supporting the Solaris 2.x software environment.
- Other software documentation that you received with your system.

Typographic Conventions

The following table describes the typographic changes used in this book.

Typeface or Symbol	Meaning	Example
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, contrasted with on-screen computer output	<pre>machine_name% su Password:</pre>
<i>AaBbCc123</i>	Command-line placeholder: replace with a real name or value	To delete a file, type <code>rm filename</code> .
<i>AaBbCc123</i>	Book titles, new words or terms, or words to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be root to do this.

Shell Prompts

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

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

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TABLE P-1 SunExpress Contact Information

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Canada	1-800-873-7869	1-800-944-0661
France	0800-90-61-57	0800-90-61-58
Germany	01-30-81-61-91	01-30-81-61-92
Holland	06-022-34-45	06-022-34-46
Japan	0120-33-9096	0120-33-9097
Luxembourg	32-2-720-09-09	32-2-725-88-50
Sweden	020-79-57-26	020-79-57-27
Switzerland	0800-55-19-26	0800-55-19-27
United Kingdom	0800-89-88-88	0800-89-88-87
United States	1-800-873-7869	1-800-944-0661

World Wide Web: <http://www.sun.com/sunexpress/>

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- Email: smcc-docs@sun.com
- Fax: SMCC Document Feedback
1-415-786-6443

Product Overview

The Sun Quad FastEthernet PCI adapter contains four fully-buffered twisted-pair Ethernet ports (RJ-45), providing four switchable 10BASE-T/100BASE-TX channels, on a PCI adapter.

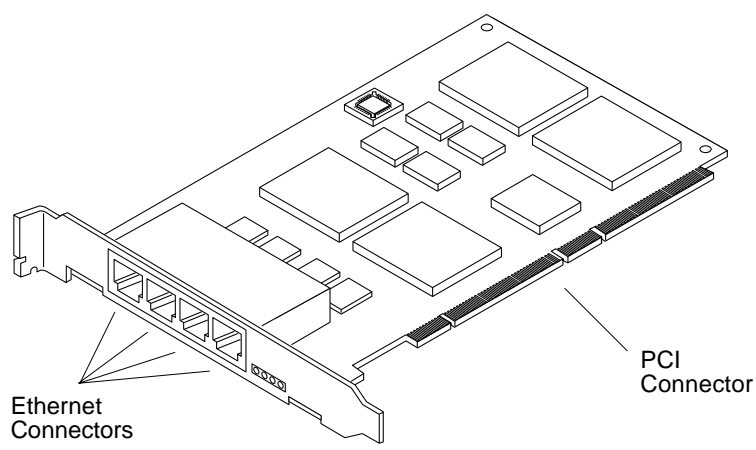


FIGURE 1-1 Sun Quad FastEthernet PCI adapter

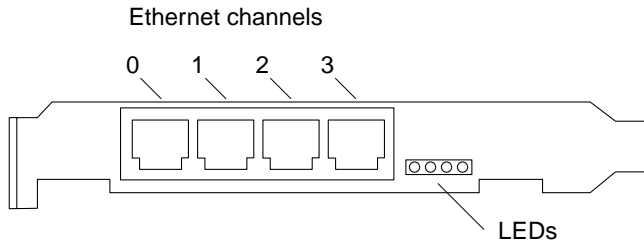


FIGURE 1-2 Sun Quad FastEthernet PCI adapter Back Panel

Features

This PCI adapter offers the following features:

- Fully complies with the ANSI/IEEE std. 802.3 CSMA/CD physical layer specification
 - Four Switchable 10BASE-T/100BASE-TX Ethernet channels with auto negotiation. Conforms to IEEE 802.3u Ethernet standard
 - Provides operations of up to 100 meters of twisted-pair without use of repeaters
- Four independent Ethernet channels run at either 10 Mbps or 100 Mbps
- Supports half-duplex or full-duplex operation modes
- Multiple 48-bit IEEE 802.3 style media access control (MAC) identifiers, one for each channel
- Link integrity LED for each channel

Hardware and Software Requirements

Before installing the adapter, make sure your system meets the following hardware and software requirements:

TABLE 1-1 Hardware and Software Requirements

Requirements	Hardware or Software
Supported Systems	Sun™ Ultra™ systems, with an available PCI slot.
Supported Operating Environments	Solaris 2.5.1 Hardware: 4/97, and later Solaris releases
OpenBoot™ PROM (OBP)	Release 3.0 or later

Note – The information above is up-to-date as of the printing of this manual. Visit Sun on the World Wide Web at <http://www.sun.com/> for the latest information.

Checking the OpenBoot PROM Revision Level

You can use the OpenBoot command `.version` to display your system's OpenBoot PROM revision level.

▼ Displaying the OpenBoot PROM Revision Level

- **At the `ok` prompt, type `.version` to check your system's OpenBoot PROM revision level.**

```
ok .version
Release 3.00 Version 1203 created 97/04/19 09:44:48
```


Installing the Adapter

This chapter tells you how to install the Sun Quad FastEthernet PCI adapter in your system and how to verify that it has been installed correctly.

Adding an Entry to the `driver_aliases` File

If your system is running the Solaris 2.5.1 Hardware: 4/97 operating environment, you will need to add an entry to the `/etc/driver_aliases` file before installing the Sun Quad FastEthernet PCI adapter. In future operating system releases, you will not need to edit this file.

1. **Check the `/etc/driver_aliases` file for the line required by the adapter.**

```
# grep 'pci_pci "pci1011,25"' /etc/driver_aliases
```

If this line already exists in the `driver_aliases` file, you can proceed with the adapter installation, which is described in the next section. Otherwise, you will need to add this line to the file before installing the adapter.

2. **Using a text editor, add the following line to the end of the `/etc/driver_aliases` file.**

```
pci_pci "pci1011,25"
```

Once you have added this line to the file, you can safely install the adapter.

Installing the Adapter

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

1. **Power off your system and open the system unit.**
2. **Attach the adhesive copper strip of the wrist strap to the metal casing of the power supply. Wrap the other end twice around your wrist, with the adhesive side against your skin.**
3. **Holding the PCI adapter by the edges, unpack and place it on an antistatic surface.**
4. **Remove the PCI filler panel from the slot in which you want to insert the Sun Quad FastEthernet PCI adapter.**
5. **Holding the PCI adapter by the edges, align the adapter edge connector with the PCI slot. Slide the adapter face plate into the small slot at the end of the PCI opening.**
6. **Applying even pressure at both corners of the adapter, push the PCI adapter until it is firmly seated in the slot.**



Caution – Do not use excessive force when installing the adapter into the PCI slot. You may damage the adapter's PCI connector. If the adapter does not seat properly when you apply even pressure, remove the adapter and carefully reinstall it again.

7. **If necessary, reinstall the PCI filler panel in the unused PCI opening.**
8. **Detach the wrist strap and close the system unit.**
9. **Connect Ethernet cables to the Sun Quad FastEthernet PCI adapter and to an Ethernet network.**

Verifying the Installation

After you have installed the Sun Quad FastEthernet PCI adapter, but *before* you boot your system, perform the following tasks to verify the installation. Refer to the *Solaris 2.x Handbook for SMCC Peripherals* manual or your Solaris documentation for the detailed instructions.

1. **Power on the system, and when the banner appears, press the Stop-A keys to interrupt the boot process and to get to the `ok` prompt.**
2. **Use the `show-devs` command to list the system devices.**

You should see lines in the list of devices, similar to the example below, specific to the Sun Quad FastEthernet PCI adapter:

```
ok show-devs
...
/pci@1f,2000/pci@2/SUNW,qfe@0,1
/pci@1f,2000/pci@2/SUNW,qfe@1,1
/pci@1f,2000/pci@2/SUNW,qfe@2,1
/pci@1f,2000/pci@2/SUNW,qfe@3,1
...
```

The `SUNW,qfe@x,1` entries identify the adapter's four Ethernet devices.

Note – If you do not see the devices listed, check that the adapter is properly seated and, if necessary, reinstall the adapter.

Diagnostic Testing

For Sun Quad FastEthernet PCI adapter diagnostic testing, see Appendix D, “Running Diagnostics Tests.”.

Examining Network Activity

After you have installed the Sun Quad FastEthernet PCI adapter, but *before* booting the system, verify the installation by examining the network interfaces with the OpenBoot PROM `watch-net-all` command.

Make sure that the interfaces are connected to an active network.

- **Examine network activity and incoming network packets by typing `watch-net-all` at the `ok` prompt.**

The `watch-net-all` command monitors network traffic on all network interfaces in the system. In the example below, the `watch-net-all` command tests all four of the adapter's interfaces, two of which are connected to a network.

```
ok watch-net-all
/pci@1f,2000/pci@2/SUNW,qfe@0,1
Internal loopback test -- succeeded.
Transceiver check -- failed

/pci@1f,2000/pci@2/SUNW,qfe@1,1
Internal loopback test -- succeeded.
Transceiver check -- passed
Looking for Ethernet Packets.
 '.' is a Good Packet.  'X' is a Bad Packet.
Type any key to stop.
..... (Press any key to continue.)

/pci@1f,2000/pci@2/SUNW,qfe@2,1
Internal loopback test -- succeeded.
Transceiver check -- failed

/pci@1f,2000/pci@2/SUNW,qfe@3,1
Internal loopback test -- succeeded.
Transceiver check -- passed
Looking for Ethernet Packets.
 '.' is a Good Packet.  'X' is a Bad Packet.
Type any key to stop.
..... (Press any key to continue.)
```

In addition to testing the adapter's interfaces, the `watch-net-all` command may also test other network devices on the system.

Note – The network speed is the same as the speed of the network that your system is connected. See the section “Forcing Network Speed Between 10 Mbps and 100 Mbps” on page 16 for more detailed information about speed selection.

Rebooting the System

After you have examined the network activity, perform a reconfiguration boot on your system so the operating environment can recognize the Sun Quad FastEthernet PCI adapter.

- **Perform a reconfiguration boot on the system.**

```
ok boot -r
```

Refer to the *Solaris 2.x Peripheral's Handbook* for more information.

Configuring the Driver Software

This chapter describes how to configure the driver software used by the Sun Quad FastEthernet PCI adapter.

Installing the Driver Software

The *Sun Quad FastEthernet 2.0* CD-ROM contains the software required by the Sun Quad FastEthernet PCI adapter. Install the software driver packages as described in the CD insert. (Future revisions of the Sun Quad FastEthernet software will also work with your adapter.)

Before you can use the four channels of the adapter, you will need to create and edit system host files, as described in the next section.

Configuring the Host Files

After installing the Sun Quad FastEthernet driver software, you must create a `hostname.qfe<num>` file for the adapter's Ethernet interfaces. You must also create both an IP address and a host name for its Ethernet interfaces in the `/etc/hosts` file.

1. At the command line, use the `grep` command to search the `/etc/path_to_inst` file for `qfe` devices.

```
# grep qfe /etc/path_to_inst
"/pci@1f,2000/pci@2/SUNW,qfe@0,1" 4 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@1,1" 5 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@2,1" 6 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@3,1" 7 "qfe"
```

In the example above, the four `SUNW,qfe@x,1` instances are from a Sun Quad FastEthernet PCI adapter installed in slot 2. For clarity, the instance numbers are bold.

2. Create an `/etc/hostname.qfe<num>` file, where `<num>` corresponds to the instance number of each interface you plan to use.

If you wanted to use all of the adapter's interfaces in Step 1's example, you would need to create four files:

Filename	Instance Number	Adapter Ethernet Channel (See FIGURE 1-2 on page 2)
<code>/etc/hostname.qfe4</code>	4	0
<code>/etc/hostname.qfe5</code>	5	1
<code>/etc/hostname.qfe6</code>	6	2
<code>/etc/hostname.qfe7</code>	7	3

- Do not create `/etc/hostname.qfe<num>` files for Sun Quad FastEthernet PCI adapter channels you plan to leave unused.
- The `/etc/hostname.qfe<num>` file must contain the hostname for the appropriate network interface.
- The host name should have an IP address and should be entered in the `/etc/hosts` file.
- The host name should be different from any other host name of any other interface, for example: `/etc/hostname.hme0` and `/etc/hostname.qfe2` cannot share the same host name.

Using the instance examples in Step 1, the following example shows the four `/etc/hostname.qfe<num>` files required for a system called `zardoz` that has a Sun Quad FastEthernet PCI adapter (`zardoz-11`, `zardoz-12`, `zardoz-13`, and `zardoz-14`).

```
# cat /etc/hostname.hme0
zardoz
# cat /etc/hostname.qfe4
zardoz-11
# cat /etc/hostname.qfe5
zardoz-12
# cat /etc/hostname.qfe6
zardoz-13
# cat /etc/hostname.qfe7
zardoz-14
```

- 3. Create an appropriate entry in the `/etc/hosts` file for each active `qfe` channel.**
Using the example in Step 1, you will have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1    localhost
129.144.10.57 zardoz    loghost
129.144.11.83 zardoz-11
129.144.12.41 zardoz-12
129.144.13.67 zardoz-13
129.144.14.30 zardoz-14
```

- 4. Reboot your system.**

Booting From the Network

To use a Sun Quad FastEthernet PCI adapter ethernet interface as the boot device, perform the following tasks:

1. At the `ok` prompt type:

```
ok show-devs
```

The `show-devs` command lists the system devices. You should see the full path name of the `qfe` devices, similar to the example below:

```
/pci@1f,2000/pci@2/SUNW,qfe@0,1  
/pci@1f,2000/pci@2/SUNW,qfe@1,1  
/pci@1f,2000/pci@2/SUNW,qfe@2,1  
/pci@1f,2000/pci@2/SUNW,qfe@3,1
```

Note – You need to select only one of these `qfe` devices for booting.

2. At the `ok` prompt type:

```
ok boot (full path name of the qfe device)
```

Post-Installation Procedures (Optional)

Perform the tasks in the following sections to customize the performance of the Sun Quad FastEthernet PCI adapter.

Configuring Driver Parameters

The `qfe` device driver, which is loaded from the CD-ROM, controls the `SUNW,qfe` Ethernet devices. The device driver automatically selects the link speed using the auto-negotiation protocol with the link partner. (See “Auto-Negotiation” on page 17.)

You can manually configure the `qfe` device driver parameters to customize each `SUNW,qfe` device in your system in one of three ways:

- Configure the `qfe` driver parameters generally for all `SUNW,qfe` devices in the system by entering the parameter variables in the `/etc/system` file.
- Set a parameter on a per-device basis by creating the `qfe.conf` file in the `/kernel/drv` directory.
- Use the `ndd` utility to *temporarily* change a parameter. This change is lost when you reboot the system.

See Appendix C, “Configuring the Quad FastEthernet Device Driver Parameters,” for more information.

Increasing TCP/IP Performance

The TCP/IP performance of the Sun Quad FastEthernet PCI adapter can be increased by changing the TCP high water mark to 64K. This can be done with the `ndd` utility as follows.

1. As superuser (root), type:

```
# ndd -set /dev/tcp tcp_xmit_hiwat 65535
# ndd -set /dev/tcp tcp_recv_hiwat 65535
# ndd -set /dev/tcp tcp_cwnd_max 65534
```

The changes take effect immediately and affect all the networking interfaces in the system. The changes are lost when you reboot the system.

Forcing Network Speed Between 10 Mbps and 100 Mbps

1. At the `ok` prompt, use the `show-devs` command to list the system devices.

You should see the full path names of the `qfe` devices, similar to the example below:

```
/pci@1f,2000/pci@2/SUNW,qfe@0,1
/pci@1f,2000/pci@2/SUNW,qfe@1,1
/pci@1f,2000/pci@2/SUNW,qfe@2,1
/pci@1f,2000/pci@2/SUNW,qfe@3,1
```

2. Type:

```
ok nvedit
```

3. Type the following, pressing the Return key at the end of line 0:

```
0: probe-all install-console banner
1: apply transfer-speed=10 (full path name of a qfe device)
```

Note – If you already have commands in NRAM, append these lines to the end of the file.

4. Press the Control-C keys after typing (full path name of a `qfe` device).

You will need to perform Steps 2 to 4 to set the network speed for each `qfe` channel.

Note – In the above example, the speed is forced to 10 Mbps. To force the speed to 100 Mbps, replace 10 with 100.

5. At the `ok` prompt type:

```
ok nvstore
ok setenv use-nvramrc? true
```

6. Reboot your system.

See Appendix C, “Configuring the Quad FastEthernet Device Driver Parameters,” for more information on forcing network speed.

Auto-Negotiation

A key feature of the Sun Quad FastEthernet PCI adapter is auto-negotiation. The *auto-negotiation* protocol, as specified by the 100BASE-T standard, selects the operation mode (half-duplex or full-duplex), and the auto-sensing protocol selects the speed (10 Mbps or 100 Mbps) for the adapter.

The link speed and modes supported by the Sun Quad FastEthernet PCI adapter are listed as follows in decreasing order of priority:

- 100 Mbps, full-duplex
- 100 Mbps, half-duplex
- 10 Mbps, full-duplex
- 10 Mbps, half-duplex

When the system is booted, the Sun Quad FastEthernet PCI adapter advertises these capabilities to the Link Partner at the other end of the link (a hub, switch, or another network interface card (NIC) in a host system). If the Link Partner also supports auto-negotiation, it will advertise its capabilities over the link. The common highest priority mode supported by both sides will be selected automatically for the link operation.

The `qfe` device driver operates the `SUNW, qfe` devices by default in half-duplex mode only. If the Sun Quad FastEthernet PCI adapter is connected to a remote system or interface that is not capable of auto-negotiation, your system automatically selects the speed and half-duplex mode.

If the Sun Quad FastEthernet PCI adapter is connected to a link partner with which the auto-negotiation protocol fails to operate successfully, you can configure the device to not use this protocol and force the driver to set up the link in the mode and speed of your choice.

local-mac-address Property

Each of the network interfaces of the Sun Quad FastEthernet PCI adapter have been assigned a unique MAC (Media Access Control) address, which represents the 48-bit ethernet address for that channel. The OpenBoot firmware reports this MAC address via the `local-mac-address` property in the device nodes corresponding to the network interfaces.

A system is not obligated to use this assigned MAC address if it has a system-wide MAC address. In such cases, the system-wide MAC address applies to all network interfaces on the system.

The device driver, or any other adapter utility, can use the network device's MAC address (`local-mac-address`) while configuring it. In the Solaris 2.6 operating system (and later Solaris revisions), you will be able to use a channel's MAC address when booting over the network.

The `mac-address` property of the network device specifies the network address (system-wide or `local-mac-address`) used for booting the system. To start using the MAC addresses assigned to the network interfaces of the Sun Quad FastEthernet PCI adapter, set the NVRAM configuration variable `local-mac-address?` to `true`.

```
ok setenv local-mac-address? true
```


Specifications

Physical Dimensions

TABLE A-1 Physical Dimensions

Assembly Dimension	Measurement
Length	7.395 in (186.06 mm)
Width	4.759 in (120.88 mm)
Height:	
Primary component side	0.570 in. (14.48 mm)
Back side	0.105 in. (2.67 mm)
Weight	5.2 oz (148 g)

Power Requirements

TABLE A-2 Power Requirements

Specification	Measurement
Maximum Power Dissipation	14 Watts
Maximum Power Consumption	2.8 Amps @ 5V
Voltage Tolerance	5V +/- 5%
Ripple	Maximum 100 mV
Operational Current	5V, 2.0 Amps

Performance Specifications

TABLE A-3 Performance Specifications

Specification	Performance
Maximum Ethernet Transfer Rate	10/100 Mbps per channel
Host Interface	256-pin PBGA PCI to PCI bridge with a 64-bit primary and 32-bit secondary interface. Operates transparently in either 64-bit or 32-bit slots via a PCI specific Universal 64-bit Card Edge. Supports both 3.3v and 5v signalling environments. Fully compliant with PCI Local Bus Spec., Rev. 2.1.
Network Interface	100BASE-TX using Category 5 (data-grade) cable; 10BASE-T using Category 3 (voice-grade) cable or better Single UTP RJ-45 for both 10 and 100 Mbps per channel
Ethernet Version	Conforms to IEEE 802.3u
PCI clock	33 MHz max.
PCI data burst transfer rate	133 MB/sec.
PCI Data/Address Lines	AD63-0
PCI modes	Master/slave

Interface Signals

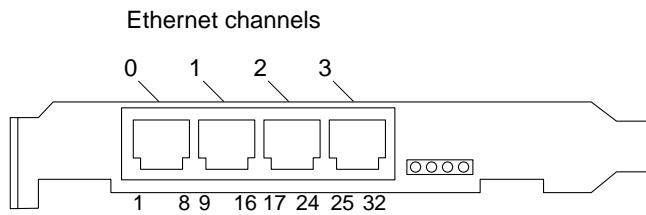


FIGURE B-1 32-Pin RJ-45 Connectors

TABLE B-1 Pin Descriptions for the 32-Pin RJ-45 Connectors: Channels 0 - 3

Description	CH0	CH1	CH2	CH3
TD+	1	9	17	25
TD-	2	10	18	26
RD+	3	11	19	27
Not Used	4	12	20	28
Not Used	5	13	21	29
RD-	6	14	22	30
Not Used	7	15	23	31
Not Used	8	16	24	32

Configuring the Quad FastEthernet Device Driver Parameters

The `qfe` device driver controls the Sun Quad FastEthernet PCI adapter's `SUNW,qfe` Ethernet devices. You can manually configure the `qfe` device driver parameters to customize each `SUNW,qfe` device in your system. This appendix provides an overview of the internal transceiver used in the adapter, lists the available `qfe` device driver parameters, and describes how you can configure these parameters.

Internal Transceiver

The four `SUNW,qfe` channels provide 10BASE-TX or 100BASE-T networking interfaces using the PCI Fast Ethernet and Expansion (PFEX) ASIC and an internal transceiver. The driver automatically sets the link speed to 10 or 100 Mbps and conforms to the 100BASE-T IEEE 802.3u Ethernet standard. The PFEX ASIC provides the PCI interface and Media Access Control (MAC) functions. The internal transceiver, which connects to an RJ-45 connector, provides the physical layer functions.

The internal transceiver is capable of all the operating speeds and modes listed in the section, “Auto-Negotiation” on page 17. The internal transceiver performs auto-negotiation with the remote end of the link (link partner) to select a common mode of operation.

The internal transceiver also supports a forced mode of operation. You can select the speed and mode using the `ndd` utility, by editing the `/etc/system` file, or creating a `qfe.conf` file.

Driver Parameter Values and Definitions

This section describes the parameters and settings for the `qfe` device driver. TABLE B-1 lists these parameters.

TABLE B-1 `qfe` Driver Parameter, Status, and Descriptions

Parameter	Status	Description
<code>transceiver_inuse</code>	Read only	Defines the current status
<code>link_status</code>	Read only	Defines the current status
<code>link_speed</code>	Read only	Defines the current status
<code>link_mode</code>	Read only	Defines the current status
<code>ipg1</code>	Read and write	Inter-packet gap parameter
<code>ipg2</code>	Read and write	Inter-packet gap parameter
<code>use_int_xcvr</code>	Read and write	Operational mode parameter
<code>pace_size</code>	Read and write	Operational mode parameter
<code>adv_autoneg_cap</code>	Read and write	Operational mode parameter
<code>adv_100fdx_cap</code>	Read and write	Operational mode parameter
<code>adv_100hdx_cap</code>	Read and write	Operational mode parameter
<code>adv_10fdx_cap</code>	Read and write	Operational mode parameter
<code>adv_10hdx_cap</code>	Read and write	Operational mode parameter
<code>autoneg_cap</code>	Read only	Local transceiver auto negotiation capability
<code>100fdx_cap</code>	Read only	Local transceiver capability of the hardware
<code>100hdx_cap</code>	Read only	Local transceiver capability of the hardware
<code>10fdx_cap</code>	Read only	Local transceiver capability of the hardware
<code>10hdx_cap</code>	Read only	Local transceiver capability of the hardware
<code>lp_autoneg_cap</code>	Read only	Link partner auto negotiation capability
<code>lp_100fdx_cap</code>	Read only	Link partner capability
<code>lp_100hdx_cap</code>	Read only	Link partner capability

TABLE B-1 qfe Driver Parameter, Status, and Descriptions (Continued)

Parameter	Status	Description
lp_10fdx_cap	Read only	Link partner capability
lp_10hdx_cap	Read only	Link partner capability
instance	Read and write	Device instance
lance_mode	Read and write	Additional delay before transmitting a packet
ipg0	Read and write	Additional delay before transmitting a packet

Defining the Current Status

The read-only parameters described in TABLE B-2 explain the operational mode of the interface. These parameters define the current status.

TABLE B-2 Read-Only Parameters Defining the Current Status

Parameter	Values	Description
link_status	0	Current link status = Link down
	1	= Link up
link_speed	0	Valid only if the link is up = 10 Mbps
	1	= 100 Mbps
link_mode	0	Valid only if the link is up = Half duplex
	1	= Full duplex

Inter-Packet Gap Parameters

The PCI Fast Ethernet and Expansion (PFEX) ASIC supports the programmable Inter-Packet Gap (IPG) parameters `ipg1` and `ipg2`. The total IPG is the sum of `ipg1` and `ipg2`. The total IPG is 9.6 microseconds when the link speed set, by the auto-negotiation protocol, is 10 Mbps. When the link speed is 100 Mbps, the total IPG is 0.96 microseconds.

TABLE B-3 lists the default values and allowable values for the inter-packet gap (IPG) parameters, `ipg1` and `ipg2`.

TABLE B-3 Read-Write Inter-Packet Gap Parameter Values and Descriptions

Parameter	Values (Byte-time)	Description
<code>ipg1</code>	0, 255	<code>ipg1</code> = 8 (default at initialization)
<code>ipg2</code>	0, 255	<code>ipg2</code> = 4 (default at initialization)

By default, the driver sets `ipg1` to 8-byte time and `ipg2` to 4-byte time, which are the standard values. (Byte time is the time it takes to transmit one byte on the link, with a link speed of either 100 Mbps or 10 Mbps.)

If your network has systems that use longer IPG (the sum of `ipg1` and `ipg2`) and if those machines seem to be slow in accessing the network, increase the values of `ipg1` and `ipg2` to match the longer IPGs of other machines.

Defining an Additional Delay Before Transmitting a Packet Using `lance_mode` and `ipg0`

The PCI Fast Ethernet and Expansion (PFEX) ASIC supports a programmable mode called `lance_mode`. The `ipg0` parameter is associated with `lance_mode`.

After a packet is received with `lance_mode` enabled (default) an additional delay is added by setting the `ipg0` parameter before transmitting the packet. This delay, set by the `ipg0` parameter, is in addition to the delay set by the `ipg1` and `ipg2` parameters. The additional delay set by `ipg0` helps to reduce collisions. Systems that have `lance_mode` enabled might not have enough time on the network.

If `lance_mode` is disabled, the value of `ipg0` is ignored and no additional delay is set. Only the delays set by `ipg1` and `ipg2` are used. Disable `lance_mode` if other systems keep sending a large number of back-to-back packets.

You can add the additional delay by setting the `ipg0` parameter from 0 to 31, which is the nibble time delay. Note that nibble time is the time it takes to transfer four bits on the link. If the link speed is 10 Mbps, nibble time is equal to 400 ns. If the link speed is 100 Mbps, nibble time is equal to 40 ns.

For example, if the link speed is 10 Mbps, and you set `ipg0` to 20 nibble times, multiply 20 by 400 ns to get 800 ns. If the link speed is 100 Mbps, and you set `ipg0` to 30 nibble-times, multiply 30 by 40 ns to get 120 ns.

TABLE B-4 defines the `lance_mode` and `ipg0` parameters.

TABLE B-4 Parameters Defining `lance_mode` and `ipg0`

Parameter	Values	Description
<code>lance_mode</code>	0	<code>lance_mode</code> disabled
	1	<code>lance_mode</code> enabled (default)
<code>ipg0</code>	0-31 ¹	Additional IPG before transmitting a packet (after receiving a packet)

1. The default value is 16 nibble-times, which is 6.4 microseconds for 10 Mbps and 0.64 microseconds for 100 Mbps.

Operational Mode Parameters

TABLE B-5 describes the operational mode parameters and their default values.

TABLE B-5 Operational Mode Parameters

Parameter	Values	Description
<code>adv_autoneg_cap</code>	0	Local transceiver capability advertised by the hardware = Forced mode
	1	= Auto-negotiation (default)
<code>adv_100fdx_cap</code> ¹	0	Local transceiver capability advertised by the hardware; read/write parameter = Not 100Mbit/sec full-duplex capable (default in the Solaris 2.5 and 2.5.1 software environments)
	1	= 100Mbit/sec full-duplex capable (default in the Solaris 2.6 software environment)
<code>adv_100hdx_cap</code> ¹	0	Local transceiver capability advertised by the hardware; read/write parameter = Not 100Mbit/sec half-duplex capable
	1	= 100Mbit/sec half-duplex capable (default)
<code>adv_10fdx_cap</code> ¹	0	Local transceiver capability advertised by the hardware; read/write parameter = Not 10Mbit/sec full-duplex capable (default)
	1	= 10Mbit/sec full-duplex capable
<code>adv_10hdx_cap</code> ¹	0	Local transceiver capability advertised by the hardware; read/write parameter = Not 10Mbit/sec half-duplex capable
	1	= 10Mbit/sec half-duplex capable (default)

1. The priority (in descending order) for these parameters is: `adv_100fdx_cap`, `adv_100hdx_cap`, `adv_10fdx_cap`, and `adv_10hdx_cap`.

Defining the Number of Back-to-Back Packets to Transmit

The `pace_size` parameter (see TABLE B-6) defines the maximum number of back-to-back packets you can transmit at one time. If the value is zero, there is no limit to the number of back-to-back packets that can be transmitted.

TABLE B-6 Back-to-back Packet Transmission Capability

Parameter	Values	Description
<code>pace_size</code>	1 to 255	= Number of back-to-back packets transmitted at one time
	0	= No limit to the number of back-to-back packets that can be transmitted (default)

Reporting Transceiver Capabilities

TABLE B-7 describes the read-only transceiver capabilities. These parameters define the capabilities of the hardware. The internal transceiver can support all of these capabilities.

TABLE B-7 Read-Only Transceiver Capabilities

Parameter	Values	Description
<code>autoneg_cap</code>	0	Local transceiver capability of the hardware = Not capable of auto-negotiation
	1	= Auto negotiation capable
<code>100fdx_cap</code>	0	Local transceiver capability of the hardware; initialized at startup = Not 100Mbit/sec full-duplex capable
	1	= 100Mbit/sec full-duplex capable
<code>100hdx_cap</code>	0	Local transceiver capability of the hardware; initialized at startup = Not 100Mbit/sec half-duplex capable
	1	= 100Mbit/sec half-duplex capable
<code>10fdx_cap</code>	0	Local transceiver capability of the hardware; initialized at startup = Not 10Mbit/sec full-duplex capable
	1	= 10Mbit/sec full-duplex capable
<code>10hdx_cap</code>	0	Local transceiver capability of the hardware; initialized at startup = Not 10Mbit/sec half-duplex capable
	1	= 10Mbit/sec half-duplex capable

Reporting the Link Partner Capabilities

TABLE B-8 describes the read-only link partner capabilities.

TABLE B-8 Read-Only Link Partner Capabilities

Parameter	Values	Description
lp_autoneg_cap	0	= No auto-negotiation
	1	= Auto-negotiation
lp_100fdx_cap	0	= No100Mbit/sec full-duplex transmission
	1	= 100Mbit/sec full-duplex
lp_100hdx_cap	0	= No 100Mbit/sec half-duplex transmission
	1	= 100Mbit/sec half-duplex
lp_10fdx_cap	0	= No 10Mbit/sec full-duplex transmission
	1	= 10Mbit/sec full-duplex
lp_10hdx_cap	0	= No 10Mbit/sec half-duplex transmission
	1	= 10Mbit/sec half-duplex

If the link partner is not capable of auto-negotiation (when `lp_autoneg_cap` is 0) the information described in TABLE B-8 is not relevant and the parameter value = 0.

If the link partner is capable of auto-negotiation (when `lp_autoneg_cap` is 1) then the speed and mode information is displayed when you use auto-negotiation and get the link partner capabilities.

Setting `qfe` Driver Parameters

You can set the `qfe` device driver parameters in three ways (`ndd`, `/etc/system`, and `qfe.conf`), depending on your needs. To set parameters that are valid until you reboot the system, use the `ndd` utility. Using `ndd` is a good way to test parameter settings.

To set parameters so they remain in effect after you reboot the system:

- Add the parameter values to the `/etc/system` file when you want to configure parameters for all devices in the system.
- Create a `/kernel/drv/qfe.conf` file and add parameter values to the this file when you need to set a particular parameter for a device in the system.

Setting Parameters Using the `ndd` Utility

Use the `ndd` utility to configure parameters that are valid until you reboot the system. The `ndd` utility supports any networking driver, which implements the Data Link Provider Interface (DLPI).

The following sections describe how you can use the `qfe` driver and the `ndd` utility to modify (with the `-set` option) or display (without the `-set` option) the parameters for each `SUNW,qfe` device.

Identifying Device Instances

Before you use the `ndd` utility to get or set a parameter for a `qfe` device, you must specify the device instance for the utility since there will be at least four `SUNW,qfe` devices.

▼ To Specify the Device Instance for the `ndd` Utility

1. Check the `/etc/path_to_inst` file to identify the instance associated with a particular device.

```
# grep qfe /etc/path_to_inst
"/pci@1f,2000/pci@2/SUNW,qfe@0,1" 4 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@1,1" 5 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@2,1" 6 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@3,1" 7 "qfe"
```

In the example above, the four `SUNW,qfe@x,1` instances are from a Sun Quad FastEthernet PCI adapter installed in slot 2. For clarity, the instance numbers are bold.

2. Use the instance number to select the device.

```
# ndd -set /dev/qfe instance instance#
```

The device remains selected until you change the selection.

Non-Interactive and Interactive Modes

You can use the `ndd` utility in two modes:

- Non-interactive
- Interactive

In non-interactive mode, you invoke the utility to execute a specific command. Once the command is executed, you exit the utility. In interactive mode, you can use the utility to get or set more than one parameter value. (Refer to the `ndd (1M)` man page for more information.)

Using the ndd Utility in Non-Interactive Mode

This section describes how to modify and to display parameter values.

- **To modify a parameter value, use the `-set` option.**

If you invoke the `ndd` utility with the `-set` option, the utility passes *value*, which must be specified down to the named `/dev/qfe` driver instance, and assigns it to the parameter:

```
# ndd -set /dev/qfe parameter value
```

- **To display the value of a parameter, specify the parameter name (and omit the value).**

When you omit the `-set` option, a query operation is assumed and the utility queries the named driver instance, retrieves the value associated with the specified parameter, and prints it:

```
# ndd /dev/qfe parameter
```

Using the ndd Utility in Interactive Mode

- **To modify a parameter value in interactive mode, specify `ndd /dev/qfe`, as shown below.**

The `ndd` utility then prompts you for the name of the parameter:

```
# ndd /dev/qfe  
name to get/set? (Enter the parameter name or ? to view all parameters)
```

After entering the parameter name, the `ndd` utility prompts you for the parameter value (see TABLE B-1 through TABLE B-8).

- To list all the parameters supported by the `qfe` driver, type `ndd /dev/qfe \?`.
(See TABLE B-1 through TABLE B-8 for parameter descriptions.)

```
# ndd /dev/qfe \?
?                (read only)
transceiver_inuse (read only)
link_status      (read only)
link_speed       (read only)
link_mode        (read only)
ipg1             (read and write)
ipg2             (read and write)
use_int_xcvr     (read and write)
pace_size        (read and write)
adv_autoneg_cap  (read and write)
adv_100fdx_cap   (read and write)
adv_100hdx_cap   (read and write)
adv_10fdx_cap    (read and write)
adv_10hdx_cap    (read and write)
autoneg_cap      (read only)
100fdx_cap       (read only)
100hdx_cap       (read only)
10fdx_cap        (read only)
10hdx_cap        (read only)
lp_autoneg_cap   (read only)
lp_100fdx_cap    (read only)
lp_100hdx_cap    (read only)
lp_10fdx_cap     (read only)
lp_10hdx_cap     (read only)
instance         (read and write)
lance_mode       (read and write)
ipg0             (read and write)
#
```

FIGURE B-1 Example of Listing All Parameters Supported by the `qfe` Driver

Setting Forced Mode

This section describes how to set forced mode (not capable of auto-negotiation).

▼ To Select One Local Transceiver Capability and Setting Forced Mode

1. **Select one of the following capabilities:** `adv_100fdx_cap`, `adv_100hdx_cap`, `adv_10fdx_cap`, **or** `adv_10hdx_cap`, **and set its value to 1.**

If you select more than one of the local transceiver capabilities, the driver selects the one that is highest in the priority order (see the footnote from TABLE B-5 on page 27).

2. **Set the local transceiver capabilities advertised by the hardware to forced mode = 0, which is not capable of auto-negotiation:** `adv_autoneg_cap 0`

Use the `ndd` utility as described in “Using the `ndd` Utility in Interactive Mode” on page 32.

Auto-Negotiation Mode

This section describes how to select at least one of the four local transceiver capabilities and set the mode to auto-negotiation.

▼ To Set the Mode to Auto-Negotiation

1. **Select at least one of the five capabilities** (`adv_100fdx_cap`, `adv_100hdx_cap`, `adv_10fdx_cap`, `adv_10hdx_cap`) **that you want to advertise to the remote system, and set its value to 1.**

2. **Set the local transceiver capabilities advertised by the hardware to 1, the auto-negotiation setting:** `adv_autoneg_cap 1`

Use the `ndd` utility as described in “Using the `ndd` Utility in Interactive Mode” on page 32.

Setting Parameters in the `/etc/system` File

To configure the `qfe` driver parameters for all `SUNW,qfe` devices in the system so that the parameter variables are always effective (even after rebooting the system), enter the parameter variables in the `/etc/system` file. When you reboot the system, the system reads the `/etc/system` file and sets these parameter variables in the `qfe` module in the operating system kernel.

TABLE B-9 lists the variables you can set in the `/etc/system` file.

TABLE B-9 Setting Variables in the `/etc/system` File

Parameter	Variable
<code>ipg1</code>	<code>qfe_ipg1</code>
<code>ipg2</code>	<code>qfe_ipg2</code>
<code>use_int_xcvr</code>	<code>qfe_use_int_xcvr</code>
<code>pace_size</code>	<code>qfe_pace_size</code>
<code>adv_autoneg_cap</code>	<code>qfe_adv_autoneg_cap</code>
<code>adv_100fdx_cap</code>	<code>qfe_adv_100fdx_cap</code>
<code>adv_100hdx_cap</code>	<code>qfe_adv_100hdx_cap</code>
<code>adv_10fdx_cap</code>	<code>qfe_adv_10fdx_cap</code>
<code>adv_10hdx_cap</code>	<code>qfe_adv_10hdx_cap</code>
<code>lance_mode</code>	<code>qfe_lance_mode</code>
<code>ipg0</code>	<code>qfe_ipg0</code>

These parameter values, described in “Driver Parameter Values and Definitions” on page 24, are applicable to all `SUNW,qfe` devices on the system. See TABLE B-1 through TABLE B-8 for the descriptions of these parameters.

Here's an example of setting parameters in a `/etc/system` file:

▼ Setting the `ipg1` and `ipg2` Parameters in the `/etc/system` File

1. **Become superuser.**
2. **Add the following lines to the `/etc/system` file:**

```
set qfe:qfe_ipg1 = 10
set qfe:qfe_ipg2 = 5
```

3. **Save the `/etc/system` file.**
4. **Save all files and exit all programs, exit the windowing system.**
5. **Reboot the system by typing `init 6` at the superuser prompt.**

Setting Parameters Using the `qfe.conf` File

You can also specify the properties described in the section, “Setting Parameters in the `/etc/system` File,” on a per-device basis by creating a `qfe.conf` file in the `/kernel/drv` directory. The properties set in the `qfe.conf` file will override the parameters set in the `/etc/system` file. Use a `qfe.conf` file when you need to set a particular parameter for a device in the system. The parameters you set are read and write parameters that are listed in “Driver Parameter Values and Definitions” on page 24.

The man pages for `prtconf` (1M), `system` (4) and `driver.conf` (4) include additional details. The next section shows an example of setting parameters in a `qfe.conf` file.

Setting ipg Driver Parameters Using a qfe.conf File

1. Obtain the hardware path names for the qfe devices in the device tree.

Typically the path names and the associated instance numbers will be present in the `/etc/path_to_inst` file.

```
# grep qfe /etc/path_to_inst
"/pci@1f,2000/pci@2/SUNW,qfe@0,1" 4 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@1,1" 5 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@2,1" 6 "qfe"
"/pci@1f,2000/pci@2/SUNW,qfe@3,1" 7 "qfe"
```

- In the above lines:
 - The first part within the double quotes specifies the hardware node name in the device tree.
 - The second number is the instance number.
 - The last part in double quotes is the driver name.
- In the device path name, the last component after the last / character and before the @ character is the device name.
- The path name before the last component is the parent name.
- The comma separated numbers after the @ character at the end represent the device and function numbers, which are together referred to as unit-address.

To identify a PCI device unambiguously in the `qfe.conf` file, use the name, parent name, and the unit-address for the device. Refer to the `pci(4)` man page for more information about the PCI device specification.

In the first line of the previous example:

- Name = `SUNW,qfe`
- Parent = `/pci@1f,2000/pci@2`
- Unit-address = `0,1`

In the second line in the previous example:

- Name = `SUNW,qfe`
- Parent = `/pci@1f,2000/pci@2`
- Unit-address = `1,1`

In the third line in the previous example:

- Name = SUNW,qfe
- Parent = /pci@1f,2000/pci@2
- Unit-address = 2,1

In the fourth line in the previous example:

- Name = SUNW,qfe
- Parent = /pci@1f,2000/pci@2
- Unit-address = 3,1

2. **Set the ipg1 and ipg2 parameters for the above four devices in the /kernel/drv/qfe.conf file.**

```
name = "SUNW,qfe" parent = "/pci@1f,2000/pci@2" unit-address = "0,1" ipg1=20 ipg2=10;
name = "SUNW,qfe" parent = "/pci@1f,2000/pci@2" unit-address = "1,1" ipg1=20 ipg2=10;
name = "SUNW,qfe" parent = "/pci@1f,2000/pci@2" unit-address = "2,1" ipg1=20 ipg2=10;
name = "SUNW,qfe" parent = "/pci@1f,2000/pci@2" unit-address = "3,1" ipg1=20 ipg2=10;
```

3. **Save the qfe.conf file.**
4. **Save and close all files and programs, and exit the windowing system.**
5. **Halt and reboot the system by typing the `init 6` command at the superuser prompt.**

Running Diagnostics Tests

This appendix describes how to test the Sun Quad FastEthernet PCI adapter with its FCode PROM `selftest`.

Note – To test the Sun Quad FastEthernet PCI adapter further, refer to the *SunVTS User's Guide* that shipped with your operating system.

Using the OpenBoot PROM FCode Selftest

The following tests are available to help identify problems with the Sun Quad FastEthernet PCI adapter if the system does not boot.

You can invoke the FCode `selftest` diagnostics by using the OpenBoot user interface `test` or `test-all` commands. If you encounter an error while running diagnostics, appropriate messages will be displayed. Refer to the *OpenBoot 3.x Command Reference Manual* for more information on the `test` and `test-all` commands.

The `selftest` exercises most functionality sub-section by sub-section and ensures the following:

- Isolates faulty field replaceable units (FRUs)
- Checks, with a high confidence, that no hardware fault exists on No Trouble Found (NTF)
- Checks connectivity during adapter card installation
- Verifies that all components are functional

▼ Running the Ethernet FCode Selftest Diagnostic

To run the ethernet diagnostics, you must first bring the system to a stop at the OpenBoot prompt after issuing a reset. If you do not reset the system, the diagnostic tests may cause the system to hang.

For more information about the OpenBoot commands in this section, refer to the *OpenBoot 3.x Command Reference* manual.

1. Shut down the system.

Use the standard shut down procedures described in *Solaris 2.x Handbook for SMCC Peripherals*.

2. At the `ok` prompt, set the `auto-boot?` configuration variable to false.

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

3. Reset the system.

```
ok reset-all
```

4. Type `show-devs` to display the list of devices.

You should see lines in the list of devices, similar to the example below, specific to the Sun Quad FastEthernet PCI adapter:

```
ok show-devs
. . .
/pci@1f,2000/pci@2/SUNW,qfe@0,1
/pci@1f,2000/pci@2/SUNW,qfe@1,1
/pci@1f,2000/pci@2/SUNW,qfe@2,1
/pci@1f,2000/pci@2/SUNW,qfe@3,1
. . .
```

In this example, the `SUNW,qfe@x,1` entries identify the device paths to the four Ethernet channels.

5. Type the following to put the OpenBoot PROM into diagnostic mode:

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

6. Type the following to run the selftest using the test command on one of the adapters four Ethernet channels:

```
ok test <device path>
```

The following tests are run when the test command is executed:

- hme register
- MAC internal loopback
- External loopback
- 100 Mbps PHY loopback
- 10 Mbps PHY loopback

If the test passes, you will see these messages:

```
Hme register test --- succeeded.  
Internal loopback test -- succeeded  
Transceiver check -- Using onboard transceiver -- Link up  
passed
```

If the channel is not connected to a network, you will see the following error messages:

```
Hme register test --- succeeded.  
Internal loopback test -- succeeded  
Transceiver check -- Using onboard transceiver -- Link down  
Autonegotiation timeout  
Check Cable or contact system administrator  
Failed  
selftest failed. return code = -1
```

Note – To test other channels of the adapter, you will need to execute the test command separately on each channel.

7. After testing the adapter, type the following to return the OpenBoot PROM to standard operating mode:

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

8. Set the `auto-boot?` configuration parameter to true.

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

9. Reset and reboot the system.

```
ok reset-all
```


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