SGI® Fibre Channel PCI Option Board and XIO™ Option Board User's Guide

CONTRIBUTORS

Written by Carolyn Curtis

Updated by Matt Hoy and Nancy Heller

Illustrated by Dan Young

Edited by Susan Wilkening

Production by Karen Jacobson

Contributions by William Mckevitt, Michael Raskie, Carl Rigg, Yin So, and Audy Watson.

Cover Design By Sarah Bolles, Sarah Bolles Design, and Dany Galgani, SGI Technical Publications.

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Record of Revision

Version	Description
006	August 2003
	Adds the following XIO options to the document: X9-FC-2POPT-B and XT-FC-2POPT-B.

Contents

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About This Guide

This guide describes the following SGI Fibre Channel option boards (also referred to as host bus adapters [HBAs]):

- SGI Fibre Channel peripheral component interconnect (PCI) boards with one copper high-speed style-2 balanced connector (PCI-FC-1PCOP-A), and SGI Fibre Channel PCI boards with one SC optical connector (PCI-FC-1POPT-A).

  These option boards are designed for PCI slots in Silicon Graphics Octane, Silicon Graphics Octane2, Silicon Graphics O2, SGI Origin 200, and SGI Origin 200 GIGAchannel systems. The boards connect to SGI Fibre Channel storage options, the SGI Fibre Channel hub, and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI Fibre Channel PCI boards with one LC optical connector (PCI-FC-1POPT-B), and SGI Fibre Channel PCI boards with two LC optical connectors (PCIX-FC-2POPT-B).

  These option boards are designed for SGI Origin 300 systems and SGI Origin 3000 series systems. The boards connect to SGI Fibre Channel storage options and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI XIO boards with one copper, high-speed, style-2 balanced connector (XT-FC-1PCOP-A); SGI XIO boards with one SC optical connector (XT-FC-1POPT-A); and SGI XIO boards with one LC optical connector (XT-FC-1POPT-B).

  These single-port option boards are designed for XIO slots in the SGI Origin 2000 server series, SGI Origin 200 GIGAchannel systems, and Silicon Graphics Onyx2 servers and graphics workstations. The boards connect to SGI Fibre Channel storage options, the SGI Fibre Channel hub, and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI XIO board with two copper DB-9 connectors (XT-FC-2P).

  The SGI FC XIO option board (XT-FC-2P) provides two Fibre Channel ports per board for the SGI Origin 2000, SGI Origin 200 GIGAchannel, and Silicon Graphics Onyx2 systems. The board connects to SGI Fibre Channel storage options or to the SGI Fibre Channel hub. It does not support fabric (Fibre Channel switches). This board is available in a different format (X9-FC-2P) for the Silicon Graphics Octane workstation.

- SGI XIO board with one optical LC connector (X9-FC-1POPT-B).

  This single-port option board is designed for the Silicon Graphics Octane2 workstation and connects to SGI Fibre Channel storage options and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI XIO board with one optical LC connector (XT-FC-1POPT-B).

  This single-port option board is designed for the SGI Origin 2000 and SGI Origin 200 GIGAchannel systems and connects to SGI Fibre Channel storage options and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI XIO board with two optical LC connectors (X9-FC-2POPT-B).

  This dual-port option board is designed for the Silicon Graphics Octane and Silicon Graphics Octane2 workstations and can connect to SGI Fibre Channel storage options, Fibre Channel RAID storage options, and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI XIO board with two LC optical connectors (XT-FC-2POPT-B).

  This dual-port option board is designed for XIO slots in the following systems: SGI Origin 2000 series servers, Silicon Graphics Onyx2 graphics workstations, SGI Origin 3000 series servers, and SGI Onyx 3000 series graphics systems. The board can connect to SGI Fibre Channel storage options, Fibre Channel RAID storage options, and SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

Audience

This guide is written for owners and users of an SGI Fibre Channel PCI or XIO option board. It presumes general knowledge of Fibre Channel technology, knowledge of the host system in which the option board is installed, and knowledge of the Fibre Channel devices to which the option board ports will be cabled.

Structure of This Document

This guide consists of the following chapters:

- Chapter 1, "Fibre Channel Option Board Features," describes Fibre Channel option boards.

- Chapter 2, "Fibre Channel Basics," provides a brief introduction to the Fibre Channel standard, architecture, and applications, with regard to SGI Fibre Channel options.

- Chapter 3, "Fibre Channel Option Board Cabling," describes cables and connections for the boards.

Note: For information on installing the PCI or XIO board, see your workstation or server owner's guide, user's guide, or installation guide. For Origin 3000 series, Origin 2000 series, and Onyx2 systems, only qualified support personnel may install XIO boards and set up storage options.

Related Publications

In addition to this manual, you may need to refer to the following documents:

- The owner's guide, user's guide, or installation guide for the server or workstation in which the Fibre Channel board is installed.

- The owner's guide or user's guide for the peripheral device(s) with which the Fibre Channel board will interface.

For full descriptions of related Fibre Channel products, see the latest versions of the following documents:

- For information about SGI Fibre Channel storage options, see *SGI TP9300 RAID Owner's Guide* (007-4644-001 or later), *SGI TP9400 and SGI TP9500 RAID Owner's Guide* (007-4304-001 or later), *SGI Total Performance 9100 Storage System Owner's Guide* (007-4068-003 or later), and *Origin FibreVault and Fibre Channel RAID Owner's Guide* (007-3428-004 or later).

- For information about the SGI Fibre Channel hub, see *Fibre Channel Hub Owner's Guide* (007-3722-001 or later).

- For information about switches, see the manuals included with the products.

- For information about the dual-channel XIO board for Octane systems (X9-FC-2P), see *OCTANE XIO Standalone Option Board Installation Guide* (007-3518-001 or later).

Obtaining Publications

You can obtain SGI documentation, release notes, or man pages in the following ways:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.

- The release notes, which contain the latest information about software and documentation in this release, are in a file named README.SGI in the root directory of the SGI ProPack for Linux Documentation CD.

- You can also view man pages by typing **man** *<title>* on a command line.

SGI systems include a set of IRIX man pages, formatted in the standard UNIX "man page" style. Important system configuration files and commands are documented on man pages. These are found online on the internal system disk (or CD-ROM) and are displayed using the man command. For example, to display the man page for the xscsidisktest command, type the following on a command line:

man xscsidisktest

References in the documentation to these pages include the name of the command and the section number in which the command is found.

For additional information about displaying man pages using the man command, see man(1).

In addition, the apropos command locates man pages based on keywords. For example, to display a list of man pages that describe disks, type the following on a command line:

apropos disk

For information about setting up and using apropos, see apropos(1).

Conventions

The following conventions are used throughout this document:

Convention	Meaning
`Command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface is also used for book titles.
`user input`	This fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
`man page(x)`	Man page section identifiers appear in parentheses after man page names.
GUI element	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, contact SGI. Be sure to include the title and document number of the manual with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located at the bottom of each page.)

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Fibre Channel Option Board Features

The SGI Fibre Channel option boards (also referred to as host bus adapter boards or HBAs) provide interconnect capability between SGI servers or workstations and various SGI Fibre Channel storage and interconnect options.

This chapter describes the Fibre Channel PCI and XIO option boards that interface between the host system and Fibre Channel peripherals in the following sections:

- "Fibre Channel PCI Option Boards" on page 2
- "Fibre Channel XIO Option Boards" on page 5

Fibre Channel PCI Option Boards

The half-size 66-MHz SGI PCI Fibre Channel option boards support Fibre Channel sustained data transfer rates as fast as 100 MB/s with half-duplex operation for the PCI-FC-1POPT-A and PCI-FC-1PCOP-A boards, and 200 MB/s with half-duplex operation for the PCI-FC-1POPT-B and PCIX-FC-2POPT-B boards.

The PCI Fibre Channel option boards provide a high-performance interface between SGI host systems and the following devices:

- Fibre Channel storage (direct connection): one Fibre Channel arbitrated loop (FC-AL) interface can control up to 110 Fibre Channel disks, such as SGI Fibre Channel storage options.

- SGI 8-port, 16-port, 32-port, or 64-port switches.

- SGI Fibre Channel hub.

    Note: The PCI-FC-1POPT-B option board does not support the SGI Fibre Channel hub.

Information about the PCI Fibre Channel option boards is provided in the following sections:

- "PCI Board Versions" on page 2
- "Required IRIX Version" on page 4
- "PCI Board Connectors" on page 4
- "PCI Option Boards Installation Instructions" on page 5

PCI Board Versions

The PCI board is available in four versions (see Table 1-1): one version has a copper Fibre Channel connector and three versions have optical Fibre Channel connectors. The PCI-FC-1PCOP-A and PCI-FC-1POPT-A boards can be installed in Octane, Octane2, O2, Origin 200, or Origin 200 GIGAchannel systems. The PCI-FC-1POPT-B and PCIX-FC-2POPT-B boards can be installed in Octane2, Origin 3000 series, Origin 300, and Silicon Graphics Fuel systems.

Table 1-1   SGI Fibre Channel PCI Boards

Connection	Marketing Code	Part Number (FRU)	Supported Platforms
Copper	PCI-FC-1PCOP-A	9210190	Octane, Octane2, O2, Origin 200, or Origin 200 GIGAchannel systems
Optical	PCI-FC-1POPT-A	9210191	
Optical	PCI-FC-1POPT-B	097-0102-001	Octane2, Origin 3000 series, Origin 300, and Silicon Graphics Fuel systems
Optical	PCIX-FC-2POPT-B	013-3726-001	

Figure 1-1 shows the four Fibre Channel PCI boards.

PCI card, optical connection (SC)
(PCI-FC-1POPT-A)
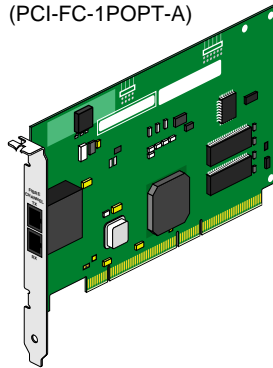
PCI card, copper connection
(PCI-FC-1PCOP-A)
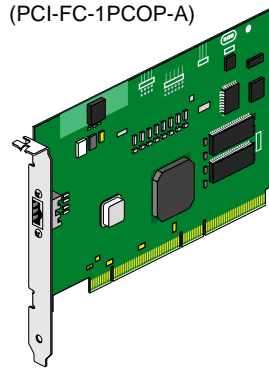
PCI card, optical connection (LC)
(PCI-FC-1POPT-B)
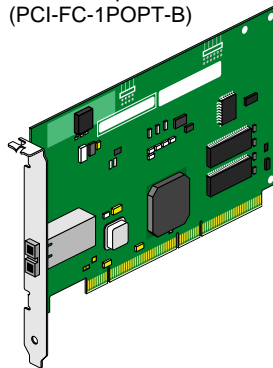
PCI card, optical connection (LC)
(PCIX-FC-2POPT-B)
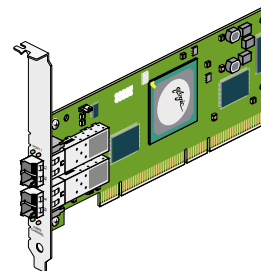
Figure 1-1   SGI Fibre Channel PCI Boards

Required IRIX Version

The PCI-FC-1PCOP-A and PCI-FC-1POPT-A Fibre Channel option boards require IRIX version 6.5; version 6.5.4 or later is preferred. (Note that the SGI SAN product requires version 6.5.5, with a specific patch, or later.) The PCI-FC-1POPT-B Fibre Channel option board requires IRIX version 6.5.15 or later, or version 6.5.14 with a specific patch, or version 6.5.13 with a specific patch. The PCIX-FC-2POPT-B Fibre Channel option board requires IRIX version 6.5.16 or later.

To determine what version of IRIX your system is running, enter the following at the command prompt:

```
uname -R
```

PCI Board Connectors

For the optical versions of the Fibre Channel PCI boards, there is a standard SC connector on the PCI-FC-1POPT-A board, a standard LC connector on the PCI-FC-1POPT-B board, and two standard LC connectors on the PCIX-FC-2POPT-B board.

The copper version of the Fibre Channel PCI boards (PCI-FC-1PCOP-A) uses a high-speed, style-2, balanced cable connector (copper cabling interface). See Figure 1-2 for pin assignments of this connector.
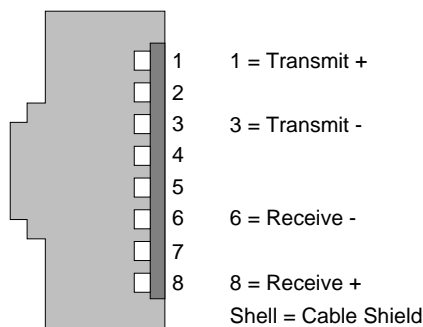
Figure 1-2   PCI Board Style-2 Cable Connector Pin Assignments

PCI Option Boards Installation Instructions

For information on installing PCI boards in a specific host system, see one of the following manuals:

- *SGI Origin 3000 Series Owner's Guide*

- *SGI Origin 300 User's Guide*

- *Origin 200 and Origin 200 GIGAchannel Maintenance Guide.*

- *Octane Workstation Owner's Guide*

- *Octane2 Owner's Guide*

- *O2 Hardware Reference Guide*

- *Silicon Graphics Fuel Visual Workstation Hardware User's Guide*

Fibre Channel XIO Option Boards

SGI provides two types of Fibre Channel XIO option boards: single-channel boards and dual-channel boards. These option boards and their installation are discussed in the following sections:

- "Single-channel XIO Option Boards" on page 5

- "Dual-channel XIO Option Boards" on page 10

- "XIO Option Board Installation Instructions" on page 17

Single-channel XIO Option Boards

This section describes the single-channel XIO option boards for Octane2, Origin 2000, and Origin 200 GIGAchannel systems in the following subsections:

- "Single-channel XIO Board Versions" on page 6

- "Required IRIX Version" on page 8

- "Single-channel Board Features" on page 8

- "Single-channel XIO Board Connectors" on page 9

- "Single-channel XIO Board LEDs" on page 9

Single-channel XIO Board Versions

Table 1-2 provides details about the four single-channel XIO option boards.

Table 1-2   SGI Single-channel XIO Option Boards

Connection	Marketing Code	Part Number	Supported Platforms
Copper	XT-FC-1PCOP-A	013-3008-001	Origin 2000 Origin 200 GIGAchannel
Optical	XT-FC-1POPT-A	013-3007-001	Origin 2000 Origin 200 GIGAchannel
Optical	XT-FC-1POPT-B	013-3859-001	Origin 2000 Origin 200 GIGAchannel
Optical	X9-FC-1POPT-B	013-3690-001	Octane2

Figure 1-3 shows the single-channel XIO boards.

XIO board, optical connection
(XT-FC-1POPT-A)

XIO board, copper connection
(XT-FC-1PCOP-A)

LEDs
A, B, C, D

LEDs
A, B, C, D

XIO board, optical connection
(X9-FC-1POPT-B)

XIO board, optical connection
(XT-FC-1POPT-B)

LEDs
A, B, C, D

LEDs
A, B, C, D

Figure 1-3   Single-channel XIO Boards

Required IRIX Version

Single-channel XIO option boards XT-FC-1PCOP-A and XT-FC-1POPT-A require IRIX version 6.5; version 6.5.4 or later is preferred. (Note that the SGI SAN product requires version 6.5.5, with a specific patch, or later.) Single-channel XIO option boards X9-FC-1POPT-B and XT-FC-1POPT-B require IRIX version 6.5.13 or later.

To determine what version of IRIX your system is running, enter the following at the command prompt:

```
uname -R
```

Single-channel Board Features

The half-size SGI single-channel Fibre Channel option boards provide a high-performance interface between an SGI host system and the following devices:

- Fibre Channel storage (direct connection): one FC-AL interface can control as many as 110 Fibre Channel disks, such as those available from SGI.

- SGI 8-port, 16-port, 32-port, or 64-port Fibre Channel switches.

- SGI Fibre Channel hub or other hub.

These 66-MHz boards support Fibre Channel and have sustained data transfer rates of up to 100 MB/s with half-duplex operation for both the XT-FC-1PCOP-A and XT-FC-1POPT-A boards, and 200 MB/s with half-duplex operation for the X9-FC-1POPT-B and XT-FC-1POPT-B boards.

Single-channel XIO Board Connectors

The connectors on the optical versions of the single-channel XIO boards (XT-FC-1POPT-A, XT-FC-1POPT-B, and X9-FC-1POPT-B) are standard SC and LC connectors.

Figure 1-4 shows pin assignments for the high-speed, style-2, balanced cable connector (copper cabling interface) on the copper version of the single-channel XIO board (XT-FC-1PCOP-A).

```
1    1 = Transmit +
2
3    3 = Transmit -
4
5
6    6 = Receive -
7
8    8 = Receive +
     Shell = Cable Shield
```
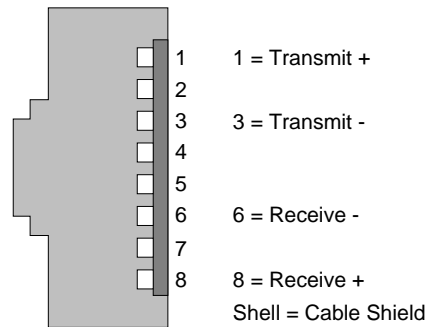
Figure 1-4   Single-channel XIO Board Style-2 Cable Connector Pin Assignments

Single-channel XIO Board LEDs

Figure 1-3 shows the four LEDs on the lower edge of the single-channel XIO option boards. When illuminated, the LEDs are green. Table 1-3 summarizes LED information.

Table 1-3   Single-channel XIO Board LEDs

LED	Purpose	Illuminated	Dark
A	33-MHz PCI clock	PCI clock functioning at 33 MHz	PCI clock not functioning at 33 MHz
B	100-MHz PCI clock	PCI clock functioning at 100 MHz	PCI clock not functioning at 100 MHz
C	Buffer status	Buffer full	Buffer not full
D	Maximum retry timeout status	Maximum retry timeout in process	Maximum retry timeout not in process

Dual-channel XIO Option Boards

This section describes the dual-channel XIO option boards for Origin 3000 series, Onyx 3000 series, Onyx2, Octane, Octane2, Origin 2000, and Origin 200 GIGAchannel systems in the following subsections:

- "Dual-channel XIO Board Versions" on page 10
- "Required IRIX Version" on page 12
- "Dual-channel Board Features" on page 13
- "Dual-channel XIO Board Connectors" on page 14
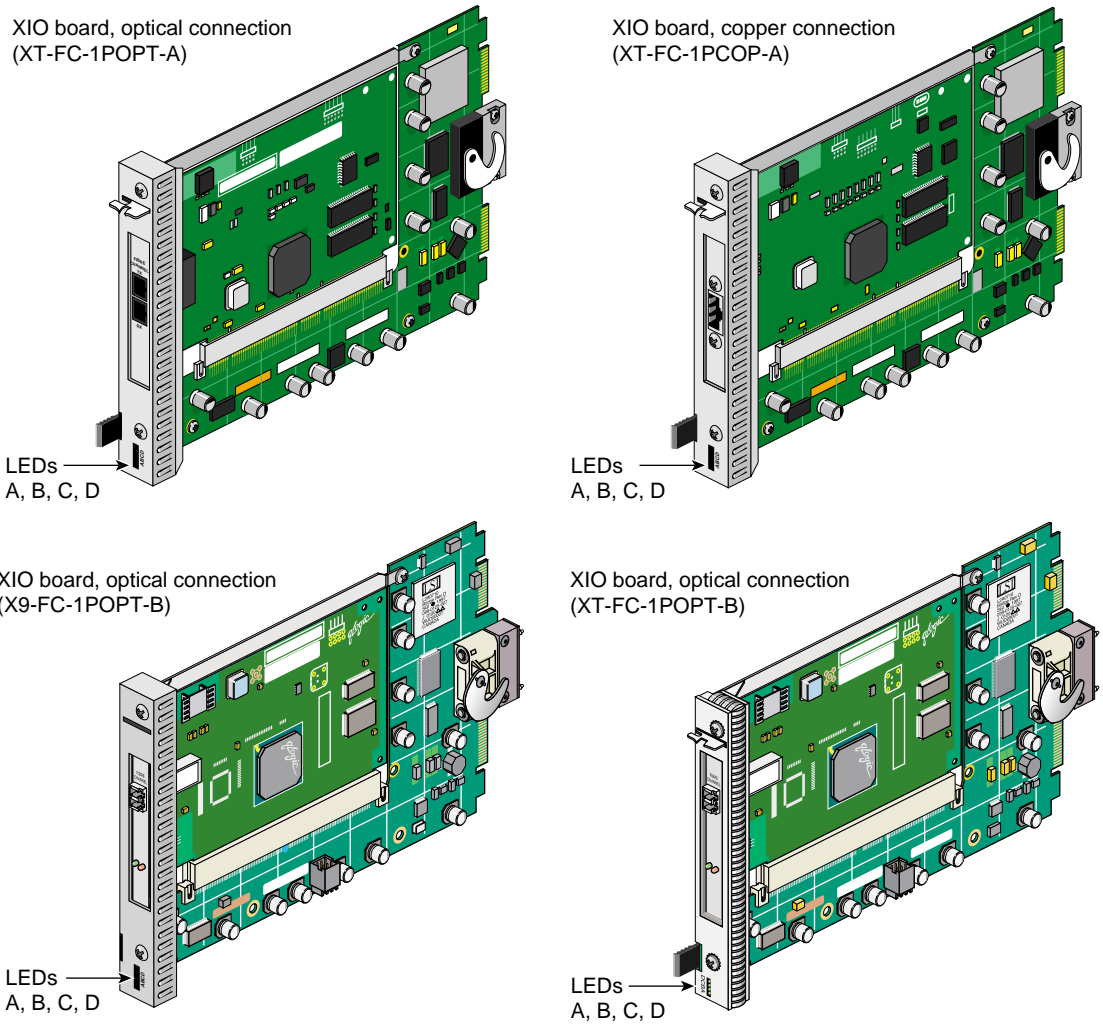- "Dual-channel XIO Board LEDs" on page 15
- "Optional Media Interface Adapter (MIA)" on page 16

Note: The Origin 3000 series and Onyx 3000 series systems require an X-brick to house the XIO boards.

Dual-channel XIO Board Versions

Table 1-4 lists the dual-channel XIO option boards that SGI supports.

Table 1-4   Dual-channel XIO Option Boards

Connector	Marketing Code	Part Number	Supported Platforms
Copper	XT-FC-2P	030-0927-00*x*	Origin 2000, Origin 200 GIGAchannel, and Onyx2
Copper	X9-FC-2P	013-2119-00*x*	Octane
Optical	XT-FC-2POPT-B	013-4048-00*x*	Origin 2000, Onyx2, Origin 3000 series server with X-brick, and Onyx 3000 series visualization system with X-brick
Optical	X9-FC-2POPT-B	013-4046-00*x*	Octane and Octane2

The XT-FC-2P and X9-FC-2P boards have identical functionality and differ only in mechanical aspects appropriate to the platforms for which they are intended, as follows:

- The XT-FC-2P board, which is for Origin 2000, Origin 200, and Onyx2 servers and graphics workstations, has a hook actuator for the compression connector on the system midplane.

- The X9-FC-2P board, which is for Octane workstations, does not have a hook actuator; this actuator is not needed for this platform and would prevent installation of the board.

Figure 1-5 shows the XT-FC-2P board. Basically, the X9-FC-2P board looks the same, but it does not have the hook actuator.
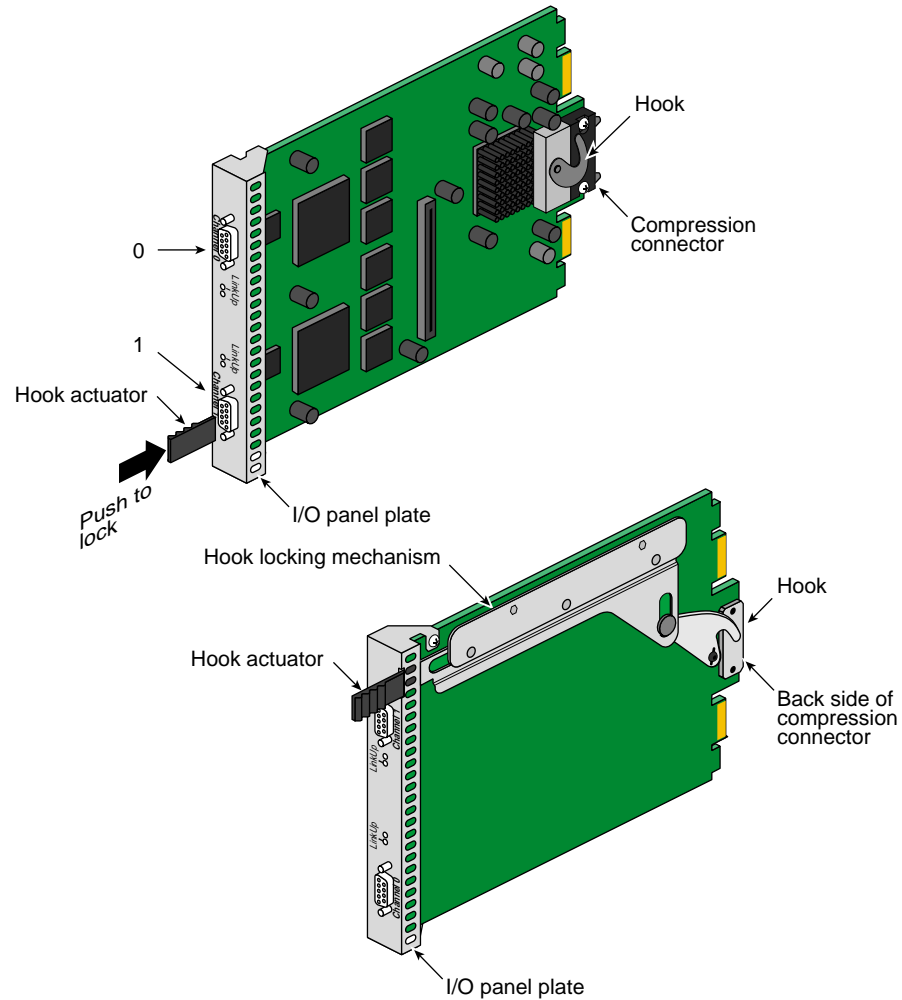
Figure 1-5   Dual-channel XT-FC-2P Board

The X9-FC-2POPT-B and XT-FC-2POPT-B boards have identical functionality. The only differences between the two cards are the supported platforms (see Table 1-4) and that the XT-FC-2POPT-B has a hook actuator at the bottom of the front bulkhead that is used to disengage the board from the XIO bus connector.

Figure 1-6 shows the dual-channel X9-FC-2POPT-B and XT-FC-2POPT-B boards.
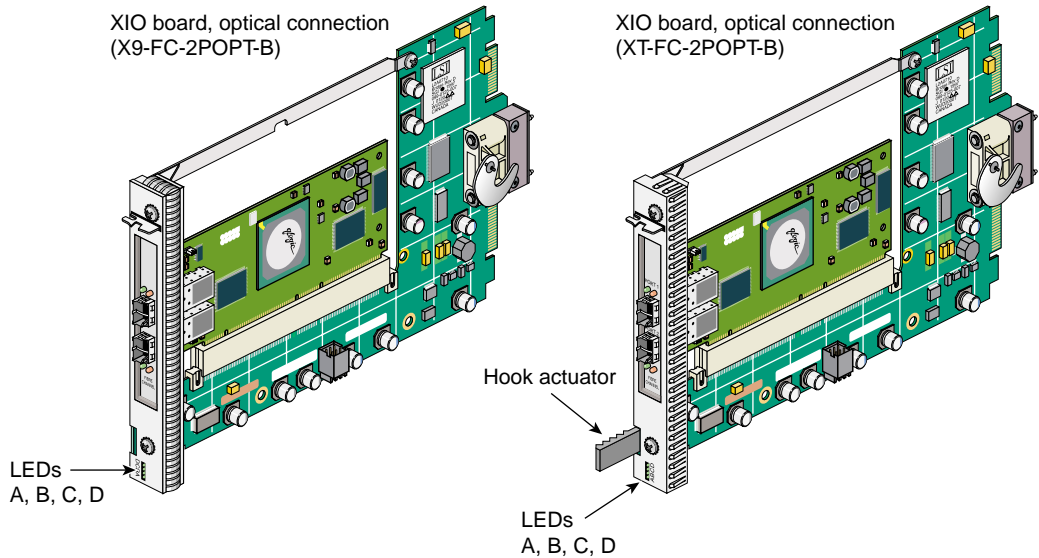
Figure 1-6   Dual-channel X9-FC-2POPT-B and XT-FC-2POPT-B Boards

Required IRIX Version

The XT-FC-2P and X9-FC-2P boards require IRIX 6.5 or later, or IRIX 6.4.1 with the June 1999 patch set. The XT-FC-2POPT-B and X9-FC-2POPT-B boards require IRIX version 6.5.16 or later.

To determine what version of IRIX your system is running, enter the following at the command prompt:

```
uname -R
```

Dual-channel Board Features

The half-size dual-channel XIO XT-FC-2P and X9-FC-2P boards provide a high-performance interface between an SGI workstation or server with an XIO slot and FC-AL interfaces, which connect to Fibre Channel disk enclosures or the SGI Fibre Channel hub or another hub. (See Chapter 2, "Fibre Channel Basics," for an explanation of Fibre Channel topology and architecture.)

These dual-channel XIO boards support Fibre Channel Class 3 operations as a loop port (L_Port). The firmware supports Class 3 and FC-AL (arbitrated loop) transfers only. For details on ports and FC-AL, see Chapter 2.

Note: These boards do not support fabric, that is, Fibre Channel switches. For such support, use the single-channel XIO option boards discussed in "Single-channel XIO Option Boards" on page 5.

The dual-channel XIO XT-FC-2POPT-B and X9-FC-2POPT-B boards provide a high-performance interface between SGI host systems and the following devices:

- Fibre Channel storage (direct connection): one Fibre Channel arbitrated loop (FC-AL or FCAL) interface can control up to 110 Fibre Channel disks.
- Fibre Channel RAID storage systems, as follows:
  - SGI Total Performance 9100 (2Gb TP9100) storage system
  - SGI Total Performance 9300 (TP9300) storage system
  - SGI Total Performance 9400 (TP9400) storage system
  - SGI Total Performance 9500 (TP9500) storage system
- SGI 8-port, 16-port, 32-port, or 64-port switches.

The 133-MHz XT-FC-2POPT-B and X9-FC-2POPT-B boards have a sustained data transfer rate of up to 200 MB/s with half-duplex operation.

Dual-channel XIO Board Connectors

The XT-FC-2P and X9-FC-2P boards each have two 9-pin (DB-9) female connectors, labeled **Channel 0** and **Channel 1**. Each channel can control as many as 110 Fibre Channel disks. Figure 1-7 shows pin assignments.

Both a copper and an optical interface are supported. The native interface is copper, as is standard for FC-AL. To use an optical cable, you must attach a media interface adapter, which is described in "Optional Media Interface Adapter (MIA)" on page 16.

Pin 1 TX +
Pin 2 MIA_VCC
Pin 3 MIA_Fault_L
Pin 4 MIA_Key
Pin 5 RX -
Pin 6 TX -
Pin 7 MIA_Odis
Pin 8 MIA_Ground
Pin 9 RX -
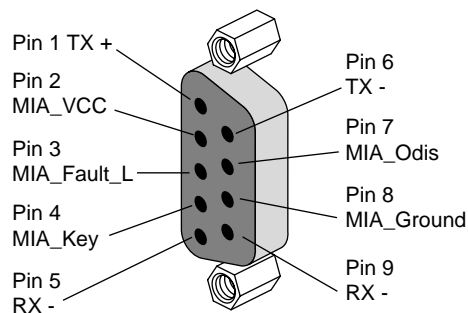
Figure 1-7   XT-FC-2P and X9-FC-2P Board Connector Pin Assignments

The two connectors on the XT-FC-2POPT-B and X9-FC-2POPT-B boards are standard LC connectors.

Dual-channel XIO Board LEDs

Each connector on the XT-FC-2P and X9-FC-2P boards has a pair of LEDs with these functions:

- The green LED (**LinkUp**) lights and remains on when the board is successfully initialized.

- The orange LED lights and remains on when the loop is successfully initialized.

The XT-FC-2POPT-B and X9-FC-2POPT-B boards have four LEDs that are located on the lower edge of the bulkhead (see Figure 1-6 on page 12). When illuminated, the LEDs are green. Table 1-5 summarizes LED information.

Table 1-5   XT-FC-2POPT-B and X9-FC-2POPT-B Board LEDs

LED	Purpose	Illuminated	Dark
A	33-MHz PCI clock	PCI clock functioning at 33 MHz	PCI clock not functioning at 33 MHz
B	100-MHz PCI clock	PCI clock functioning at 100 MHz	PCI clock not functioning at 100 MHz
C	Buffer status	Buffer full	Buffer not full
D	Maximum retry timeout status	Maximum retry timeout in process	Maximum retry timeout not in process

Optional Media Interface Adapter (MIA)

SGI provides an optional fiber optic media interface adapter (MIA) to enable a connection between the DB-9 connectors of the XT-FC-2P and X9-FC-2P boards and fiber optic cabling. For these connections, SGI supports optical cabling distances of 25, 100, or 300 meters. The MIA is used with 62.5 µm optical cable.

The marketing code for the MIA (X-F-OE-KIT) includes two modules (part number 9980952), one for each end of an optical cable.

The MIA uses a shortwave laser (CD-ROM laser) with a wavelength of 780 nm. A full-duplex module, it converts photons to electrons in one direction, and converts electrons to photons in the other direction.

An industry-standard duplex SC connection supplies the external fiber optic connection. This connection consists of two parts: the female part is in the MIA and the male part is on the fiber optic cable connector, as indicated in Figure 1-8. This connection is keyed.

MIA
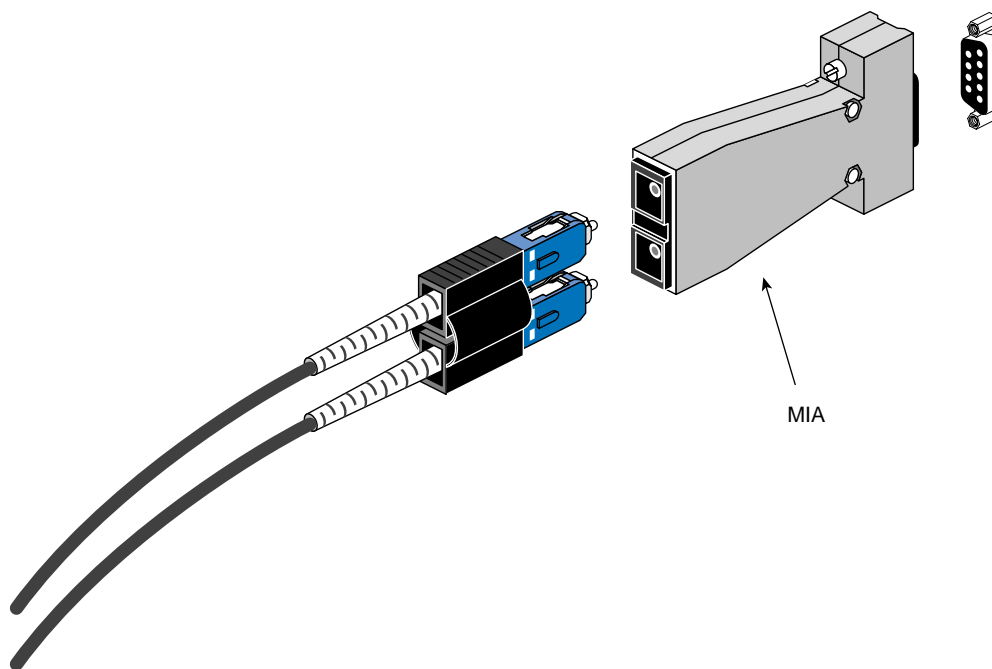
Figure 1-8   Media Interface Adapter (MIA) for Optical Cables

Transceivers (SerDes) embedded on each board convert 8-bit parallel user data to 10-bit differential serial signals (8B10) and vice versa. They also provide frame synchronization, word alignment, and clock recovery for incoming serial data.

For incoming serial data, two recovered clocks at 53.125 MHz for odd or even bytes are provided as outputs on two pins, 180 degrees out of phase. Any required equalization to compensate for high-frequency losses for copper cables (by attenuating the lower frequencies to match) is supplied externally to the Fibre Channel option board. Serial data in both directions between the transformer and the external connector is AC-coupled via a capacitor.

If the XT-FC-2P or X9-FC-2P board loses power or the physical Fibre Channel connection is broken, the link to which the board is attached becomes inoperable. High-availability loop configurations require the use of a Fibre Channel hub.

XIO Option Board Installation Instructions

The board installation process depends on the type of workstation or server you have, as follows:

- For Origin 2000 series servers, Origin 3000 series servers, Onyx 3000 series graphics systems, and Onyx2 workstations, contact your factory-authorized field service personnel.

- For all other applicable SGI workstations or servers, such as the Octane, Octane2, and Origin 200 GIGAchannel, refer to the owner's guide, user's guide, maintenance guide, or installation guide that came with your system. If you do not have these guides, see "Obtaining Publications" on page xvii.

- For the dual-channel XIO board for Octane systems (X9-FC-2P), see *OCTANE XIO Standalone Option Board Installation Guide*, which is included with this option board.

Fibre Channel Basics

This chapter provides a brief overview of Fibre Channel with regard to SGI Fibre Channel options. It briefly explains the following:

- "The Fibre Channel Standard" on page 19
- "Networks, Channels, and Fibre Channel" on page 20
- "Fibre Channel Applications" on page 22

For more information, see the following resources:

- ANSI Fibre Channel standards: Global Engineering Documents, 15 Inverness Way East, Englewood, CO, 80112, USA. Telephone: +303 397 0271 or 1 800 854 7179 (U.S. and Canada)
- Fibre Channel Industry Association (FCIA): http://www.fibrechannel.org
- Storage Networking Industry Association (SNIA): http://www.snia.org/home

Note: Some information in this chapter was derived from the Fibre Channel Loop Community (FCLC) website, and the Fibre Channel Association (FCA) technical information website.

The Fibre Channel Standard

Fibre Channel is the general name of an integrated set of standards being developed by the American National Standards Institute (ANSI). The Fibre Channel standard defines a high-speed data transfer interface that can be used to connect workstations, mainframes, supercomputers, storage devices, and displays. The Fibre Channel standard addresses the need for very fast transfer of large amounts of information. Currently, Fibre Channel is used primarily as an interface to storage.

Conceived as a generic, efficient physical transport system that can support multiple protocols, the standard also relieves system manufacturers of the burden of supporting the various channels and networks currently in place, because it provides one standard for networking, storage, and data transfer. Note that this SGI implementation is for communication with mass storage systems only.

Fibre Channel can provide a general transport vehicle for Upper Level Protocols (ULPs), including the Intelligent Peripheral Interface (IPI) and Small Computer System Interface (SCSI) command sets, high-performance parallel interface (HIPPI) data framing, Internet Protocol (IP), and IEEE 802.2. Proprietary and other command sets can also use and share the Fibre Channel, although such use is not defined as part of the Fibre Channel standard and is not supported by SGI host systems. The SGI implementation currently supports only the SCSI Fibre Channel protocol.

Note: For a description of SGI Fibre Channel storage options, see *SGI TP9300 RAID Owner's Guide* (007-4644-001 or later), *SGI TP9400 and SGI TP9500 RAID Owner's Guide* (007-4304-001 or later), *SGI Total Performance 9100 Storage System Owner's Guide* (007-4068-003 or later), or *Origin FibreVault and Fibre Channel RAID Owner's Guide* (007-3428-004 or later).

Networks, Channels, and Fibre Channel

The two most common peripheral protocols for device communication in the computer industry are networks and channels.

Networks have the following characteristics:

- Involve I/O interfaces that usually support many small transactions with relatively high overhead due to software involvement in the flow of information.

- Allow a host or device in the network to communicate with any other device.

- Operate in an open, unstructured, and unpredictable environment.

Channels have the following characteristics:

- Supply peripheral I/O interface to a host and transport large amounts of data between the host and peripherals.

- Keep data processing overhead to a minimum by handling data transfer in hardware, with little or no software involvement once an I/O operation begins.

- Operate in a closed, structured, and predictable environment where all devices that can communicate with a host are known in advance and any change requires host software or configuration table changes.

Fibre Channel technology attempts to combine the best of these two methods into an I/O interface that meets the needs of both channel users and network users. Fibre Channel communications can be conducted over copper twinax, twisted pair, or optical fiber.

Fibre Channel technology provides different interconnect topologies to serve the combined needs of channel and network usages. These topologies are the following:

- Fabric

- Arbitrated loop, including point-to-point

Currently, SGI supports both these topologies.

Fabric Topology

A fabric is an active, intelligent interconnect scheme for Fibre Channel servers and storage. Fabric topology permits dynamic interconnections between nodes through ports connected to the fabric.

A Fibre Channel switch is the cornerstone of the fabric, supporting connectivity of a range of host and storage types. Switches can be cascaded for more complex configurations. Parallel fabrics can provide redundancy. SGI provides 8-port, 16-port, 32-port, and 64-port switches with a variety of cabling options. See "Connections for SGI Fibre Channel Options" on page 31 for details of connections.

Arbitrated Loop Topology

In Fibre Channel arbitrated loop (FC-AL) topology, each port arbitrates for access to the loop. Ports that "lose" the arbitration act as repeaters of all traffic on the loop. The loop is a dedicated transmit channel and a dedicated receive channel that are clad together into one cable to form a loop out and back. This protocol allows as many as 127 ports to be connected in a serial loop (one FL_Port and 126 NL_Ports). SGI supports a maximum of 110 disks in a single rack.

Ports are called Node Ports (N_Ports), Node_Loop Ports (NL_Ports), Fabric_Ports (F_Ports), or Fabric_Loop Ports (FL_Ports).

An NL_Port represents each disk in a disk array. Each NL_Port sees all messages and passes messages not addressed to that port. Ports passing messages are said to be in "repeat mode."

The SGI Fibre Channel hub, an intelligent digital hub for FC-AL storage clusters, provides gigabit-speed storage connectivity, network management, data reliability, and module network scalability for SGI storage configurations. The hub uses copper cabling, and optical cabling with media interface adapters (MIAs). Its ten FC-AL ports can function as a single loop, can be segmented into two 5-port loops, or can be connected (cascaded) with another SGI Fibre Channel hub to form one 18-port loop.

Point-to-Point Topology

In point-to-point host applications, two ports are connected to a link. The transmitter of each port is connected directly to the receiver of the opposite port. This topology limits the number of connections that can be made across the wire.

Fibre Channel Applications

Figure 2-1 shows Fibre Channel in the overall Origin 2000 and Onyx2 I/O structure.
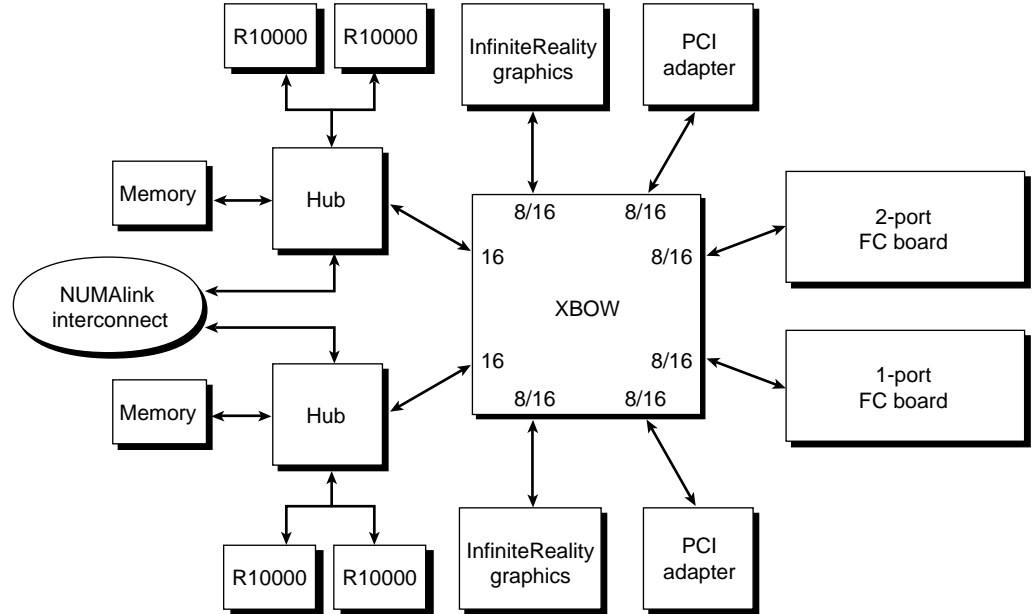
Figure 2-1   Fibre Channel in the Origin 2000 and Onyx2 I/O Structure

Fibre Channel is useful for many applications, including the following:

- Scientific graphics and video markets, which use high-bandwidth rates with large I/O requests.

- Fileserver and database markets, which must support many I/Os per second (IOPS) with relatively small random I/Os.

  High-availability RAID is also a requirement for this market. Fibre Channel RAID addresses the needs of this market by supporting several disks in a well-balanced access pattern on a single arbitrated loop. The arbitrated loop also provides an arbitration fairness scheme that prevents high-priority requests from starving low-priority requests. For more information on high availability and RAID within Fibre Channel options, see *SGI TP9300 RAID Owner's Guide* (007-4644-001 or later), *SGI TP9400 and SGI TP9500 RAID Owner's Guide* (007-4304-001 or later), *SGI Total Performance 9100 Storage System Owner's Guide* (007-4068-003 or later), or *Origin FibreVault and Fibre Channel RAID Owner's Guide* (007-3428-004 or later).

Fibre Channel Option Board Cabling

This chapter describes cabling for the Fibre Channel XIO option board and PCI option board in the following sections:

- "Cables for SGI Fibre Channel Options" on page 25
- "GBICs Available from SGI" on page 29
- "SFPs Available from SGI" on page 31
- "Connections for SGI Fibre Channel Options" on page 31
- "Cable Labels" on page 34

Cables for SGI Fibre Channel Options

Note the following shipping configurations for SGI Fibre Channel storage cables:

- Two 10-m (32.8 ft) copper cables (DB-9 connectors at each end) are shipped with the Fibre Channel dual-channel XT-FC-2P and X9-FC-2P boards.
- No cables are shipped with the single-channel XIO option boards, the PCI option boards, or the XT-FC-2POPT-B and X9-FC-2POPT-B boards.
- No cables are included with the SGI Fibre Channel hub or switches, or with the Origin FibreVault or Fibre Channel RAID enclosures.

Cables can be ordered separately from SGI.

This section discusses cables for SGI Fibre Channel options in the following subsections:

- "Cables Available from SGI" on page 26
- "Cable Characteristics" on page 28
- "Cable Distances and Shielding" on page 29

Cables Available from SGI

Table 3-1 describes the copper and optical cables available from SGI. Table 3-2 and Table 3-3 provide additional information about these cables.

Table 3-1   SGI Fibre Channel Cabling Options

Cable	Length	Marketing Code	Part Number
FC optical cable, SC connector to SC connector (62.5 µm, for shortwave fiber optic transmissions)	3 m (9.8 ft)	X-F-OPT-3M	018-0656-001
Note: The 300-m cable is supported only with MIAs for use with the SGI Fibre Channel hub and SGI Fibre Channel storage.	10 m (32.8 ft)	X-F-OPT-10M	018-0656-101
	25 m (82 ft)	X-F-OPT-25M	018-0656-201
	50 m (164 ft)	X-F-OPT-50M	018-0656-501
	100 m (328 ft)	X-F-OPT-100M	018-0656-301
	300 m (984 ft)	X-F-OPT-300M	018-0656-401
FC optical cable, LC to SC connector small form factor connectors (62.5 µm, for shortwave fiber optic transmissions) .	3 m (9.8 ft)	X-F21-OPT-3M	018-1023-001
Note: These cables are for use between a 1-GB component and a 2-GB component.	10 m (32.8 ft)	X-F21-OPT-10M	018-1030-001
	25 m (82 ft)	X-F21-OPT-25M	018-1024-001
	100 m (328 ft)	X-F21-OPT-100M	018-1025-001
FC optical cable, LC to LC small form factor connectors (50.0 µm, for shortwave fiber optic transmissions)	3 m (9.8 ft)	X-F22-OPT-3M	018-1026-001
Note: These cables are for use with 2-GB components.	10 m (32.8 ft)	X-F22-OPT-10M	018-1027-001
	25 m (82 ft)	X-F22-OPT-25M	018-1028-001
	100 m (328 ft)	X-F22-OPT-100M	018-1029-001

Table 3-1   SGI Fibre Channel Cabling Options **(continued)**

Cable	Length	Marketing Code	Part Number
FC copper cable, high-speed style-2 balanced cable connector at each end.	1 m (3.28 ft)	X-FSW-COP-1M	N/A
	3 m (9.8 ft)	X-FSW-COP-3M	N/A
	12 m (39.36 ft)	X-FSW-COP-12M	N/A
FC copper cable, high-speed style-2 balanced cable connector to DB-9	3 m (9.8 ft)	X-FS-COP-3M	N/A
	12 m (39.36 ft)	X-FS-COP-12M	N/A
	25 m (82 ft)	X-FS-COP-25M	N/A
FC copper cable, DB-9 connector at each end	0.3 m (1 ft)	X-F-COP-0.3M	9470156
Note: Two of these 10-m cables are included with each 2-port FC XIO board (XT-FC-2P and X9-FC-2P).	10 m (32.8 ft)	X-F-COP-10M	018-0570-001
	25 m (82 ft)	X-F-COP-25M	018-0571-001
Two MIA modules (FC copper-to-optical).	N/A	X-F-OE-KIT	9980952

Cable Characteristics

Table 3-2 provides additional information about the fiber optic cables available from SGI.

Shortwave fiber is 62.5 μm or 50 μm multimode.

Table 3-2   Characteristics of SGI Fiber Optic FC Cables

Characteristic	(X-F21-OPT-*n*M)	(X-F21-OPT-*n*M)	(X-F22-OPT-*n*M)
Variant	100-M6-SN-I	100-M6-SN-I	200-M5-SN-I
Range	At least 175 m (depends on device)	At least 175 m (depends on device)	At least 300 m (depends on device)
Transmitter	Optical laser: 780 nm	Optical laser: 780 nm	Optical laser: 780 nm
Medium	62.5 μm multimode SC to SC, 160 MHz/km	62.5 μm multimode SC to LC, 160 MHz/km	50.0 μm multimode LC to LC
Connectors	SC duplex on each end	SC duplex to LC duplex	LC duplex on each end

Table 3-3 provides information about the 1-Gb/s copper cables available from SGI.

Table 3-3   Characteristics of SGI Copper FC Cables

Characteristic	(X-FSW-COP-*n*M)	(X-FS-COP-*n*M)	(X-F-COP-*n*M)
Variant	100-TW-EL-S full-duplex (quad conductor)	100-TW-EL-S full-duplex (quad conductor)	100-TW-EL-S full-duplex (quad conductor)
Range	12 m maximum	12 m with switch; 25 m point-to-point	25 m maximum
Transmitter	PECL	PECL	PECL
Medium	1 m and 3 m: 30 gauge unequalized 12 m: 23 gauge unequalized	3 m: 30 gauge unequalized 12 m: 23 gauge unequalized 25 m: 23 m equalized	10 m and under: 30 gauge unequalized 12 m: 23 gauge unequalized 25 m: 24 gauge equalized
Connectors	High-speed style-2 balanced on each end	Male DB-9; high-speed style-2 balanced	Male DB-9 on each end

Cable Distances and Shielding

62.5 μm optical cables support a maximum distance of 100 m (328 ft) or, with MIAs, 300 m (984 ft).

50.0 μm optical cables support a maximum distance of 300 m (984 ft) when operating at 2 Gbit/s.

The three types of SGI copper cables are fully shielded, full-duplex, balanced cables capable of supporting distances of 12 m (39.36. ft) at the 1.0625 Gbaud transfer rate.

The shield on the DB-9 connector (used in X-F-COP-nM and X-FS-COP-nM) connects directly to the connector shield, providing a DC ground on both ends.

The high-speed style-2 connector (used in X-FSW-COP-nM and X-FS-COP-nM) also connects directly to the connector shield, providing a DC ground on both ends.

GBICs Available from SGI

Gigabit interface connectors (GBICs) are adapters used on the SGI 8-port and 16-port 1-Gb Fibre Channel switches to interface with cables. Table 3-4 outlines GBICs available from SGI for its Fibre Channel switches.

Table 3-4   GBIC Kits for the SGI Fibre Channel Switch

GBIC Type	Kit Marketing Code	Quantity	Part Number	Use These Cables
Copper	XCOPGBIC-1	1	9470357	X-FSW-COP-1M X-FSW-COP-3M X-FSW-COP-12M X-FS-COP-3M (unequalized) X-FS-COP-12M (unequalized) X-FS-COP-25M (equalized)
Shortwave optical	XSWOPTGBIC-1	1	9470358	X-F-OPT-3M X-F-OPT-10M X-F-OPT-25M
Longwave optical	XLWOPTGBIC	2	9470359	X-F-OPT-100M; also with longer cables not supplied by SGI

For short distances, a passive copper GBIC (XCOPGBIC) is available from SGI, which supports the following configurations:

- Cabling for distances up to 12 m (39.36 ft); use this cabling with the SGI 8-port and 16-port Fibre Channel switches.

- Cabling for distances up to 25 m (82 ft) and equalized 22 AWG (American wire gauge) cabling for distances up to 25 m (82 ft); use this cabling for a direct connection to storage.

For intermediate distances, a shortwave GBIC (XSWOPTGBIC) is supported by SGI for the following configurations:

- 62.5 μm optical cabling for distances up to 100 m (328 ft) (cables available from SGI).
- 50 μm optical cabling for distances up to 500 m (1640 ft) at 1 Gb (cables not available from SGI).
- 50 μm optical cabling for distances up to 300 m (984 ft) at 2 Gb (cables not available from SGI).

For long distances, a longwave GBIC (XLWOPTGBIC) is supported by SGI for optical cabling distances to 10 km (6.2 miles) (cables not available from SGI).

See "Cable Characteristics" on page 28 for more information on these cables. For distance considerations with respect to cables, see "Connections" on page 32.

SFPs Available from SGI

Small form factor pluggables (SFPs) are adapters used on the SGI 8-port, 16-port, 32-port, and 64-port 2-Gb Fibre Channel switches to interface with LC-ended optical cables. Table 3-5 outlines SFPs available from SGI for its Fibre Channel switches.

Table 3-5   SFP Kits for the SGI Fibre Channel Switch

SFP Type	Kit Marketing Code	Use with These Cables
Short wave, multi mode	XSWOPTSFP-2	X-F21-OPT-nM
		X-F22-OPT-nM
Long wave, single mode	XLWOPTSFP-2	Cables not supplied by SGI.

See "Cable Characteristics" on page 28 for more information on these cables. For distance considerations with respect to cables, see "Connections" on page 32.

Connections for SGI Fibre Channel Options

This section explains the various Fibre Channel option board connections, and the cables required for each, in these subsections:

- "Connections" on page 32
- "Cable Interoperability" on page 33
- "Checking the Grounding in Configurations with Copper Cabling" on page 34

Connections

Table 3-6 lists the cables required for specific connections.

Table 3-6   SGI Cable Connections

From SGI FC Device	To SGI FC Device	Distance (m)	GBIC/MIA at Source Device	Cable	Type	GBIC/MIA at Target Device
PCI, style-2 copper connector (PCI-FC-1PCOP-A), or single-channel XIO board, style-2 copper connector (XT-FC-1PCOP-A)	FC storage	3 to 25	None	X-FS-COP-nM	Copper	None
	FC hub	3 to 25	None	X-FS-COP-nM	Copper	None
	FC switch	1 to 12	None	X-FSW-COP-nM	Copper	Copper GBIC
PCI, SC optical connector (PCI-FC-1POPT-A), or single-channel XIO board, SC optical connector (XT-FC-1POPT-A)	FC storage	3 to 100	None	X-F-OPT-nM	Optical	MIA
	FC hub	3 to 100	None	X-F-OPT-nM	Optical	MIA
	FC switch	3 to 100	None	X-F-OPT-nM	Optical	SW GBIC
PCI, LC optical connector (PCI-FC-1POPT-B and PCIX-2POPT-B), or XIO, LC optical connector (X9-FC-1POPT-B, XT-FC-1POPT-B, XT-FC-2POPT-B, and X9-FC-2POPT-B)	FC storage	3 to 100	None	X-F22-OPT-nM	Optical	SFP
	FC switch	3 to 100	None	X-F21-OPT-nM	Optical	SFP & GBIC
Dual-channel XIO board, copper DB-9 connector (XT-FC-2P, X9-FC-2P)	FC storage	0.3 to 25	None	X-F-COP-nM	Copper	None
		3 to 100	MIA	X-F-OPT-nM	Optical	MIA
	FC hub	0.3 to 25	None	X-F-COP-nM	Copper	None
		3 to 100	MIA	X-F-OPT-nM	Optical	MIA
Fibre Channel hub	FC storage	0.3 to 25	None	X-F-COP-nM	Copper	None
		3 to 100	MIA	X-F-OPT-nM	Optical	MIA
	FC hub	0.3 to 25	None	X-F-COP-nM	Copper	None
1-Gb 8-port or 16-port Fibre Channel switch	FC storage	0.3 to 25	Copper GBIC	X-FS-COP-nM	Copper	None
		3 to 100	SW GBIC	X-F-OPT-nM	Optical	MIA
	FC hub	0.3 to 25	Copper GBIC	X-FS-COP-nM	Copper	None
		3 to 100	SW GBIC	X-F-OPT-nM	Optical	MIA

For distances to 10 km (6.2 miles), use a longwave GBIC or SFP and 9 μm single-mode fiber optic cabling; this cabling is not available from SGI.

For information on cabling SGI Fibre Channel storage options to the Fibre Channel XIO or PCI board, see *SGI TP9300 RAID Owner's Guide* (007-4644-001 or later), *SGI TP9400 and SGI TP9500 RAID Owner's Guide* (007-4304-001 or later), *SGI Total Performance 9100 Storage System Owner's Guide* (007-4068-003 or later), or *Origin FibreVault and Fibre Channel RAID Owner's Guide* (007-3428-004 or later). In the case of Origin 3000 series, Origin 2000 series, and Silicon Graphics Onyx2 systems, only qualified SGI support personnel can install the boards and cable the options.

For optimal performance when using a 1-Gb (100-MB/s) switch, use copper cabling in the following situations:

- A Fibre Channel switch is inside the Fibre Channel storage rack.

- A Fibre Channel switch is next to the storage rack and uses the same ground.

- A Fibre Channel switch is next to the CPU and uses the same ground.

- A Fibre Channel switch is cabled to another switch, for cost reasons (unless distance warrants the use of optical cable).

Note: No copper cabling solution is available for 2-Gb Fibre Channel switches.

Cable Interoperability

To maintain acceptable quality and signal integrity, use only copper and optical cables from SGI with your SGI Fibre Channel enclosures. If you use both 62.5 μm and 50 μm fiber optic cabling in the same environment, use the same gauges for a patch cord and a trunk.

If your configuration uses cables, GBICs, or SFPs other than those available from SGI, support is limited.

Checking the Grounding in Configurations with Copper Cabling

Grounding is very important in SGI computer systems. Each chassis must be well-grounded through its power connector. All chassis with XIO boards with copper cables connected to them must share the same transformer, be grounded through the same earthing rod, and be on the same branch circuit. If you have any doubts about the quality of the ground connection, consult a qualified electrician.

Use an optical cable between the fiber enclosure(s) and the host XIO connection to eliminate any problems related to common grounding.

Caution: Any difference in ground potential greater than 500 millivolts (0.5 volts) between two chassis connected by copper XIO cables can cause severe equipment damage and can create hazardous conditions.

The branch circuit wiring must have an insulated grounding conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors. The grounding conductor should be green, with or without one or more yellow stripes. This grounding or earthing conductor should be connected to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set. The power receptacles in the vicinity of the systems should all be of an earthing type, and the grounding or earthing conductors serving these receptacles should be connected to earth at the service equipment.

Cable Labels

A label kit for identifying Fibre Channel cable connectors is included in the Fibre Channel option board shipment. After identifying (and perhaps diagramming) all cable connections for your configuration, it is a good idea to label each end of each cable before attaching the cable. You can also use these labels to identify, for example, the FC option board that is connected to a particular Fibre Channel storage enclosure, fiber rack, fabric, or loop.