

FDDIXPress™ User's Guide for the PCI Local Bus

Document Number 007-3447-001

CONTRIBUTORS

Written by Paul Panish
Illustrated by Dany Galgani
Production by Michael Dixon
Engineering contribution by Premkumar Thoppae

© 1996, Silicon Graphics, Inc.— All Rights Reserved

The contents of this document may not be copied or duplicated in any form, in whole or in part, without the prior written permission of Silicon Graphics, Inc.

RESTRICTED RIGHTS LEGEND

Use, duplication, or disclosure of the technical data contained in this document by the Government is subject to restrictions as set forth in subdivision (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS 52.227-7013 and/or in similar or successor clauses in the FAR, or in the DOD or NASA FAR Supplement. Unpublished rights reserved under the Copyright Laws of the United States. Contractor/manufacturer is Silicon Graphics, Inc., 2011 N. Shoreline Blvd., Mountain View, CA 94043-1389.

Silicon Graphics, IRIS, Indigo, and the Silicon graphics logo are registered trademarks, and IRIX, and FDDIXPress are trademarks of Silicon Graphics, Inc. Indy is a registered trademark used under license in the U.S. and owned by Silicon Graphics, Inc., in other countries worldwide.

Contents

List of Figures v

List of Tables vii

Introduction ix

Product Support x

1. **Overview of FDDI** 1
 - The FDDI Dual Ring 1
 - The Token 1
 - The Frame 2
 - How Information Circulates on the Ring 2
 - Ways of Attaching to the Ring 2
 - Three PCI FDDIXPress Boards 3
 - The Optical Bypass Switch (OBS) 3
 - How the Rings Work 4
 - Installing the FDDI Driver 7
2. **The Single-Attachment Station (SAS) Boards** 9
 - A SAS Board With a MIC Receptacle 9
 - The Fiber-Optic Network Cable 10
 - The SAS/UTP Board 11
 - The UTP Network Cable 12
 - Connecting the SAS Board to a Concentrator 12
3. **The Dual-Attachment Station (DAS) Board** 15
 - Overview of the DAS Board 15
 - The Fiber-Optic Network Cables 17
 - Connecting the SC-to-MIC Cables 17
 - Connecting the DAS Board to the Dual-Ring Network 18

4.	The Optical Bypass Switch (OBS)	21
	Connecting the Optical Bypass Switch	21
5.	Verifying Functionality	25
	Reading the LEDs	25
	Network Interface Names for FDDIXPress	26
	Index	27

List of Figures

Figure 1-1	A Typical FDDI Network Configuration	4
Figure 1-2	FDDI Dual Ring With One Failed Station and No OBS	6
Figure 1-3	FDDI Dual Ring With One Failed Station Attached to an OBS	7
Figure 2-1	A SAS Board with a MIC Receptacle and the Fiber-Optic Network Cable	10
Figure 2-2	The SAS/UTP Board and the UTP Cable	11
Figure 3-1	A DAS Board With Adapter Cables	16
Figure 3-2	A Dual-Ring FDDI LAN	19
Figure 4-1	The Optical Bypass Switch	22

List of Tables

Table 2-1	RJ-45 Connector Pin Assignments	12
Table 4-1	Mini-DIN Connector Pinouts	23
Table 5-1	LED States	25

Introduction

Welcome to the world of fast communication with the PCI FDDI network connection for your workstation. FDDI can replace Ethernet as your network connection, or it can be used in addition to Ethernet.

The *Owner's Guide* that comes with your Silicon Graphics workstation provides instructions for installing the PCI boards into your system. The *FDDIXPress User's Guide* (this manual) describes the three FDDI boards that connect to the PCI local bus in your workstation and tells you how to connect your workstation to the FDDI network ring. No special knowledge or tools are required.

In addition to this user's guide, you might wish to consult the *FDDIXPress Administration Guide*, which describes station and software configurations. It also includes verification procedures for the FDDI connection and a glossary of FDDI terms.

To install the FDDI driver, install and read the FDDI release notes on the CD.

Chapter 1, "Overview of FDDI," introduces the FDDI dual-ring network and the three boards (SAS, SAS/UTP, and DAS) that you can use with your workstation. It also introduces the optical bypass switch (OBS).

Chapter 2, "The Single-Attachment Station (SAS) Boards," describes two types of the SAS board and tells you how to connect the boards to the network.

Chapter 3, "The Dual-Attachment Station (DAS) Board," describes the DAS board and tells you how to connect the board to the network.

Chapter 4, "The Optical Bypass Switch (OBS)," describes the installation of the optical bypass switch.

Chapter 5, "Verifying Functionality," tells you how to verify that you have installed the board properly and that it is functioning properly.

Product Support

Silicon Graphics[®], Inc., provides a comprehensive product support and maintenance program for its products. If you are in North America and would like support for your Silicon Graphics-supported products, contact the Technical Assistance Center at 1-800-800-4SGI or your authorized service provider. If you are outside North America, contact the Silicon Graphics subsidiary or authorized distributor in your country.

Overview of FDDI

Fiber Distributed Data Interface (FDDI) is a local area network (LAN) based on token-ring architecture. It offers high-performance communication between your workstation and the network. The name FDDIXPress includes both the hardware—the three boards described in this guide—and the software that is required to use them.

This chapter offers a basic description of the FDDI dual-ring network and the boards that connect your workstation to it.

The FDDI Dual Ring

The FDDI network consists of a group of stations connected in a ring using fiber-optic network cables. It is called a dual ring because there are actually two concentric rings, a primary ring and a secondary ring. Figure 1-1 on page 4 shows a typical FDDI network configuration. The information moves in one direction in the primary ring and in the opposite direction in the secondary ring. The two rings are therefore said to be *counterrotating*. Normally, the secondary ring is used as a backup ring in case of failure of one or more stations.

Two types of information flow through the ring:

- the token
- the frame

The Token

The token is a signal that permits the station through which it is passing to place information onto the network. When a station receives the token, the station checks to see if it has anything to transmit. If it does, it grabs the token, transmits the information (the *frame*) onto the network, and releases the token.

If it has nothing to transmit, it simply releases the token to the next station on the ring.

The Frame

As mentioned parenthetically above, the frame is the set of information that a station passes onto the network.

How Information Circulates on the Ring

When a station receives a frame that is not addressed to it, it passes the frame along to its downstream neighbor. When a station receives a frame that is addressed to it, it copies the frame into its memory, then forwards the frame along the cable to its downstream neighbor.

When the station that originated the frame receives that frame back, the station strips the frame off the network. Only the station that originated the frame can do this.

Ways of Attaching to the Ring

There are two basic kinds of attachments to the ring:

- single-attachment stations (SAS)
- dual-attachment stations (DAS)

The single-attachment station (SAS) has only one connector; it can therefore be attached only to one ring. Normally, however, the SAS is connected to a concentrator, which may be a dual-attachment concentrator (DAC) or a single-attachment concentrator (SAC). The concentrator can accommodate many SAS attachments, and is itself attached to one ring or two rings, depending on whether it is a SAC or a DAC. For more information, see Chapter 2, "The Single-Attachment Station (SAS) Boards."

The dual-attachment station (DAS) is attached to both the primary and the secondary ring. The DAS board contains two connectors, one for each ring. For more information, see Chapter 3, "The Dual-Attachment Station (DAS) Board."

Three PCI FDDIXPress Boards

There are three PCI FDDIXPress boards that you can obtain from Silicon Graphics. All three boards conform to the PCI Local Bus Specification, Rev. 2.0:

- The DAS board, which contains two small-configuration (SC) receptacles. This board comes with two SC-to-MIC adapter cables.
- A SAS board with a MIC receptacle.
- A SAS board with an RJ-45 jack.

For information on the SAS boards and how they connect to the ring, see Chapter 2, “The Single-Attachment Station (SAS) Boards.”

For information on the DAS board and how it connects to the ring, see Chapter 3, “The Dual-Attachment Station (DAS) Board.”

The Optical Bypass Switch (OBS)

The optical bypass switch (OBS) is a device (also available from Silicon Graphics) that is installed between the DAS board and the network. Its job is to allow the information to bypass a failed station.

For information on installing and using the OBS, see Chapter 4, “The Optical Bypass Switch (OBS).”

How the Rings Work

Figure 1-1 shows a typical FDDI network configuration.

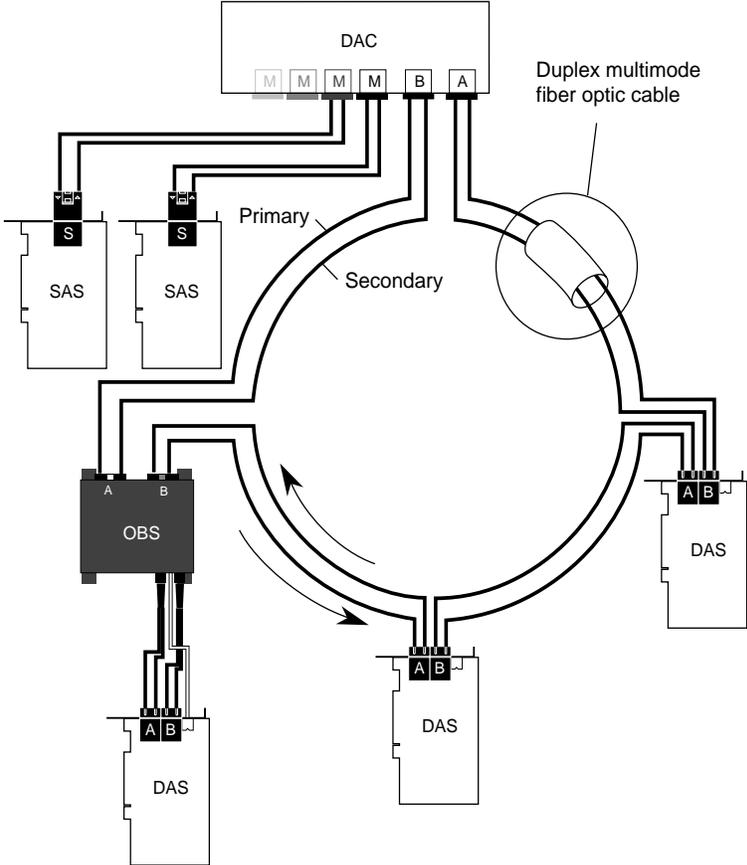


Figure 1-1 A Typical FDDI Network Configuration

The objects labeled “DAS” represent workstations that are attached to both rings by means of a DAS board. Note that one of them has an OBS that is installed between the board and the network.

In addition, there is a DAC (dual-attachment concentrator) to which several stations with SAS boards are attached.

Note: Although the duplex fiber-optic cable is represented as two widely separated rings, it is a single cable made up of two fibers.

Figure 1-2 shows what happens when one of the stations fails. In this case, the station that failed is connected directly to the rings without the interposition of an OBS. Notice that the two separate rings now loop back (wrap) through the stations that are upstream and downstream from the failed station. The two rings have now become one ring, and information keeps flowing, although the failed station is isolated.

This shows the advantage of the dual-ring configuration. If this were a single ring, all communication would have stopped when one station failed.

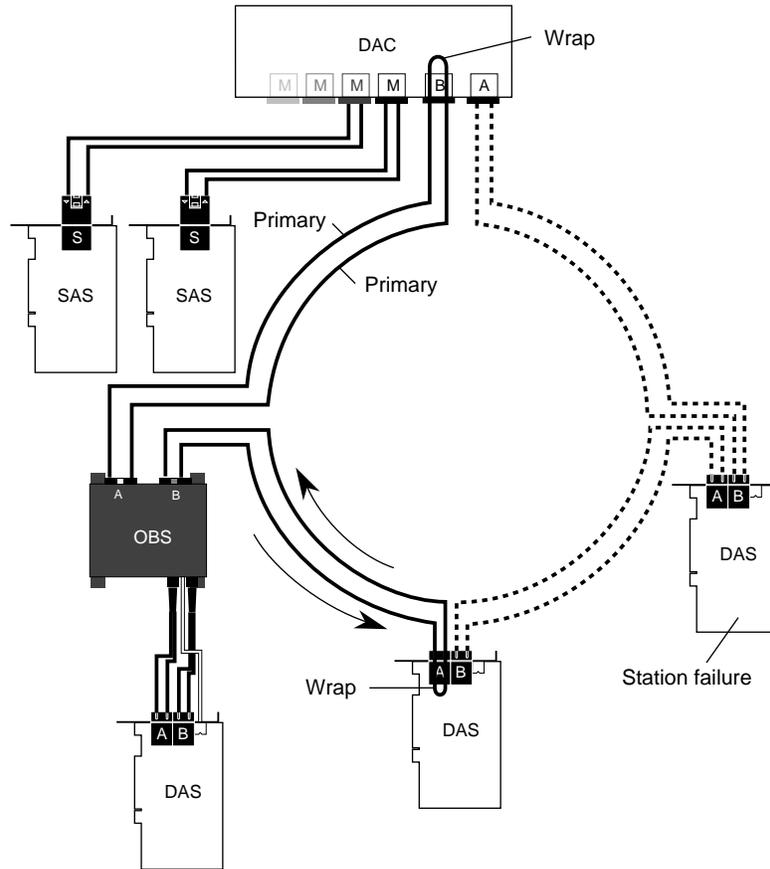


Figure 1-2 FDDI Dual Ring With One Failed Station and No OBS

Figure 1-3 shows what happens when the station with the OBS fails. In this case, the information keeps flowing through the OBS, unaffected by the failed station. The failed station is isolated, but no wrapping occurs and both rings are preserved.

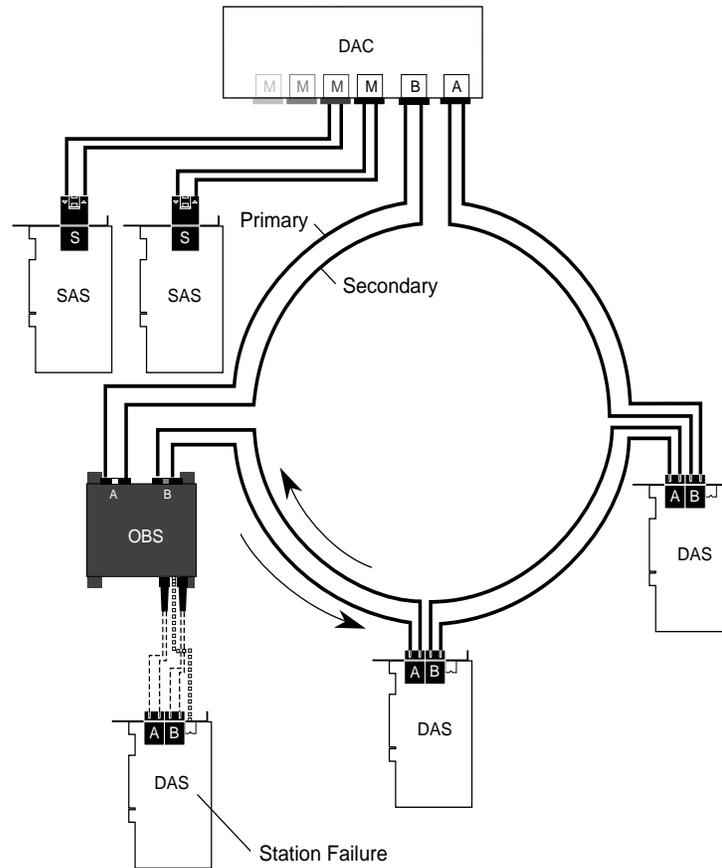


Figure 1-3 FDDI Dual Ring With One Failed Station Attached to an OBS

This becomes critical when there is a larger ring with many stations and more than one station fails. If there are no OBSs, failures in different parts of the ring can cause the ring to fragment into isolated networks.

Installing the FDDI Driver

For instructions on installing the FDDI driver, install and read the FDDI release notes on the CD.

The Single-Attachment Station (SAS) Boards

As mentioned in Chapter 1 (see “Three PCI FDDIXPress Boards” on page 3), there are two kinds of SAS boards: the SAS with a media interface connector (MIC) that connects to a concentrator through a fiber-optic network cable and the SAS/UTP that connects to a concentrator through an unshielded twisted-pair cable.

A SAS Board With a MIC Receptacle

A SAS board that contains a MIC receptacle is shown in Figure 2-1. The figure also shows the fiber-optic network cable needed to connect the board to the network.

The illustration shows a rubber dust plug that fits over the MIC receptacle. To remove the dust plug, grasp the two tabs on the plug and pull.

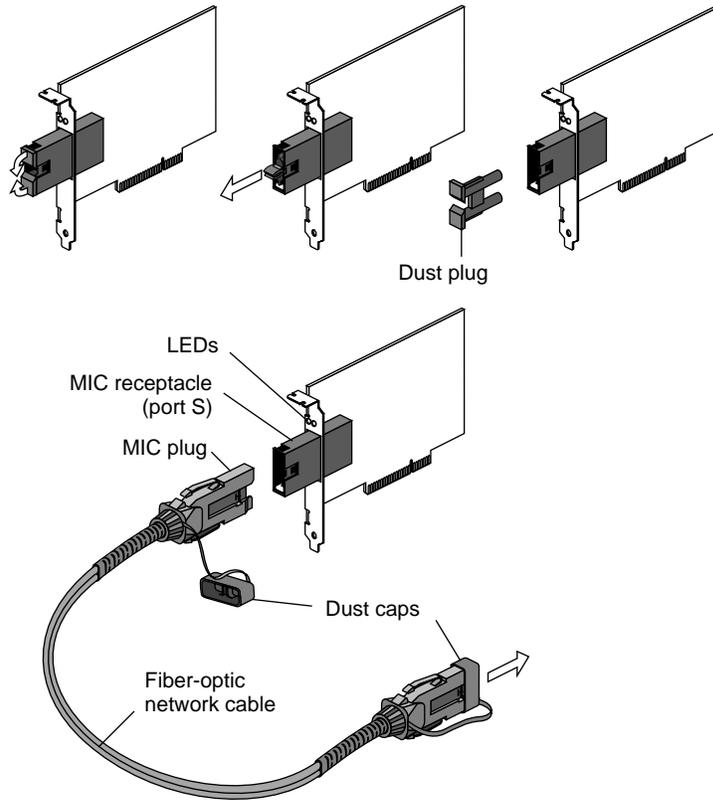


Figure 2-1 A SAS Board with a MIC Receptacle and the Fiber-Optic Network Cable

The Fiber-Optic Network Cable

The fiber-optic network cable connects the SAS board to a concentrator. The cable (which is not supplied by Silicon Graphics) must be a 62.5/125- μm multimode duplex cable with a media interface connector (MIC) plug at each end.

Network cables come with colored keys, which are sometimes on the dust cap of the MIC plug. The keys help prevent cabling errors. By default, both MIC plugs on the cable are keyed S (that is, no key). Key the plug at one end of the cable M (often color coded green).

The S-keyed MIC plug mates with an S-keyed MIC receptacle, and the M-keyed MIC plug mates with an M-keyed MIC receptacle.

Fiber-optic network cables must be less than 2 kilometers long.

The SAS/UTP Board

The SAS/UTP board is shown in Figure 2-2. It has an RJ-45 jack and connects to a concentrator by means of an unshielded twisted pair (UTP) network cable.

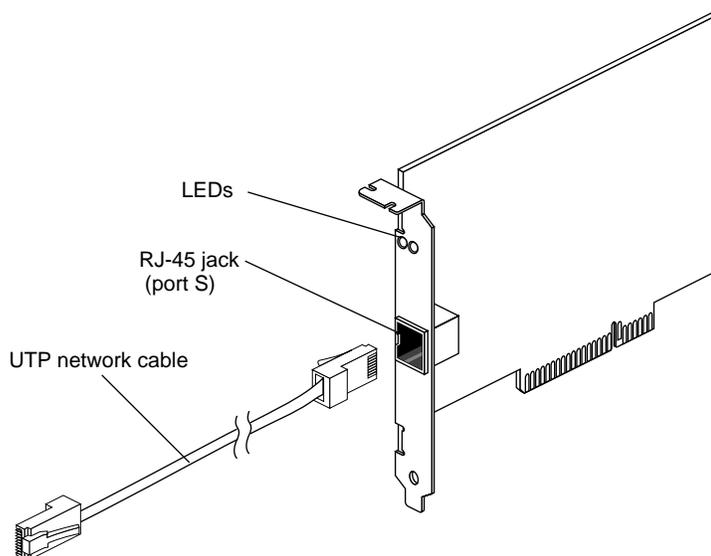


Figure 2-2 The SAS/UTP Board and the UTP Cable

The UTP Network Cable

The UTP network cable (which is not supplied by Silicon Graphics) is a category-5 cable with phone-style RJ-45 connectors on both ends. The pin descriptions for the RJ-45 connector are shown in Table 2-1.

Table 2-1 RJ-45 Connector Pin Assignments

RJ-45 Plug Pin Number	Assignment
1	TRANSMIT+
2	TRANSMIT-
3	Not used
4	Not used
5	Not used
6	Not used
7	RECEIVE+
8	RECEIVE-

Connecting the SAS Board to a Concentrator

Connect the SAS or the SAS/UTP board to the concentrator as follows.

1. Remove the dust plugs from the connector on the board and the dust caps from the cables.

Caution: Do not touch the fiber-optic material exposed at the ends of the cable. If the cables are not connected, do not leave the cable ends uncapped. Performance of the fiber-optic cable can seriously degrade from grease or dust.

2. Insert the S-keyed MIC plug of the fiber-optic network cable into the board's MIC receptacle. Push to snap the two together.

If you are using a SAS/UTP board, plug one end of the UTP cable into the RJ-45 jack on the SAS board.

3. Insert the M-keyed MIC plug of the fiber-optic network cable into the M-keyed MIC receptacle on the concentrator and push to snap the two together.

If you are using a SAS/UTP board, plug the other end of the UTP cable into the RJ-45 connector on the concentrator.

Figure 3-2 on page 19 shows the connection of a SAS board with a MIC and a SAS/UTP board to a concentrator.

The Dual-Attachment Station (DAS) Board

Overview of the DAS Board

The dual-attachment station (DAS) is a single media access control (MAC) device. A single MAC device can receive frames addressed to itself or originate network traffic on one ring only. It repeats information from its upstream neighbor to its downstream neighbor on the second ring.

The DAS board has two small-configuration (SC) receptacles. Two SC-to-MIC adapter cables (banded together) are provided to convert SC receptacles to MIC receptacles.

Figure 3-1 shows the DAS board, the SC receptacles on the board, and two SC-to-MIC cables. It also shows the dust plugs that cover the SC receptacles on the board, the SC plugs on the cable, and the MIC receptacles on the cable.

The SC receptacles on the board come with rubber dust caps over them. Remove these dust caps so you can plug in the SC-to-MIC cables.

The SC plugs come with small black dust caps placed directly over the fibers. Hold the dust caps at the very tip with your thumb and index finger, then *gently* pull the caps off.

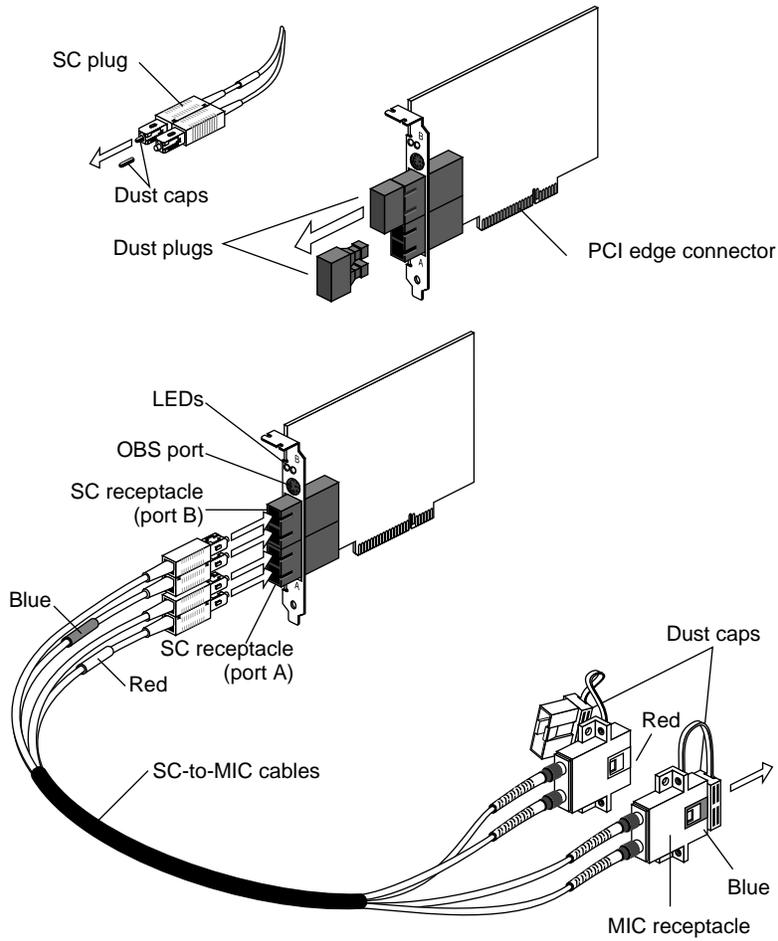


Figure 3-1 A DAS Board With Adapter Cables

Figure 3-1 shows that in addition to two SC receptacles, the board has a small, round DIN connector for the cable from the OBS. This is described in Chapter 4, “The Optical Bypass Switch (OBS).”

The Fiber-Optic Network Cables

Two fiber-optic network cables connect the DAS to its upstream and downstream neighbors. The network cable (which is not supplied by Silicon Graphics) must be a 62.5/125- μm multimode duplex cable with a media interface connector (MIC) plug at each end. (See Figure 2-1 on page 10.)

Network cables come with colored keys, which are sometimes on the dust cap of the MIC plug. The keys help prevent cabling errors. By default, both MIC plugs on the cable are keyed S (that is, no key).

Key the plug at one end of the cable A (often color coded red), and key the plug at the other end of the cable B (often color coded blue). The A-keyed MIC plug mates with an A-keyed MIC receptacle, and the B-keyed MIC plug mates with a B-keyed MIC receptacle.

Fiber-optic network cables must be less than 2 kilometers long.

Connecting the SC-to-MIC Cables

The cables that you plug into the board's SC connectors are color coded, as shown in Figure 3-1. The SC receptacle that is closest to the bottom of the board (the edge with the PCI connector) has the letter A near it, and the upper SC receptacle closer to the LEDs has the letter B near it. These identifications are vital. The two letters are not easy to see once the board has been installed.

Always use the cable with the red band for the A receptacle on the board and the cable with the blue band for the B receptacle on the board.

1. Remove the dust caps from the connectors on the board and on the cables.

Caution: Do not touch the fiber exposed at the ends of the FDDI cables. If the cables are unplugged, do not leave the cable ends uncapped. Performance of the fiber-optic cable can seriously degrade due to grease or dust.

2. Insert the SC plug of the SC-to-MIC cable with the red band into the SC receptacle marked A on the board. Push to snap the two together.
3. Insert the SC plug of the SC-to-MIC cable with the blue band into the board's SC receptacle labeled B. Push to snap the two together.

4. Install the optical bypass switch (optional) if one was ordered for this station. For instructions, see Chapter 4, "The Optical Bypass Switch (OBS)."

For instructions on how the DAS is connected to the dual-ring network, see the next section, "Connecting the DAS Board to the Dual-Ring Network."

Connecting the DAS Board to the Dual-Ring Network

You have performed steps 1 through 3 above to plug the SC-to-MIC cables into the board.

1. Connect the fiber-optic network cables to the MIC end of the SC-to-MIC cables as follows:
 - Insert the A-keyed MIC plug of the first fiber-optic network cable into the A-keyed MIC receptacle of the SC-to-MIC cable.
 - Insert the B-keyed MIC plug of the second fiber-optic network cable into the B-keyed MIC receptacle of the other SC-to-MIC cable.
2. Connect the other end of the fiber-optic network cables to the upstream and downstream stations as follows:
 - Insert the B-keyed MIC plug of the first fiber-optic network cable into the B-keyed MIC receptacle of the upstream station.
 - Insert the A-keyed MIC plug of the second fiber-optic network cable into the A-keyed MIC receptacle of the downstream station.

Figure 3-2 shows the DAS board connected to a dual ring FDDI LAN.

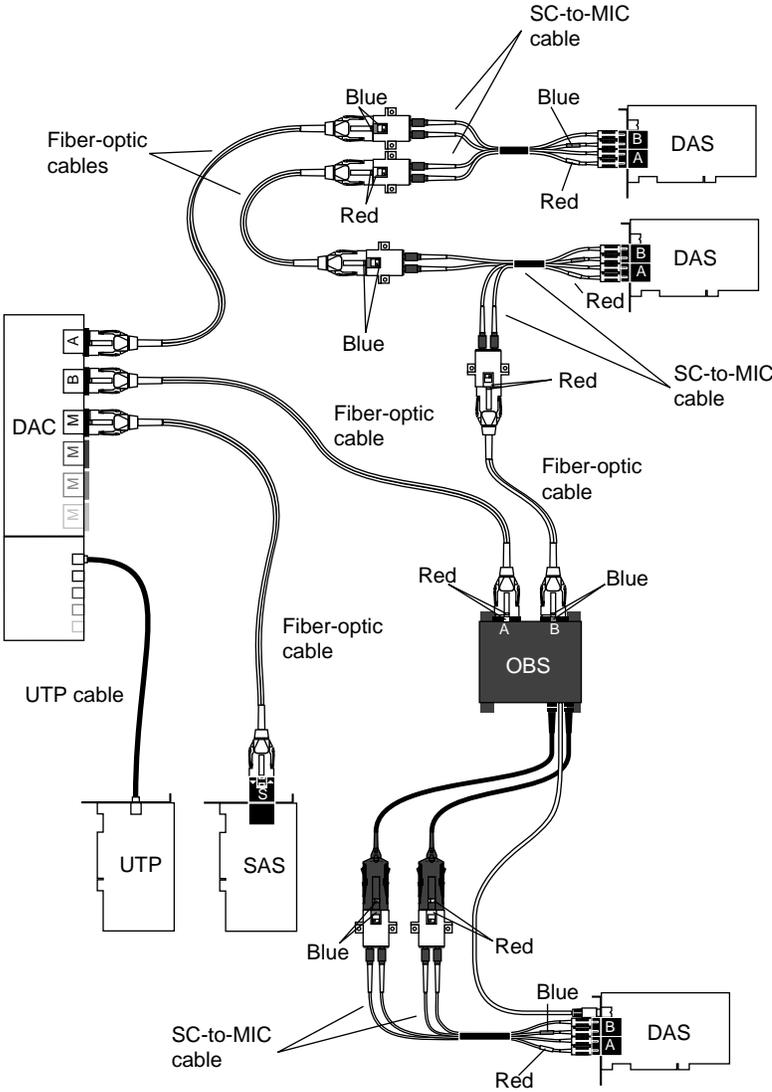


Figure 3-2 A Dual-Ring FDDI LAN

The Optical Bypass Switch (OBS)

The optical bypass switch (OBS) is a device that is installed between the DAS board and the network. Its job is to allow the information to bypass a failed station.

Connecting the Optical Bypass Switch

To use the OBS, connect it to the workstation's DAS board. It is for use only with the DAS board.

Caution: If you have optical bypass switches connected to all or most of the workstations in the ring, and if four contiguous workstations with OBSs fail, the switches use enough energy to degrade the performance of the network.

The OBS has two projecting cables with MIC plugs. On the same side of the switch there is a projecting cable with a 6-pin Mini-DIN connector (see Figure 4-1). On the opposite side of the switch there are two MIC receptacles (not shown in Figure 4-1).

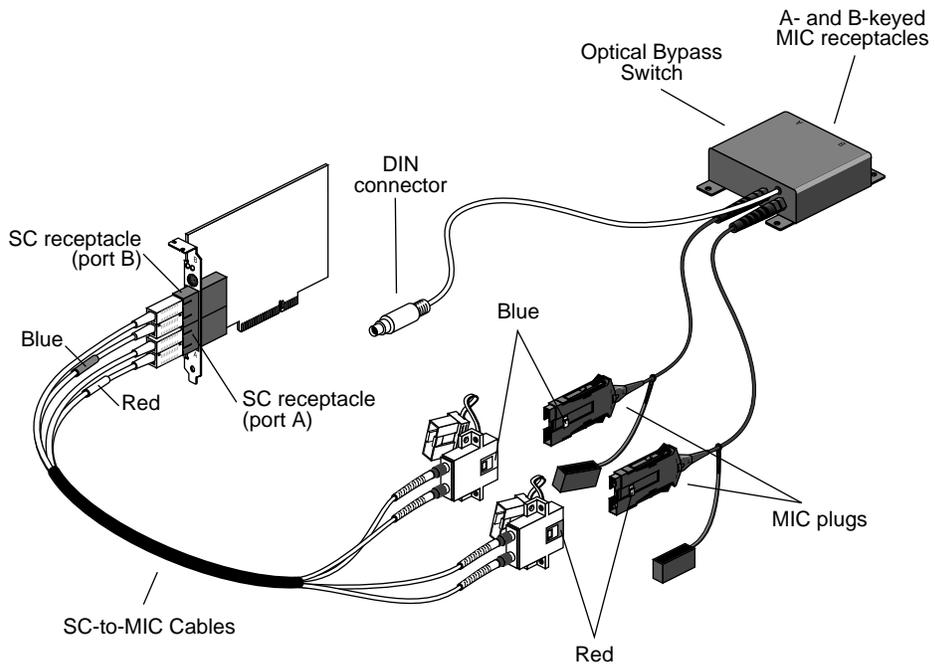


Figure 4-1 The Optical Bypass Switch

Before you follow the directions below, be sure that you understand how the two SC connectors on the DAS board are connected to the network. Review Chapter 3, “Connecting the SC-to-MIC Cables” carefully.

To install the OBS, follow these steps:

1. Insert the OBS’s A-keyed MIC plug into the A-keyed MIC receptacle on one of the SC-to-MIC cables.
2. Insert the OBS’s B-keyed MIC plug into the B-keyed MIC receptacle of the other SC-to-MIC cable.
3. Connect the OBS’s mini-DIN cable to the mini-DIN connector on the board.

4. Connect the fiber-optic network cables to the MIC receptacles on the OBS as follows. (See “The Fiber-Optic Network Cables” on page 17 for more information on the fiber-optic network cables.)
 - Insert the A-keyed MIC plug of the first fiber-optic network cable into the A-keyed MIC receptacle on the OBS.
 - Insert the B-keyed MIC plug of the second fiber-optic network cable into the B-keyed MIC receptacle on the OBS.
5. Connect the other end of the fiber-optic network cables to the upstream and downstream stations as follows:
 - Insert the B-keyed MIC plug of the first fiber-optic network cable into the B-keyed MIC receptacle of the upstream station.
 - Insert the A-keyed MIC plug of the second fiber-optic network cable into the A-keyed MIC receptacle of the downstream station.

Figure 3-2 on page 19 shows the connection of an OBS to the network.

Table 4-1 shows the pinouts for the mini-DIN connector.

Table 4-1 Mini-DIN Connector Pinouts

Pin	Signal	Description
1, 2	VCC	+5V power (fused)
3	PRIEN*	PRIMARY ENABLE When low, enables primary ring insertion.
4	SECEN*	SECONDARY ENABLE When low, enables secondary ring insertion.
5	GND	GROUND Logic ground, +5V return
6	RELAY*	When low, indicates that OBS is installed.

Verifying Functionality

Reading the LEDs

The FDDIXPress boards have two small light-emitting diodes (LEDs) that can be seen through their I/O panels. After turning on the system, the green LED should be on.

Table 5-1 describes the meanings of the various combinations of LED readings.

Table 5-1 LED States

Yellow LED	Green LED	Board Status	Bit 0	Bit 1	Description
Off	Off	Failure	0	0	The adapter is not functional or the driver is not loaded.
Off	On	Ring is operating	0	1	Normal operation. For DAS, both A and B ports are in Thru B configuration. For SAS, the S port is in Wrap S configuration.
On	Off	Cable error	1	0	The adapter is not able to connect. There might be a cable problem.
On	On	Ring operation/ Wrapped	1	1	This is normal operation for a DAS board only. A or B port is in Wrap A or Wrap B configuration. No meaning is assigned to this combination of LED statuses for SAS.

Network Interface Names for FDDIXPress

The network interface name for the FDDIXpress PCI board is *rns#*, where # is 0 for the first board, 1 for the second board (if installed), and so on.

You can use the commands in the examples shown below to display the network interface names.

- To verify that the operating system has located the FDDIXPress board, use this command:

```
%/bin/hinv
```

The response should be something like the following:

```
RNS 2200 PCI/FDDI controller: rns#, version 3
```

Instead of the # symbol, the board number is displayed.

If a line resembling this does not appear, you may have to reseal the FDDIXPress board.

Refer also to the `hinv(1M)` man page for details.

- To verify that the network interface is configured properly and is enabled, use this command:

```
%/usr/etc/netstat -ia
```

The response should be something like the following:

```
Name MTU Network Address
```

Under the `Name` column, the *rns* number should appear. If it is followed by an asterisk (*), there is a problem; for example, the software might not be installed.

Under the `MTU` column, the number 4352 should appear.

Under the `Network` column, the IP network address should appear.

Under the `Address` column, something like the following should appear: `00:00:bc:0e:0e:52`. This is the canonical MAC address of the FDDIXPress board. The first three sets of numbers (for example `00:00:bc`) are the Organizationally Unique Identifier (OUI) of the board vendor. The last three sets may differ on your workstation.

Refer also to the `netstat(1)` man page for more details.

Index

C

- cable for dual ring, 1
- cables
 - color coding (DAS board), 17, 18, 23
 - color coding (SAS board), 10, 17
- concentrator
 - dual attachment (DAC), 2
 - SAS connected to, 2
 - single attachment (SAC), 2

D

- DAC (dual-attachment concentrator), 2
- DAS
 - definition
- DAS board
 - color coding cables, 17, 18, 23
 - connecting, 17-19
 - overview, 15-16
- DIN relay connector pinouts, 23
- driver, installing, ix
- dual attachment, See DAS
- dual ring
 - functioning, 2
 - how it functions, 4-7

F

- FDDI
 - definition, 1
 - installing driver, ix
- frame
 - definition, 2
- functionality of boards
 - verifying, 25

I

- installing the FDDI driver, ix

L

- LED readings, 25

M

- MAC device, 15
- media access control (MAC) device, 15
- media interface connector
 - See MIC connector
- MIC connector
 - on SAS board, 9
- MIC receptacle, 3

- N**
 - network cable, 10, 17
 - network interface names, 26

- O**
 - OBS
 - definition, 21
 - installation, 21-23
 - optical bypass switch
 - See* OBS
 - optical bypass switch, *See* OBS

- P**
 - product support, x

- R**
 - RJ-45 connector pin assignments, 12
 - RJ-45 jack, 3, 11

- S**
 - SAC (single-attachment concentrator), 2
 - SAS board, 10
 - color coding cables, 17
 - connecting to concentrator, 2
 - definition
 - with MIC connector, 9
 - SAS/UTP board
 - definition
 - single attachment, *See* SAS board
 - support for product, x

- T**
 - technical support, x
 - token
 - definition, 1

- U**
 - unshielded twisted-pair cable, *See* UTP cable
 - UTP cable, 12

- V**
 - verification
 - network interface is properly configured and enabled, 26
 - operating system has located FDDIXPress board, 26
 - verifying functionality of boards, 25

We'd Like to Hear From You

As a user of Silicon Graphics documentation, your comments are important to us. They help us to better understand your needs and to improve the quality of our documentation.

Any information that you provide will be useful. Here is a list of suggested topics to comment on:

- General impression of the document
- Omission of material that you expected to find
- Technical errors
- Relevance of the material to the job you had to do
- Quality of the printing and binding

Please include the title and part number of the document you are commenting on. The part number for this document is 007-3447-001.

Thank you!

Three Ways to Reach Us



The **postcard** opposite this page has space for your comments. Write your comments on the postage-paid card for your country, then detach and mail it. If your country is not listed, either use the international card and apply the necessary postage or use electronic mail or FAX for your reply.



If **electronic mail** is available to you, write your comments in an e-mail message and mail it to either of these addresses:

- If you are on the Internet, use this address: techpubs@sgi.com
- For UUCP mail, use this address through any backbone site:
[your_site]!sgi!techpubs



You can forward your comments (or annotated copies of manual pages) to Technical Publications at this **FAX** number:

415 965-0964