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FX200 Hardware Reference for Dual-Channel PCI and PMC Cards

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CE

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TABLE OF CONTENTS

1. INTRODUCTION 1-1
- 1.1 How To Use This Manual 1-1
  - 1.1.1 Purpose 1-1
  - 1.1.2 Scope 1-1
  - 1.1.3 Style Conventions 1-1
- 1.2 Related Information 1-1
- 1.3 Quality Assurance 1-2
- 1.4 Technical Support 1-3
- 1.5 Ordering Process 1-3

2. PRODUCT OVERVIEW 2-1
- 2.1 Overview 2-1
- 2.2 Product Ruggedization Levels 2-1
  - 2.2.1 Standard 2-2
  - 2.2.2 Rugged 1 2-2
  - 2.2.3 Rugged 2 2-2
- 2.3 FX200 DC PCI Card 2-3
  - 2.3.1 Card Features 2-3
- 2.4 FX200 DC PMC Card 2-4
  - 2.4.1 Card Features 2-4
- 2.5 Host PCI Interface 2-5
- 2.6 FX200 DC Card Interfaces 2-5
  - 2.6.1 Host Bus Interface 2-5
  - 2.6.2 Fibre Channel Interface 2-5
  - 2.6.3 SFF Media Options 2-6
- 2.7 Functional Blocks 2-6
  - 2.7.1 PCI/PMC Connectors 2-7
  - 2.7.2 +5 V to +3.3 V Regulator 2-7
  - 2.7.3 JNIC-1560 ASIC 2-7
  - 2.7.4 Synchronous SRAM 2-7
  - 2.7.5 Serial EEPROM (SEEPROM) 2-7
  - 2.7.6 Serializer/Deserializer (SERDES) 2-7
  - 2.7.7 Fibre Channel Physical Media Interface 2-7
  - 2.7.8 Status LEDs 2-7
- 2.8 Fibre Channel Applications 2-9
- 2.9 Topologies 2-10
  - 2.9.1 Point-to-Point Connection 2-10
  - 2.9.2 Arbitrated Loop Without Hub 2-12
  - 2.9.3 Arbitrated Loop With Hub 2-14
- 2.10 Accessories 2-16
  - 2.10.1 Software Drivers 2-16
  - 2.10.2 LinkXchange LX2500 Crossbar Switch (LX2500) 2-16
  - 2.10.3 Cables 2-16

3. INSTALLATION 3-1
- 3.1 Overview 3-1
- 3.2 Unpack the Card 3-1
- 3.3 Inspect the Card 3-1
- 3.4 Install the Card 3-2
  - 3.4.1 Install the DC PCI Card 3-2
  - 3.4.2 Install the DC PMC Card 3-3
- 3.5 Connect the Cables 3-4
  - 3.5.1 Fiber-Optic Cable 3-4
  - 3.5.2 HSSDC Copper Cables 3-5
- 3.6 Memory Map 3-6
- 3.7 Activate the Card 3-6
- 3.8 Troubleshooting 3-6
- 3.9 Maintenance 3-6

APPENDICES

A: SPECIFICATIONS A-1
B: ORDERING INFORMATION B-1
GLOSSARY GLOSSARY-1
INDEX INDEX-1

FIGURES

Figure 2-1 FX200 DC PCI 2-3
Figure 2-2 FX200 DC PMC 2-4
Figure 2-3 FX200 Block Diagram 2-6
Figure 2-4 FX200 DC PMC Front Panel 2-8
Figure 2-5 Point-to-Point Connection 2-10
Figure 2-6 Point-to-Point Connection to a single Fibre Channel Disk Drive 2-11
Figure 2-7 Point-to-Point Connections to Two FC Disk Drives 2-11
Figure 2-8 Two-Node Arbitrated Loop without Hub 2-12
Figure 2-9 Arbitrated Loop without Hub 2-13
Figure 2-10 Arbitrated Loop with Hub 2-14
Figure 2-11 Arbitrated Loop with Hub, with Node 4 Off-Line 2-15
Figure 3-1 FX200 PCI Card Installation 3-2
Figure 3-2 FX200 DC PMC Card Installation 3-3
Figure 3-3 Mechanical Dimensions of FX200 DC PMC 3-4
Figure 3-4 Fiber-Optic Simplex LC Connector 3-5
Figure 3-5 Fiber-Optic Duplex LC Connector 3-5
Figure 3-6 HSSDC Copper Connector 3-5
Figure 3-7 HSSDC Connector Pin Assignment 3-5

TABLES

Table 3-1 HSSDC Receptacle Pin Assignments 3-5

1. INTRODUCTION

1.1 How To Use This Manual

1.1.1 Purpose

This manual describes how to install, set up, and run the FibreXpress FX200 Dual-Channel (DC) cards.

1.1.2 Scope

The information in this manual is intended for information systems personnel, system coordinators, or highly skilled network users. You need at least a systems-level understanding of general computer processing, memory, and hardware operation to effectively use this manual.

1.1.3 Style Conventions

- Called functions are italicized. For example, *OpenConnect()*
- Data types are italicized. For example, *int*
- Function parameters are bolded. For example, **Action**
- Path names are italicized. For example, *utility/sw/cfg*
- File names are bolded. For example, **config.c**
- Path file names are italicized and bolded. For example, ***utility/sw/cfg/config.c***
- Hexadecimal values are written with a "0x" prefix. For example, 0x7e
- For signals on hardware products, a signal name with a slash (/) prefix represents an 'Active Low.' For example, /SYNC
- Code and monitor screen displays of input and output are boxed and indented on a separate line. Text that represents user input is bolded. Text that the computer displays on the screen is not bolded. For example:

```
C:\ls
file1          file2              file3
```

- Large samples of code are Courier font, at least one size less than context, and are usually on a separate page or in an appendix.

1.2 Related Information

- ANSI Z136.2-1988 American National Standard for the Safe Use of Optical Fiber Communication Systems Using Laser Diode and LED Sources.
- Draft Standard for a Common Mezzanine Card Family: CMC; IEEE P1386, Draft 2.0, April 4, 1995.
- Draft Standard Physical and Environmental Layers for PCI Mezzanine Cards: PMC, IEEE P1386.1, Draft 2.0, April 4, 1995.
- Fibre Channel Arbitrated Loop (FC-AL) Specification, Revision 4.5, June 1995; Produced by the ANSI X3T9.3 standards group.
- Fibre Channel Fabric Generic Requirements (FC-FG) Specification, Revision 2.0, October 12, 1993; Produced by the ANSI X3T9.3 standards group.

- Fibre Channel Physical and Signaling Interface (FC-PH), Revision 4.3, June 1, 1994; Produced by the ANSI X3T9.3 standards group.
- Fibre Channel Physical and Signaling Interface-2 (FC-PH-2), Revision 7.3, January 5, 1996; Produced by the ANSI X3T11 standards group.
- Fibre Channel Physical and Signaling Interface-3 (FC-PH-3), Revision 8.6, April, 1996; Produced by the ANSI X3T11 standards group.
- IEC 825-1984 Radiation Safety of Laser Products, Equipment Classification, Requirements, and User's Guide, 2 parts, 1993.
- *Fibre Channel, A Technical Overview* – available from Systran.
- Small Form-factor Pluggable (SFP) MultiSource Agreement (MSA) INF-8074i, Revision 1.0, May 12, 2001, SFF Committee - http://www.sffcommittee.org/ie/Specifications.html
- *Small Form Factor Transceiver Multisource Agreement* (SFF MSA), July 5, 2000
- CERN Fibre Channel Homepage – www.cern.ch/HSI/fcs/fcs.html
- JNI Corp. – www.jni.com
- Medusa Labs – www.medusalabs.com
- PCI Special Interest Group – www.pcisig.com
- Systran Corp. – www.systran.com
- T11 Home page - www.t11.org
- University of New Hampshire Interoperability Lab – www.iol.unh.edu

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Systran's Quality System conforms to the ISO 9001 international standard for quality systems. ISO 9001 is the model for quality assurance in design, development, production, installation and servicing. The ISO 9001 standard addresses all 20 clauses of the ISO quality system, and is the most comprehensive of the conformance standards.

Our Quality System addresses the following basic objectives:

- Achieve, maintain and continually improve the quality of our products through established design, test, and production procedures.
- Improve the quality of our operations to meet the needs of our customers, suppliers, and other stakeholders.
- Provide our employees with the tools and overall work environment to fulfill, maintain, and improve product and service quality.
- Ensure our customer and other stakeholders that only the highest quality product or service will be delivered.

The British Standards Institution (BSI), the world's largest and most respected standardization authority, assessed Systran's Quality System. BSI's Quality Assurance division certified we meet or exceed all applicable international standards, and issued Certificate of Registration, number FM 31468, on May 16, 1995. The scope of Systran's registration is: "Design, manufacture and service of high technology hardware and software computer communications products." The registration is maintained under BSI QA's bi-annual quality audit program.

Customer feedback is integral to our quality and reliability program. We encourage customers to contact us with questions, suggestions, or comments regarding any of our products or services. We guarantee professional and quick responses to your questions, comments, or problems.

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Technical documentation is provided with all of our products. This documentation describes the technology, its performance characteristics, and includes some typical applications. It also includes comprehensive support information, designed to answer any technical questions that might arise concerning the use of this product. We also publish and distribute technical briefs and application notes that cover a wide assortment of topics. Although we try to tailor the applications to real scenarios, not all possible circumstances are covered.

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- World Wide Web address: www.systran.com

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2. PRODUCT OVERVIEW

2.1 Overview

The FX200 Dual-Channel (DC) cards belong to Systran's family of FibreXpress (FX) products. The FX200 DC cards are high-performance host bus adapters (HBA) that are ideal for data-intensive applications. This unique design provides support for SCSI Fibre Channel Protocol (FCP) and Internet Protocol (IP), eliminating the need to deal directly with the FC interface. In addition, the FX200 DC cards feature two separate high-performance RISC I/O engines to minimize host CPU overhead. The superior communication and interconnect capabilities of the FC standard are maximized by Systran's FX200 DC cards.

The FX200 DC cards incorporate the functionality of two independent FC 2.125 Gbps channels on a single HBA. This compact design minimizes the number of required host computer slots, while providing the performance of two separate HBAs. As a result, an efficient Fibre Channel (FC) system is established using only a minimal number of Single Board Computers (SBC) or PCI slots.

Each channel on the FX200 DC card is capable of sustaining a 200 MBps transfer rate, and up to 400 MBps transfer rate in full duplex, thus achieving 800 MBps in combined throughput. In addition, both channels on the FX200 card support 1.0625 Gbps and the 2.125 Gbps rates, automatically detecting and switching to the appropriate rate using Auto-Speed Negotiation. This feature enables the FX200 cards to interoperate with existing FC devices at 1.0625 Gbps, and provides seamless transition to higher performance 2.125 Gbps devices.

The physical media interface of the FX200 DC products is the Small Form Factor (SFF) transceiver. The SFF transceivers are soldered to the card and are not removable. This secure connection is utilized for rugged operating environments. The following sections list the type of physical media interface supported on each FX200 DC product.

The specifications for the FX200 DC cards are described in Section A.1 of Appendix A. The specifications of the physical media interface are contained in Section A.3 of Appendix A.

FX200 software drivers are available for the FX200 card. The FX200 software drivers support several protocols under a variety of popular operating environments. These drivers are continually being developed at Systran. Contact Systran for more information concerning which versions and platforms of the FX200 drivers are currently supported. This manual does not address driver installation or interface. Refer to the appropriate software driver manual for information on installation and use of the software drivers.

2.2 Product Ruggedization Levels

The FX200 DC cards are offered at three different ruggedization levels. Each ruggedization level is organized to address different operational applications. These levels are defined below.

Standard and ruggedized environmental conditions are defined in Appendix A. Current FX200 DC standard and ruggedized cards are listed in Appendix B.

2.2.1 Standard

FX200 DC cards designed to meet this level are intended for use in sheltered, benign environments such as laboratories or light commercial office applications. They use readily available components and require normal convection airflow for proper cooling. No special environmental design or manufacturing processes are required.

2.2.2 Rugged 1

Rugged 1 FX200 DC cards are designed for the temperatures, vibrations, and shocks typically found in light to moderate industrial applications. Conformal coating is applied to protect the product from the effects of high humidity and other aggressive components in the atmosphere such as salt and sand.

2.2.3 Rugged 2

Rugged 2 FX200 DC cards are designed for the extended temperatures, vibrations, and shocks typically found in heavy industrial and some military applications. The same conformal coating requirements for Rugged 1 apply to Rugged 2.

2.3 FX200 DC PCI Card

Systran's FibreXpress FX200 DC PCI card is an ANSI-Standard card for FC communications on host nodes. Figure 2-1 shows the FX200 DC PCI card.

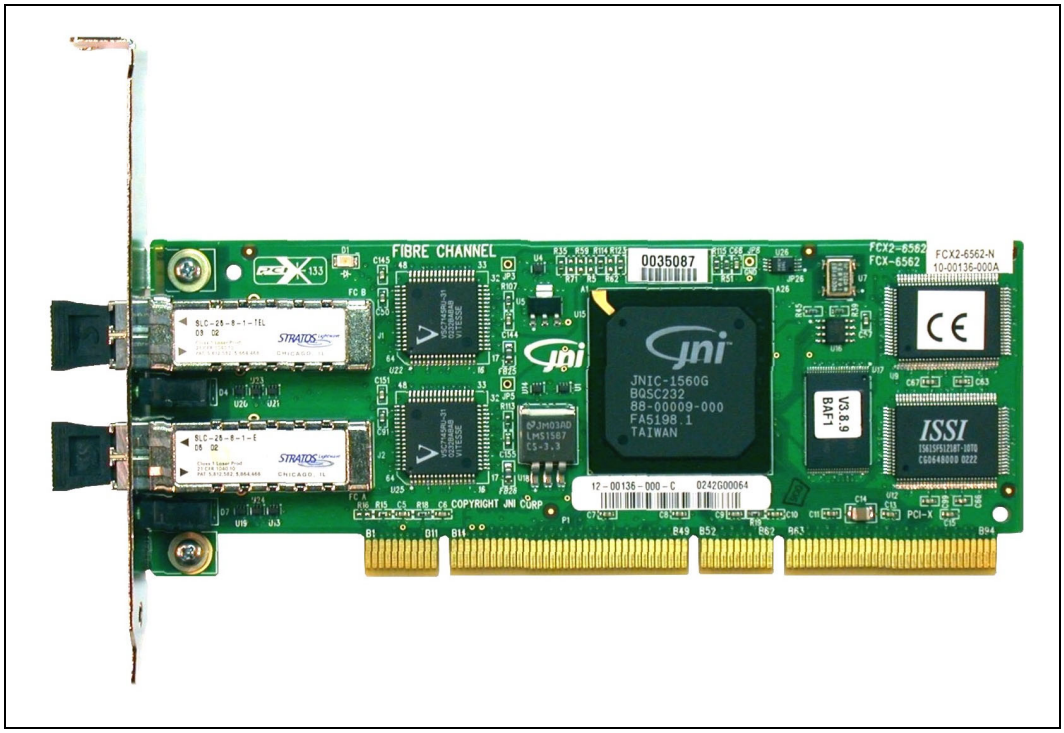


Figure 2-1 FX200 DC PCI

2.3.1 Card Features

The FX200 DC PCI card has the following features:

- PCI-to-FC ASIC with two independent FC functions
- Dedicated RISC Engine for each FC function
- Provides the performance of two HBAs on a single HBA form-factor
- Requires only one PCI slot
- Two independent 2.125 Gbps channels (up to 400 MBps per channel, full duplex)
- Detects 1.0625 and 2.125 Gbps using Auto-Speed Negotiation
- FC physical media interfaces use SFF transceivers
- Status LEDs indicate current condition of each channel
- MD2 form-factor (low-profile PCI)

2.4 FX200 DC PMC Card

Systran's FibreXpress FX200 DC PMC card, also called HBA, is an ANSI-Standard card for FC communications on host nodes. The FX200 DC PMC card mounts onto any PMC-compliant carrier.

To ensure proper operation in rugged environments, stiffening ribs are typically present on rugged PMC-compliant carriers. The FX200 DC PMC design makes allowances to interface to host carriers with on-board stiffening ribs. Figure 2-2 shows the FX200 DC PMC card.

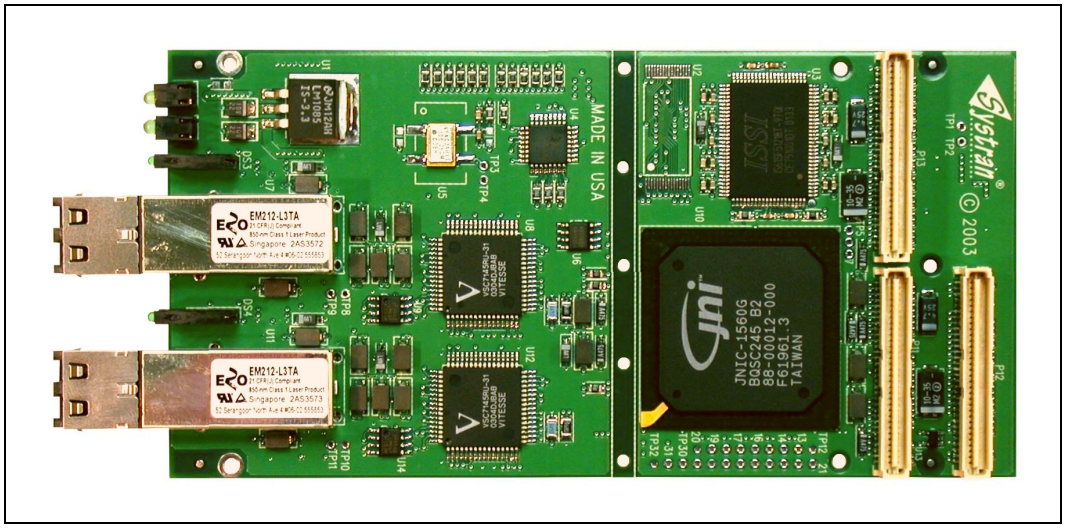


Figure 2-2 FX200 DC PMC

2.4.1 Card Features

The FX200 DC PMC card has the following features:

- PCI-to-FC ASIC with two independent FC functions
- Dedicated RISC Engine for each FC function
- Provides the performance of two HBAs on a single HBA form factor
- Requires only one system slot
- Two independent 2.125 Gbps channels (up to 400 MBps per channel, full duplex)
- Detects 1.0625 and 2.125 Gbps using Auto-Speed Negotiation
- FC physical media interfaces is SFF transceivers
- Status LEDs indicate current condition of each channel
- PMC form factor
- Meets Standard, rugged level 1, and rugged level 2 environments
- Provides mechanical interface to stiffener rib, located on PMC-compliant carriers, to ensure robust mechanical performance in extreme environments

2.5 Host PCI Interface

The FX200 DC products have the following PCI interface:

- 33/66 MHz PCI clock rate
- 32 or 64-bit data path
- 64-bit addressing
- PCI specification 2.2 and PC99 compliant
- 528 MBps burst transfer data rate at 64-bit, 66 MHz
- Zero-wait-state transfers with cache line streaming
- Fewer than one interrupt per command completion
- Independent DMA channels for receive, transmit and command
- Programmable priority for the DMA channels
- Dual-address cycle capable power management registers
- Compatible with +5.0 V and 3.3 V PCI signaling levels

2.6 FX200 DC Card Interfaces

The FX200 card has the following interfaces:

- A PCI bus interface used for communication with a host computer
- A physical media and FC interface used for communication with other FC entities

2.6.1 Host Bus Interface

The host bus interface for the FX200 is the PCI bus. All communications with the FX200 are handled through the appropriate FX200 device driver. The FX200 card is mapped into PCI memory and I/O space. The card operates as a PCI bus initiator, target, or interrupting device as required according to the current operation.

2.6.2 Fibre Channel Interface

The FX200 DC card provides dual-FC interfaces with the following features per channel:

- Implemented using JNI Corp. JNIC-1560 PCI-to-FC controller ASIC.
- The JNIC-1560 hardware (not all features are supported by software) supports the following:
  - 1.0625 or 2.125 Gbps Full-Duplex FC data rate
  - 200 MBps and 400 MBps (Full-Duplex) data rate (per channel)
  - Auto-Speed Negotiation
  - Concurrent FCP and IP protocol support
  - Concurrent Target and Initiator Mode Support
  - Up to 1,278 concurrent, active Exchanges supported
  - Up to 126 AL_PA Aliases
  - Switched Fabric, Arbitrated Loop, and Point-to-Point support
  - Support for Class 1, 2, 3, and intermix services
  - Full-Duplex and Dynamic Half-Duplex support
  - Raw frame handling
  - Internal Loopback Mode
  - Programmable removal from loop
  - Fibre Channel Analyzer mode
  - FC-AL-2 rev. 7.0 compliant
  - Up to 16 million simultaneous SCSI Targets supported

2.6.3 SFF Media Options

There are three basic SFF media options—a long wavelength laser (1300 nm) and short wavelength laser (850 nm), and HSSDC copper. Long wavelength laser interconnections are recommended for distances longer than 300 meters, as loss in multimode fiber degrades connections with short wavelength lasers past this distance. HSSDC interconnections are recommended for very short distances of 30 meters or less.

The short wavelength version is useful for intrasystem connections, where you are connecting between cards on the same backplane. It is also suited for short reach intersystem connections (< 300 m).

All cards use a Duplex LC style connector or HSSDC receptacle, available from most major cable manufacturers. Refer to Appendix A for physical media interface specifications and Appendix B for ordering information.

2.7 Functional Blocks

The FX200 DC card performs four main functions:

- Interfaces with the PCI Local Bus
- Performs FC-0 Fibre Channel physical media interface
- Performs FC-1 and FC-2 transmission and framing and signaling protocol (except basic and extended link services)
- Implements FC-4, SCSI Upper Layer Protocol (FCP-SCSI) and IP

The JNIC-1560 ASIC performs all functions, with the exception of the FC-0 interface. This ASIC is the heart of the FX200 and requires very little support circuitry. The Fibre Channel physical media interface, the Serializer/Deserializer (SERDES), the SRAM, and the Serial EEPROM (SEEPROM) are the only external components needed to support the JNIC-1560. See Figure 2-3 for a block diagram of the FX200 DC card.

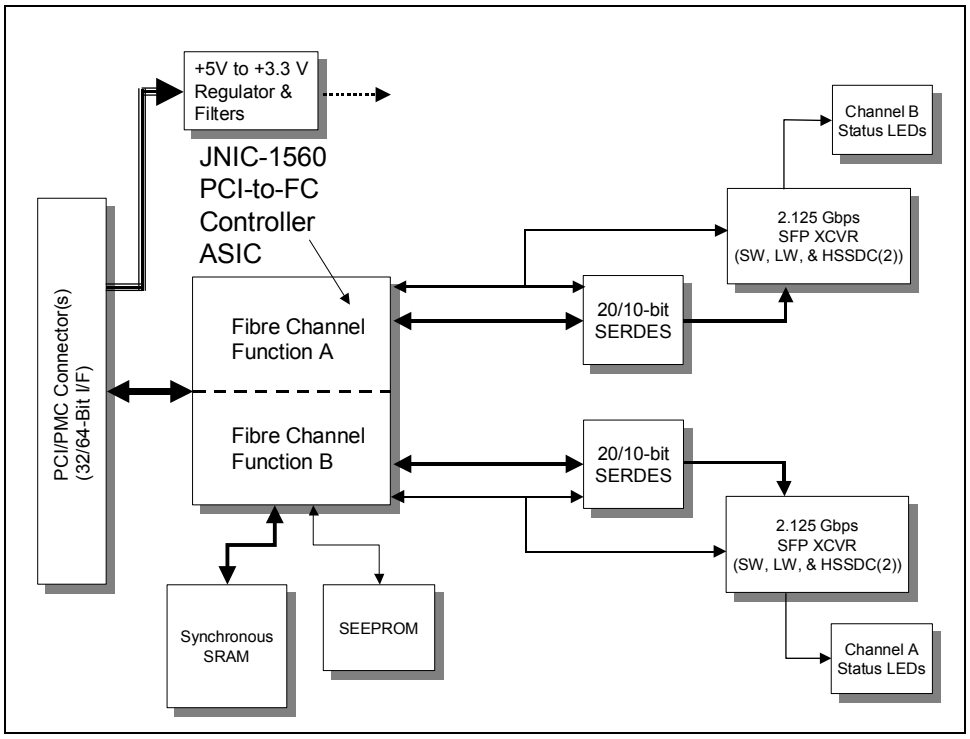


Figure 2-3 FX200 Block Diagram

2.7.1 PCI/PMC Connectors

These connectors provide the electrical and mechanical interface to the 64-bit PCI bus for the FX200 DC PCI and PMC card. These connectors are backwards compatible with 32-bit PMC systems.

2.7.2 +5 V to +3.3 V Regulator

This regulator, and its associated filter network, provides a clean +3.3 V to the JNIC-1560. An on-card regulator was chosen in lieu of the +3.3 V provided by the PCI bus to control the noise content and quality of this voltage.

2.7.3 JNIC-1560 ASIC

This ASIC performs virtually all of the FC functions of the FX200 DC card. The JNIC-1560 relieves the host from the burden of dealing with the FC interface by implementing the SCSI FCP and IP protocol in hardware and firmware. The JNIC-1560 includes a PCI interface, RISC I/O Engine, separate FC receive and send buffers, and FC Send, Receive, and Arbitrated Loop control. In addition, the JNIC-1560 ASIC contains two independent FC functions (A and B) that provide the interface to its respective external SERDES chip. Each function is completely independent excluding the PCI interface, SRAM, and SEEPROM, which are shared between the functions.

2.7.4 Synchronous SRAM

The Synchronous SRAM provides storage for the current FCP and/or IP I/O commands being executed by the JNIC-1560. This memory is not accessible to the user.

2.7.5 Serial EEPROM (SEEPROM)

The SEEPROM stores information related to the configuration and initialization of the JNIC-1560. Information such as the World Wide Names for each FC function is stored here. The SEEPROM is under the control of the device driver and not accessible to the user.

2.7.6 Serializer/Deserializer (SERDES)

FX200 designs use the Vitesse VSC7146 or VSC7145 SerDes chips. The operation of each SERDES chip is controlled independently by either FC function A or B within the JNIC-1560 ASIC. These chips convert parallel 20-bit (10-bit on the VSC7145 designs) 8B/10B encoded FC data words, from the JNIC-1560, into serial format for transmission over the FC physical media. Conversely, serial FC data is received from the physical media, converted to 20-bit (or 10-bit) parallel format by the SERDES chips, and sent to the JNIC-1560.

2.7.7 Fibre Channel Physical Media Interface

The FC Physical Media consists of SFF transceivers. There are three SFF media options—a long wavelength laser (1300 nm) and short wavelength laser (850 nm), and HSSDC copper. See section 2.6.3 for further details on transceiver types.

2.7.8 Status LEDs

Two sets of status LEDs are present on the FX200 DC cards. The first set indicates the status of Channel A and the second provides the status of Channel B. These status LEDs are described below.

"SIGNAL DETECT" LEDS

The Signal Detect (SD) LEDs indicate activity on the FC physical media. A SD LED is present for both Channel A and B. These SD LEDs do not indicate valid data; it only indicates that laser light has been detected from the up-stream node. The FX200 DC PMC front panel is shown in Figure 2-4.

- The SD LED for Channel A is labeled "A-SD" on the front panels of the FX200 DC PMC cards and "SD" on the front panel of the FX200 DC PCI.
- The SD LED for Channel B is labeled "B-SD" on the front panels of the FX200 DC PMC cards and "SD" on the front panel of the FX200 DC PCI.

"LINK UP" LEDS

The Link Up LED is a front-panel LED that indicates activity on the FC physical media. In addition, this LED indicates that the JNIC-1560 ASIC is receiving good signals. This LED is deasserted upon Loss of Sync, Loop Failure, or Loss of Signal. A Link Up LED is present for both Channel A and B. The Link Up LEDs are labeled "LU" on the front panel of the FX200 DC PMC card, as shown in Figure 2-4. No Link Up LEDs are present on the FX200 DC PCI cards.

"RATE" LEDS

The Rate LED indicates if Channel A or B are receiving data at 1.0625 or 2.125 Gbps rates. The Rate LED is on when the data rate is 2.125 Gbps and off to signify 1.0625 Gbps operation. The Rate LEDs for Channel A and B are labeled "R" on the front panel of the FX200 DC PMC card, as shown in Figure 2-4. The Rate LEDs for Channel A and B are labeled "2G" on the front panel of the FX200 DC PCI card.

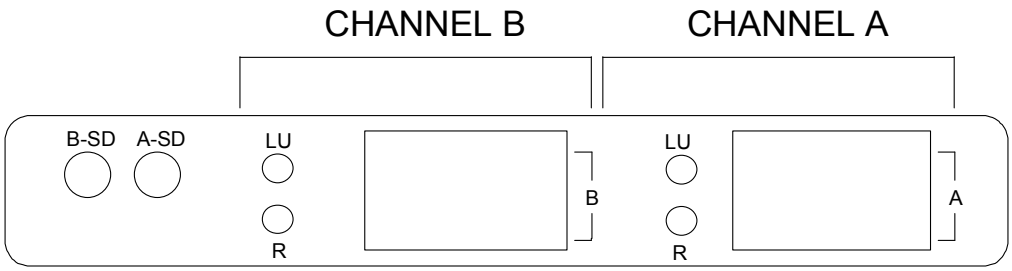


Figure 2-4 FX200 DC PMC Front Panel

2.8 Fibre Channel Applications

Fibre Channel communication provides a practical, inexpensive, yet scalable solution for achieving high-speed gigabit per second data transfer among workstations, mainframes, supercomputers, desktop computers, storage devices, and display devices. Distributed processors, storage devices, and peripherals can connect to one another over distances of up to 10 km per link (using Long Wavelength Optical Transceivers). Hubs can link up to 126 individual nodes together on a single loop and can provide fault isolation by bypassing failed nodes. Fabric switches can be used to link separate loops and can be cascaded to allow several thousand nodes to communicate and share data.

Fibre Channel is ideal for the following applications:

- High-performance storage area network (SAN)
- Large (multiple terabyte) databases and data warehouses
- Storage backup systems and recovery
- Server clusters
- Network based storage
- Real-time applications
- Digital audio/video networks
- Digital imaging
- Embedded military sensor, processing, and displays
- Industrial control systems

Contact Systran for assistance in implementing your particular Fibre Channel application.

2.9 Topologies

The versatile FX200 DC card operates in topologies specified by the Fibre Channel standard. These topologies are:

- Point-to-Point (two-node arbitrated loop)
- Arbitrated Loop
- Switched Fabric

2.9.1 Point-to-Point Connection

A dual point-to-point connection between the FX200 DC cards using a fabric switch is shown in Figure 2-5. Direct point-to-point between two FX200 DC cards is not supported.

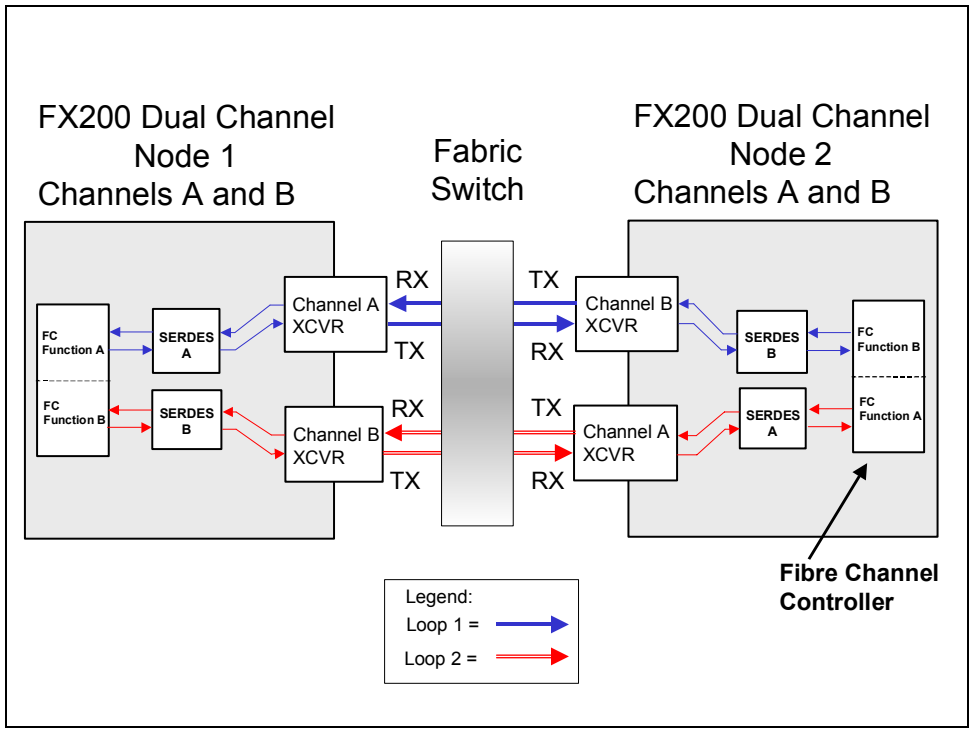


Figure 2-5 Point-to-Point Connection

Figure 2-6 shows a simple point-to-point connection between an FX200 card and a single FC disk drive. In this example, Channel A is communicating directly to the disk drive and Channel B is left completely unconnected. Figure 2-7 is an example of how two FC disk drives may be connected to a single FX200 DC card. In this configuration, each channel is operating on an independent point-to-point connection with a disk drive.

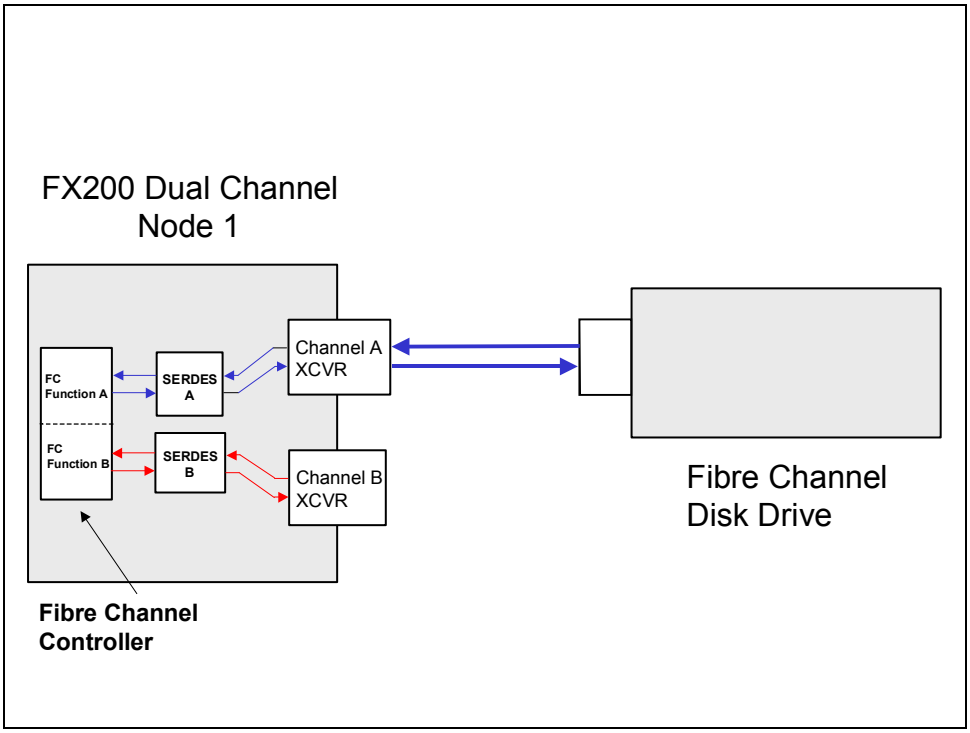


Figure 2-6 Point-to-Point Connection to a single Fibre Channel Disk Drive

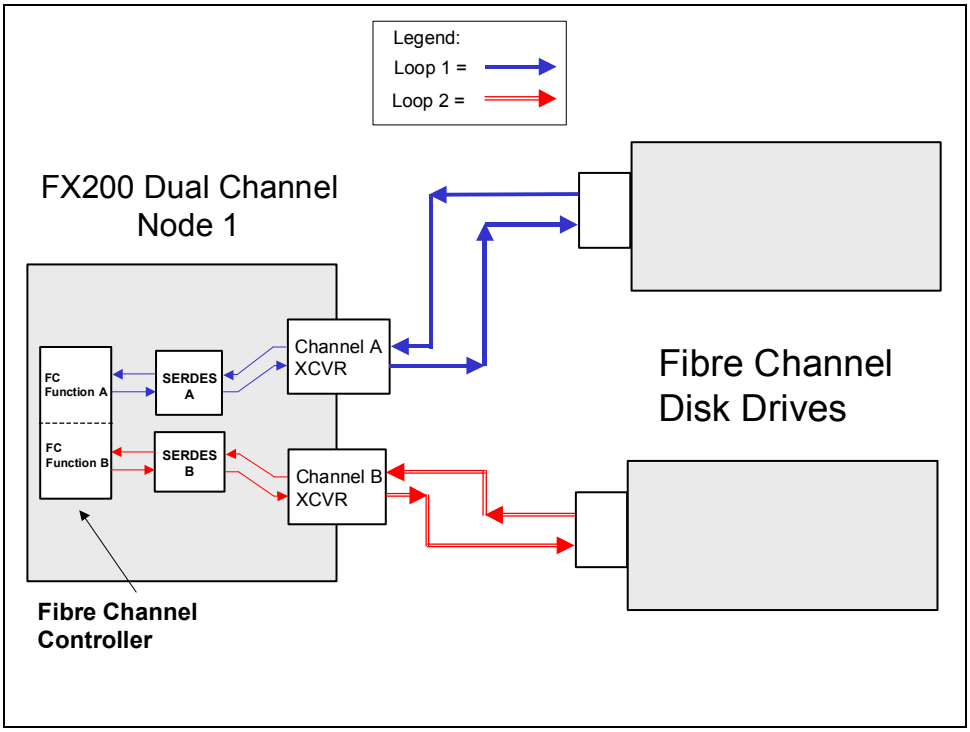


Figure 2-7 Point-to-Point Connections to Two FC Disk Drives

2.9.2 Arbitrated Loop Without Hub

A dual point-to-point connection using arbitrated loop configuration is shown in Figure 2-8. In this example, Node 1's Channels A and B are connected directly to Node 2's Channel B and A, respectively. This constitutes two independent arbitrated loops between two FX200 DC PMC cards.

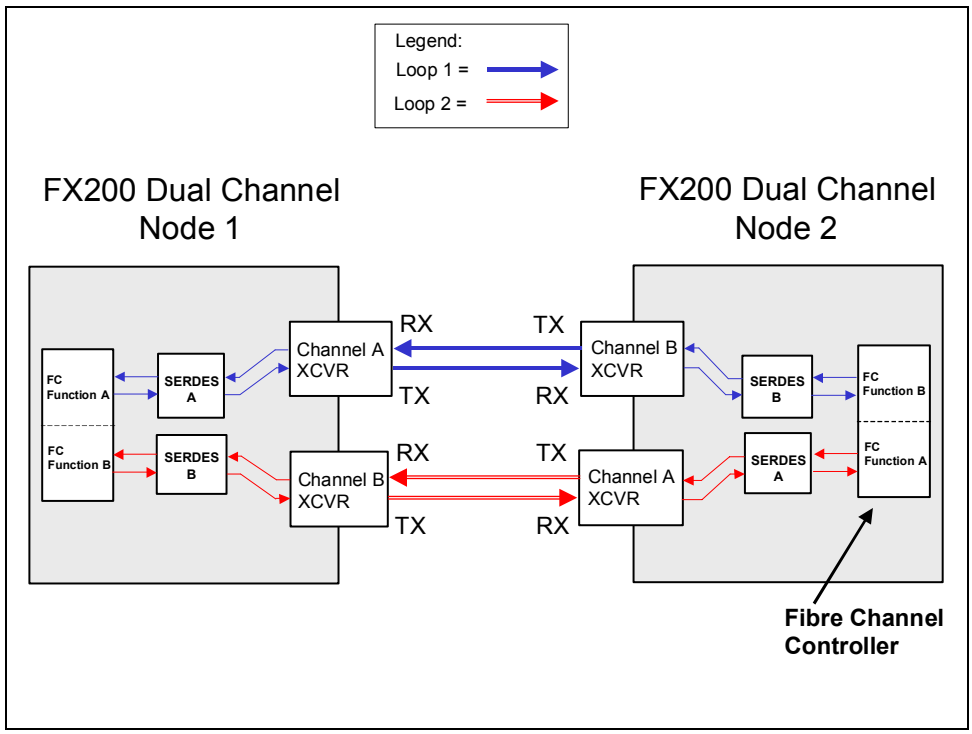


Figure 2-8 Two-Node Arbitrated Loop without Hub

The following figure depicts a possible configuration of multiple FX200 DC cards in an arbitrated loop topology. In Figure 2-9, two independent arbitrated loops are created using four FX200 DC cards. Each arbitrated loop is uniquely marked. Refer to the legend in Figure 2-9 more details. Notice that no cross connection between the channels exists. This allows each channel to operate independent of the other.

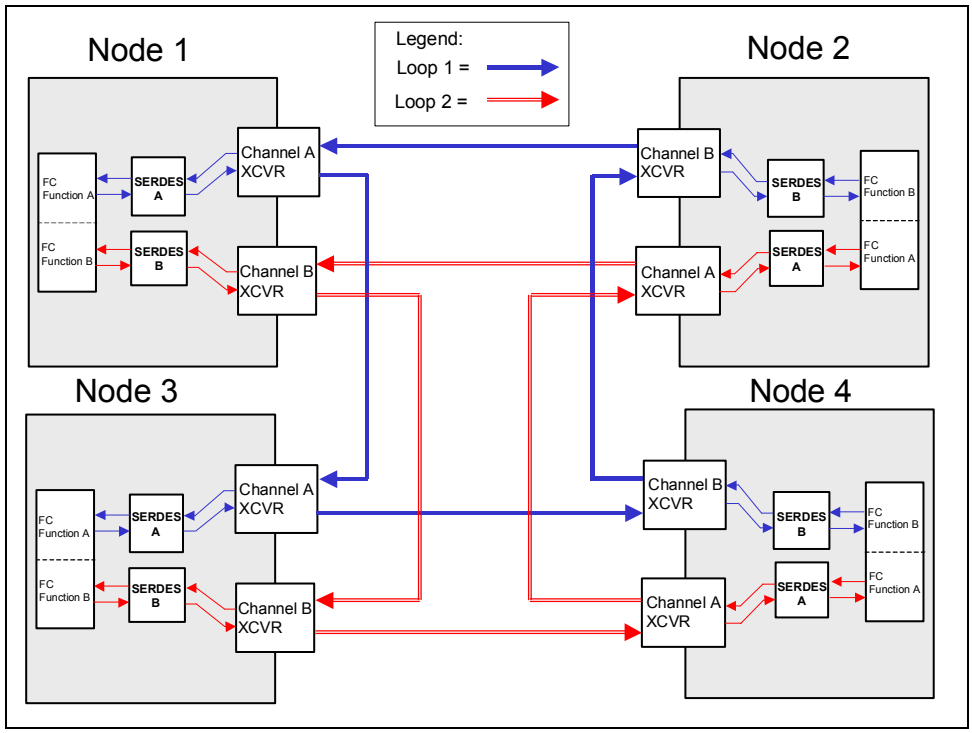


Figure 2-9 Arbitrated Loop without Hub

To achieve the arbitrated loop topology similar to that shown in Figure 2-9, use simplex fiber optic cables. No simplex versions of the HSSDC cables are available. Therefore, the loop topology without a Hub is not supported with HSSDC cables. See Appendix B for cable ordering information.

2.9.3 Arbitrated Loop With Hub

Another arbitrated loop configuration method available is with a Fibre Channel hub, such as Systran's LX2500 Crossbar Switch. A Hub is easily configurable and allows individual nodes to be switched in and out of a loop.

To configure the FX200 DC card in an arbitrated loop connection with a hub, connect cables between the transmitter and receiver of each node to the hub as shown in Figure 2-10. In this example, Systran's LX2500 Crossbar Switch is used.

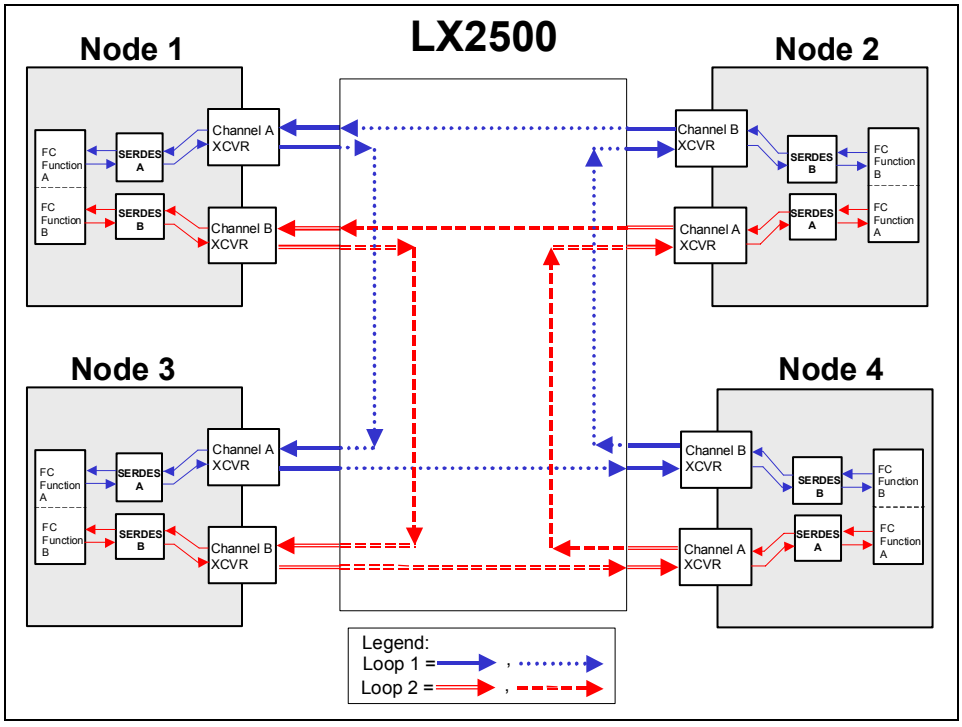


Figure 2-10 Arbitrated Loop with Hub

Figure 2-11 demonstrates the LX2500's ability to automatically isolate a failed node while leaving the remaining original loops intact. In this example, the LX2500 has isolated Node 4 due to loss of signal detect. A cable break at point ① has caused the LX2500 to switch Node 4's Channel B out of the arbitrated loop. As Node 4's Channel B is isolated, the LX2500 switches to the backup loop connecting Node 3's Channel A to Node 2's Channel B (points ② and ③ in Figure 2-11). This functionality assures that a single port failure will not result in an entire arbitrated loop failure.

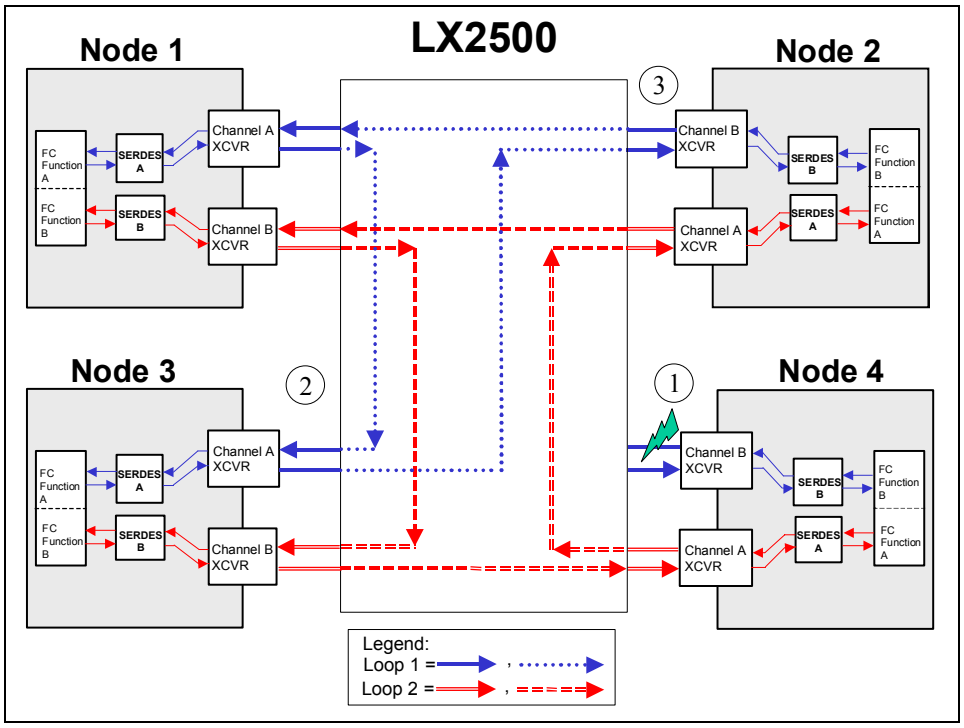


Figure 2-11 Arbitrated Loop with Hub, with Node 4 Off-Line

For additional information about Systran's LinkXchange LX2500 Crossbar Switch, reference section 2.10.2.

2.10 Accessories

Systran offers the following accessories for the FX200 DC card:

- Software drivers
- LinkXchange LX2500 Crossbar Switch (LX2500)
- Fiber optic cables
- HSSDC copper cables
    - Cables equalized for 1.0625 Gbps operation
    - Cables equalized for 2.125 Gbps operation

2.10.1 Software Drivers

Systran's FX200 software drivers provide a common application-programming interface (API) across different host computers and operating systems. The following operating systems are supported:

- Windows NT and Windows 2000
- VxWorks
- Solaris
- Linux

Contact Systran for versions and platforms that are currently available.

2.10.2 LinkXchange LX2500 Crossbar Switch (LX2500)

Systran's LX2500 Crossbar Switch provides the following features:

- Up to 32 non-blocking media-specific I/O ports
- Up to 2.5 Gbps/port baud rate (port card dependent)
- Support for multiple point-to-point, loop, and broadcast communication links simultaneously
- Automatic I/O Port fault isolation
- Multiple media options
    - HSSDC ("Style-2" connector)
    - HSSDC2
    - Short wavelength (850 nm)
    - Long wavelength (1300 nm)
- Different media interfaces can be mixed
- Out-of-band control through an RS-232 port
- Can be connected to a modem and controlled from a remote location

For more detailed information regarding LX2500 features and operation, contact Systran and request a copy of the *LinkXchange LX2500 Crossbar Switch Hardware Reference Manual* or visit our web site.

2.10.3 Cables

Short Wavelength (Multimode Optical Fiber), Long Wavelength (Singlemode Optical Fiber), and HSSDC copper cable assemblies are available to support the FX200 physical media interface.

Descriptions and order numbers for various cable lengths are shown in Appendix B.

3. INSTALLATION

3.1 Overview

This chapter describes how to unpack, configure, install, connect, and activate the FX200 card. The FX200 DC card requires only one slot on the host computer backplane and a fiber-optic or HSSDC cable connection.

3.2 Unpack the Card



CAUTION: Exercise care regarding the static environment. Use an anti-static mat connected to a wristband when handling or installing the FX200 DC card. Failure to do this may cause permanent damage to the components on the card.

Follow the steps below to unpack the card:

1. Put on the wristband attached to an anti-static mat.
2. Remove the card and anti-static bag from the carton.
3. Place the bag on the anti-static mat.
4. Open the anti-static bag and remove the card.
5. In the unlikely event that you should need to return your FX200 DC card, please keep the original shipping materials for this purpose.

Any optional equipment is shipped in separate cartons.

3.3 Inspect the Card

The FX200 consists of a single card with a physical media interface. If the card was damaged in shipping, immediately notify Systran Corporation or your supplier.

3.4 Install the Card

WARNING: Turn off all power to your system before attempting to install the FX200 cards. In addition, always take the usual precautions against electrostatic discharge when handling the FX200 cards.

3.4.1 Install the DC PCI Card

To install the FX200 PCI card, push the card into the motherboard as shown in Figure 3-2, steps 1 and 2, until it is firmly seated. Install the mounting screw as shown in step 3.

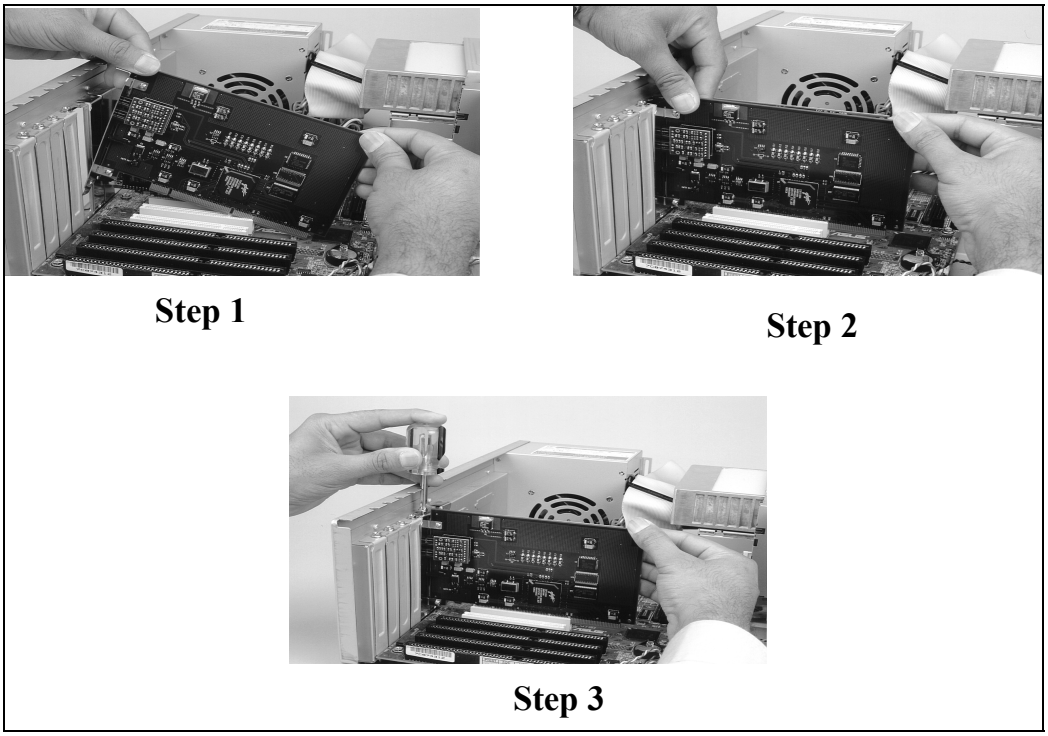


Figure 3-1 FX200 PCI Card Installation

3.4.2 Install the DC PMC Card

The FX200 DC PMC card requires one slot on the host computer.

To install the FX200 DC PMC card, insert the card into an available slot by inserting the faceplate into the cutout on the carrier until it butts up against the mating connector as shown in Figure 3-2 in steps 1 and 2. Then firmly push the connectors together. Install the four mounting screws through the PCB of the host SBC to fasten it in place, as shown in step 3.

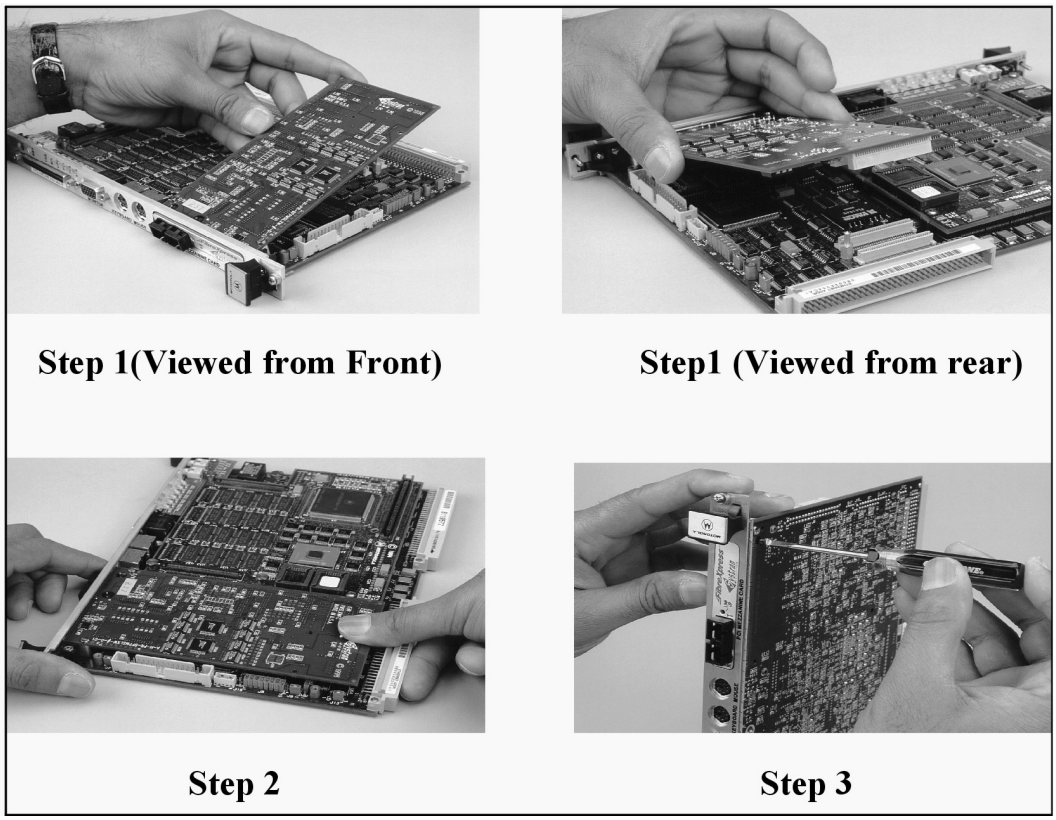


Figure 3-2 FX200 DC PMC Card Installation



NOTE: The 3.3 V key is not present on the FX200 DC PMC cards. Removing the 3.3 V key was required to provide clearance to mechanically connect the PMC to the stiffening rib, located on the host PMC-complaint carrier. The FX200 DC PMC cards do support universal PCI signaling (3.3 and 5 V IO), but physically will appear to be a 5 V signaling card due to the absence of the 3.3 V key.

To enhance performance in rugged environments, some PMC-compliant carriers designs use on-board stiffening ribs. The FX200 DC PMC design supports the mechanical connection between the PMC and the stiffening ribs on the host carrier. The mounting holes on the PMC card are 0.087 in (2.2 mm).

PMC-compliant carrier manufacturers typically supply the mounting screws that attach the PMC card to the stiffening rib. As a result, no mounting screws are provided with the FX200 DC PMC.

See Figure 3-3 for mechanical dimensions of the stiffening rib interface on the FX200 DC PMC.

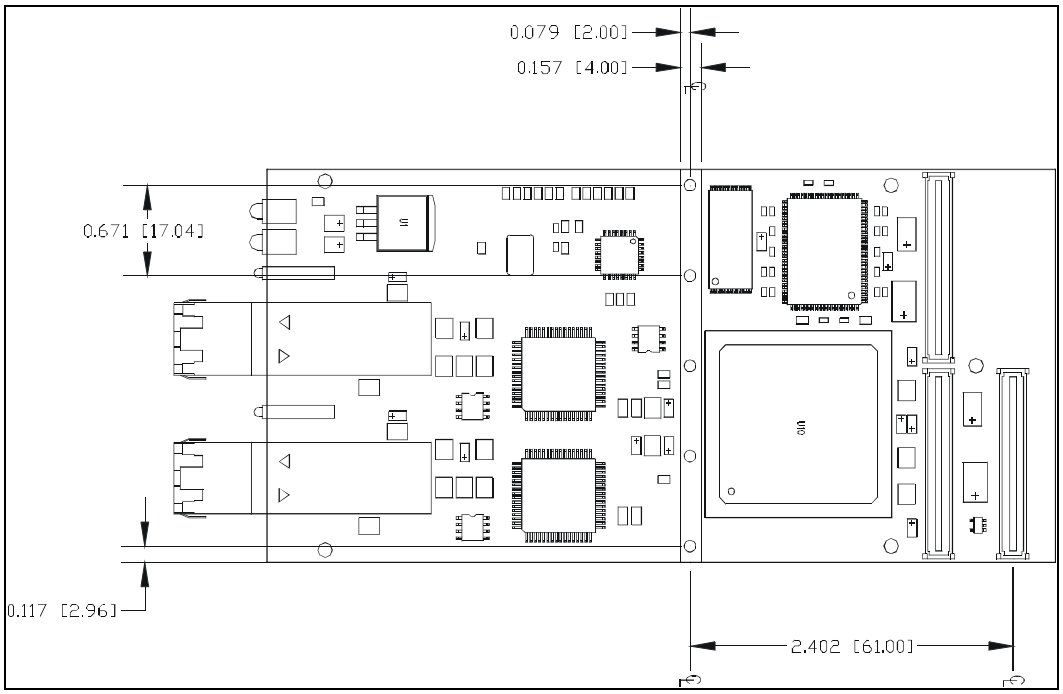


Figure 3-3 Mechanical Dimensions of FX200 DC PMC

3.5 Connect the Cables

3.5.1 Fiber-Optic Cable

The typical FX200 network communication architecture consists of FX200 cards connected by fiber-optic cable. The recommended distance between each node of the network depends on the type of cable used. Refer to Section A.2 in Appendix A for more information.

Fiber-optic cable Precautions

CAUTION: Fiber-optic cables are made of glass and may break if crushed or bent in a loop with less than a 2-inch radius.

Look at the cable ends closely before inserting them into the physical media connector. If debris is inserted into the transmitter/receiver connector, it may not be possible to clean the connector out and could result in damage to the transmitter or receiver lens. Hair, dirt, and dust can interfere with the light signal transmission.

Use an alcohol-base wipe to clean the cable ends.

The optional fiber-optic cables may be shipped in a separate carton. Remove the protective caps on the fiber-optic transmitters and receivers as well as the ones on the fiber-optic cables. These protective caps should be replaced when cables are not in use or in the event the node must be returned to the factory. Attach the fiber-optic cables to the connectors on the FX200 DC card. Figure 3-4 and Figure 3-5 depict the types of fiber-optic connectors needed for the FX200 DC card.

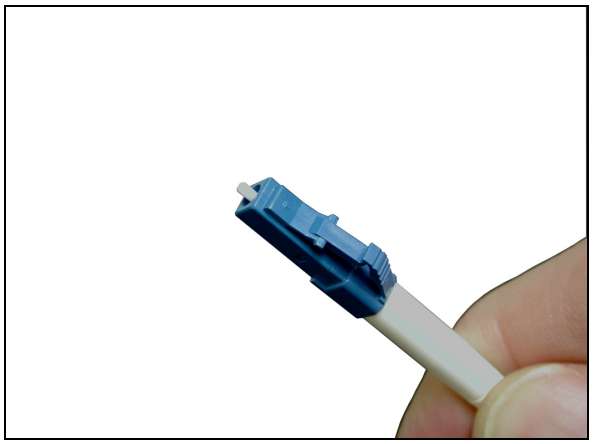


Figure 3-4 Fiber-Optic Simplex LC Connector

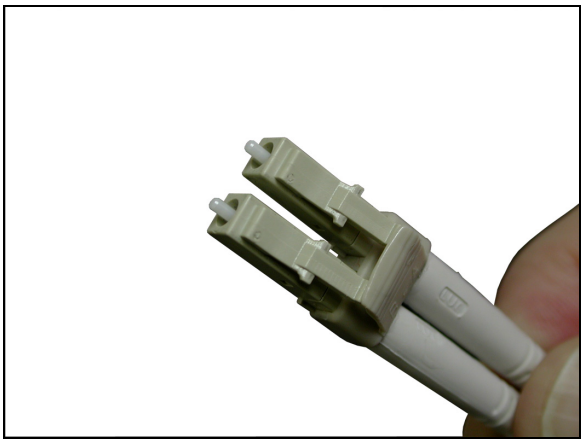


Figure 3-5 Fiber-Optic Duplex LC Connector

Fiber-optic cables can be purchased from Systran. The recommended fiber-optic cables are 50/125 um for multimode (short wavelength) cable and 9/125 um for singlemode (long wavelength) cable. See Appendix B for order numbers for the fiber-optic cables.

3.5.2 HSSDC Copper Cables

The copper media interface on the FX200 cards support 150 Ohm shielded quad cable, terminated with HSSDC connectors ("Style-2"), as shown in Figure 3-6. The HSSDC receptacle, used on the FX200 cards, is displayed in Figure 3-7. This figure also indicates the contact pin locations and Table 3-1 contains the pin assignments.

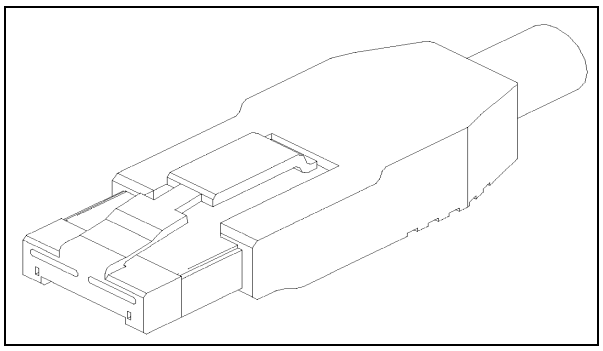


Figure 3-6 HSSDC Copper Connector

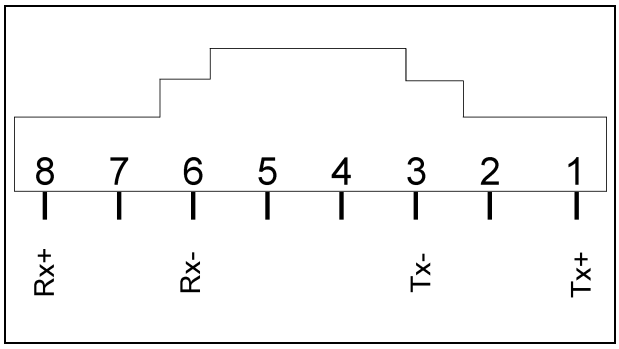


Figure 3-7 HSSDC Connector Pin Assignment

Table 3-1 HSSDC Receptacle Pin Assignments

Pin Number	Pin Description	Pin Number	Pin Description
1	Transmit +	5	NC
2	No-connect (NC)	6	Receive -
3	Transmit -	7	NC
4	NC	8	Receive +

To insure data integrity, care must be taken when selecting the appropriate HSSDC cable assembly for the FX200 application. Length boundaries for HSSDC cable assemblies are determined by the data rate of the application and if equalization circuits are present. Application operating at 2.125 Gbps must use equalized HSSDC cables, if cable lengths are greater than 5 meters. However, applications operating at 1.0625 Gbps must use equalized HSSDC cables when cable lengths exceed 20 meters.

3.6 Memory Map

The PCI BIOS maps the FX200 into PCI memory and I/O space on power-up. If using the FX200 card in a system that does not provide this address assignment mechanism, the Systran FX200 driver software assigns the addresses. Alternatively, any custom software written for the card must provide this address assignment.

3.7 Activate the Card

Power up the system after the hardware is installed and cables are connected. If you purchased Systran's FX200 driver software with your Systran card, install the driver according to the instructions provided with the software. Systran's driver software comes with some simple applications that allow you to test the card and verify it is working correctly. The API Guide provides instructions on how to use the sample applications. Source code is also provided with the sample applications to show you how to write your own applications using Systran's API calls to the driver.



NOTE: If you are not using Systran's FX200 driver software, proprietary information on how to interface with the JNIC-1560 ASIC is covered by Non-Disclosure Agreements between Systran and JNI. Contact Customer Support at Systran for more information.

3.8 Troubleshooting

If the system does not boot correctly, power-down the system, reseat the card and double-check cable connections. If problems persist, call Systran's Customer Support at **(800) 252-5601** for assistance.

Please be prepared to supply the following information:

Host Machine: _____
OS Name: _____
OS Version: _____
Bus Interface: _____
FX200 Card S/N: _____
Error Messages: _____
The last action you performed: _____

3.9 Maintenance

No routine maintenance is required for the FX200 nodes beyond that which is required for the host computer system.

APPENDIX A

SPECIFICATIONS

TABLE OF CONTENTS

A.1 Hardware Specifications A-1
A.1.1 FX200 Dual-Channel PCI Card A-1
A.1.2 FX200 Dual-Channel PMC Card A-2
A.2 Ruggedized PMC Environmental Specifications A-3
A.2.1 Rugged Level 1 ..... A-3
A.2.2 Rugged Level 2 ..... A-4
A.3 Media Interface Specifications A-5
A.3.1 Short Wavelength Laser Media Interface A-5
A.3.2 Long Wavelength Laser Media Interface A-5
A.3.3 HSSDC Copper Media Interface: 1.0625 Gbps A-5
A.3.4 HSSDC Copper Media Interface: 2.125 Gbps A-5

A.1 Hardware Specifications



NOTE: "Peak" current specifications are based on measurements taken while the card was transmitting and receiving large buffers of data. "Average" current specifications are based on measurements taken while the card was powered on but not transmitting or receiving any data.



CAUTION: Power usage is highly system dependent and varies from system to system.

A.1.1 FX200 Dual-Channel PCI Card

Hardware Compatibility: ..... PCI Local Bus Revision 2.2
Physical Dimensions: ..... 2.536 in by 6.6 in (64.41 mm by 167.64 mm)
Weight:..... TBD pounds (TBD grams)
Electrical Requirements:
Power ..... +TBD VDC, TBD Amps, TBD Watts
PCI Signaling ..... +5 V and +3.3 V supported
Storage Temperature Range: ..... -40 to +85°C
Operating Temperature Range: ..... +0 to +50°C*
Storage Humidity Range:..... 5% to 90% (noncondensing)
Operating Humidity Range:..... 20% to 80% (noncondensing)
Network Line Transmission Rate:..... 1.0625 or 2.125 Gbps
Fibre Channel ASIC: JNIC-1560

A.1.2 FX200 Dual-Channel PMC Card

Hardware Compatibility:	PCI Local Bus Revision 2.2 PMC IEEE P1386.1 CMC IEEE P1386
Physical Dimensions:	2.915 in by 5.866 in (74 mm by 149 mm)
Weight:	≈ 0.25 pounds (115 grams)
Operating Voltage:	4.75 V to 5.25 V
Power Dissipation:	
Power	7.5 W Peak, 6.5 W Average
Electrical Requirements:	
Supply	+5 VDC, 1.5 Amps Peak, 1.3 Amps Average
PCI Signaling	+5 V and +3.3 V supported
Storage Temperature Range:	-40 to +85°C
Operating Temperature Range:	+0 to +50°C*
Storage Humidity Range:	5% to 90% (noncondensing)
Operating Humidity Range:	20% to 80% (noncondensing)
Network Line Transmission Rate:	1.0625 or 2.125 Gbps
Fibre Channel ASIC:	JNIC-1560
Mean Time Between Failure (MTBF) Data**	
Short wavelength laser:	151,958 hours (17.3 years)
Rugged Level 1	104,137 hours (11.9 years)
Rugged Level 2	79,572 hours (9.1 years)
Long wavelength laser:	148,044 hours (16.9 years)
Rugged Level 1	102,284 hours (11.7 years)
Rugged Level 2	78,485 hours (9.0 years)
HSSDC Copper Media:	78,660 hours (9.0 years)
Rugged Level 1	63,553 hours (7.3 years)
Rugged Level 2	53,477 hours (6.1 years)

* 200 LFPM airflow is required for proper thermal management. Operating the FX200 card without supplying specified airflow may affect device reliability.

** These MTBF numbers are based on calculations using MIL-HDBK-217F, Appendix A, for a ground-benign environment.



NOTE: The 3.3 V key is not present on the FX200 DC PMC cards. Removing the 3.3 V key was required to provide clearance to mechanically connect the PMC to the stiffening rib, located on the host PMC-complaint carrier. The FX200 DC PMC cards do support universal PCI signaling (3.3 and 5 V IO), but physically will appear to be a 5 V signaling card due to the absence of the 3.3 V key.

A.2 Ruggedized PMC Environmental Specifications

The FX200 products are offered at three different ruggedization levels. These levels are Standard, Rugged Level 1, and Rugged Level 2. Standard level operation specifications are defined in Sections A.1 of Appendix A. The specifications for Rugged Level 1 and Rugged Level 2 are defined in the following sections.

Current FX200, standard and ruggedized, products are listed in Appendix B.

A.2.1 Rugged Level 1

Temperature Range:	
Operating	-10° to +70° C
Storage	-40° to +85°C
Humidity Range:	
Operating	5% to 95% (noncondensing)
Storage	0% to 95% (noncondensing)
Altitude:	
Operating	25,000 ft steady; rapid decompression to 40,000 ft
Storage	25,000 ft
Vibration:	
Sine	10 g peak 10 Hz to 2 kHz
Random	.04 g^2/Hz 10 Hz to 2 kHz -6 dB/octave 1 kHz to 2 kHz
Shock	20 g peak ½ sine wave 11 ms duration
Conformal Coating	Acrylic HumiSeal 1B31*

* Ruggedized cards are coated with HumiSeal 1B31 acrylic conformal coating. This coating is qualified to MIL-I-46058C, Type AR. More detailed information on the coating can be found at the HumiSeal website http://www.humiseal.com/.

A.2.2 Rugged Level 2

Temperature Range:	
Operating	-40° to +85° C
Storage	-40° to +85°C
Humidity Range:	
Operating	5% to 95% (noncondensing)
Storage	0% to 95% (noncondensing)
Altitude:	
Operating	25,000 ft steady; rapid decompression to 40,000 ft
Storage	25,000 ft
Vibration:	
Sine	10 g peak 10 Hz to 2 kHz
Random	.1 g^2/Hz 10 Hz to 2 kHz -6 dB/octave 1 kHz to 2 kHz
Shock	30 g peak ½ sine wave 11 ms duration
Conformal Coating	Acrylic HumiSeal 1B31*

* Ruggedized cards are coated with HumiSeal 1B31 acrylic conformal coating. This coating is qualified to MIL-I-46058C, Type AR. More detailed information on the coating can be found at the HumiSeal website http://www.humiseal.com/.

A.3 Media Interface Specifications

A.3.1 Short Wavelength Laser Media Interface

Maximum Data Rate: ..... 2.125 Gbps
Compatibility: ..... 200-M5-SN-I (50 µm multimode fiber, no Open Fibre Control)
200-M6-SN-I (62.5 µm multimode fiber, no Open Fibre Control)
Connector:..... Duplex LC
Cable:..... 50/125 µm or 62.5/125 µm multimode fiber optic
Maximum Cable Length:
50 µm:..... 300 meters
62.5 µm:..... 150 meters
Transmit Power: ..... -10 to -4 dBm
Transmit Wavelength:..... 830 to 860 nm
Receive Wavelength: ..... 770 to 860 nm
Receive Power:
2 Gbps..... -16 to 0 dBm
1 Gbps..... -17 to 0 dBm

A.3.2 Long Wavelength Laser Media Interface

Maximum Data Rate: ..... 2.125 Gbps
Compatibility: ..... 200-SM-LC-L (singlemode intermediate distance)
Connector:..... Duplex LC
Cable:..... 9/125 µm singlemode fiber optic
Maximum Cable Length:..... 10 kilometers
Transmit Power: ..... -9.5 to –3 dBm
Transmit Wavelength:..... 1290 to 1335 nm
Receive Wavelength: ..... 1290 to 1335 nm
Receive Power: ..... -19 to -3 dBm

A.3.3 HSSDC Copper Media Interface: 1.0625 Gbps

Maximum Data Rate: ..... 1.0625 Gbps
Connector:..... HSSDC (“Style-2”)
Cable:..... 150-Ohm Shielded Quad copper
Maximum Cable Length:..... 30 meters

A.3.4 HSSDC Copper Media Interface: 2.125 Gbps

Maximum Data Rate: ..... 2.125 Gbps
Connector:..... HSSDC (“Style-2”)
Cable:..... 150-Ohm Shielded Quad copper
Maximum Cable Length:..... 15 meters

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APPENDIX B

ORDERING INFORMATION

TABLE OF CONTENTS

B.1 Order Numbers B-1
B.1.1 PMC cards B-1
B.1.2 Ruggedized Level 1 PMC cards B-1
B.1.3 Ruggedized Level 2 PMC cards B-1
B.1.4 PCI cards B-2
B.2 Cables B-2
B.2.1 Short Wavelength: Multimode Fiber-optic cable B-2
B.2.2 Long Wavelength: Singlemode Fiber-optic cable B-3
B.2.3 HSSDC Copper: 1.0625 Gbps B-4
B.2.4 HSSDC Copper: 2.125 Gbps B-4

TABLES

Table B-1 FX200 DC PMC Card Configurations B-1
Table B-2 FX200 DC PMC Card Configurations B-1
Table B-3 FX200 DC PMC Card Configurations B-1
Table B-4 FX200 DC PCI Card Configurations B-2
Table B-5 Short Wavelength LC to LC B-2
Table B-6 Short Wavelength LC to ST B-2
Table B-7 Short Wavelength SC to LC B-3
Table B-8 Long Wavelength LC to LC B-3
Table B-9 Long Wavelength SC to LC B-3
Table B-12 Shielded 150-Ohm Quad Copper Cable with HSSDC Connectors B-4
Table B-13 Shielded 150-Ohm Quad Copper Cable with HSSDC Connectors B-4

B.1 Order Numbers

B.1.1 PMC cards

The following table lists the order numbers for the FX200 DC PMC card configurations currently available.

Table B-1 FX200 DC PMC Card Configurations

Order Number	Description
FHJ4-PM5MW000-00	Dual-Channel PMC with Short Wavelength SFF Laser media interface
FHJ4-PM5SW000-00	Dual-Channel PMC with Long Wavelength SFF Laser media interface
FHJ4-PM5HS000-00	Dual-Channel PMC with HSSDC SFF copper media interface

B.1.2 Ruggedized Level 1 PMC cards

The following table lists the order numbers for the Ruggedized Level 1 FX200 DC PMC card configurations currently available.

Table B-2 FX200 DC PMC Card Configurations

Order Number	Description
FHJ4-PM5MW000-R1	Ruggedized Level 1 Dual-Channel PMC with Short Wavelength SFF Laser media interface
FHJ4-PM5SW000-R1	Ruggedized Level 1 Dual-Channel PMC with Long Wavelength SFF Laser media interface
FHJ4-PM5HS000-R1	Ruggedized Level 1 Dual-Channel PMC with HSSDC SFF copper media interface

B.1.3 Ruggedized Level 2 PMC cards

The following table lists the order numbers for the Ruggedized Level 2 FX200 DC PMC card configurations currently available.

Table B-3 FX200 DC PMC Card Configurations

Order Number	Description
FHJ4-PM5MW000-R2	Ruggedized Level 2 Dual-Channel PMC with Short Wavelength SFF Laser media interface
FHJ4-PM5SW000-R2	Ruggedized Level 2 Dual-Channel PMC with Long Wavelength SFF Laser media interface
FHJ4-PM5HS000-R2	Ruggedized Level 2 Dual-Channel PMC with HSSDC SFF copper media interface

B.1.4 PCI cards

The following table lists the order numbers for the FX200 DC PCI card configurations currently available.

Table B-4 FX200 DC PCI Card Configurations

Order Number	Description
FHJ3-PC5MW000-00	Dual-Channel PCI with Short Wavelength SFP Laser media interface

B.2 Cables

Systran offers the following cables for use with its FX200 DC cards:

B.2.1 Short Wavelength: Multimode Fiber-optic cable

The following table lists the order numbers for the simplex and duplex, 50/125 µm multimode fiber-optic cables, for use with the short wavelength laser media interface.

Table B-5 Short Wavelength LC to LC

Simplex Part Number	Duplex Part Number	Length	Cable End 1	Cable End 2
FHAC-M1LC3000-00	FHAC-M2LC3000-00	3 meters	LC	LC
FHAC-M1LC5000-00	FHAC-M2LC5000-00	5 meters	LC	LC
FHAC-M1LC1001-00	FHAC-M2LC1001-00	10 meters	LC	LC
FHAC-M1LC2001-00	FHAC-M2LC2001-00	20 meters	LC	LC
FHAC-M1LC3001-00	FHAC-M2LC3001-00	30 meters	LC	LC
FHAC-M1LCxxxx-00	FHAC-M2LCxxxx-00	Custom	LC	LC

Table B-6 Short Wavelength LC to ST

Simplex Part Number	Duplex Part Number	Length	Cable End 1	Cable End 2
FHAC-M1LCST03-00	FHAC-M2LCST03-00	3 meters	LC	ST
FHAC-M1LCST05-00	FHAC-M2LCST05-00	5 meters	LC	ST
FHAC-M1LCST10-00	FHAC-M2LCST10-00	10 meters	LC	ST
FHAC-M1LCST20-00	FHAC-M2LCST20-00	20 meters	LC	ST
FHAC-M1LCST30-00	FHAC-M2LCST30-00	30 meters	LC	ST

Table B-7 Short Wavelength SC to LC

Simplex Part Number	Duplex Part Number	Length	Cable End 1	Cable End 2
FHAC-M1SCLC01-00	FHAC-M2SCLC01-00	1 meter	SC	LC
FHAC-M1SCLC03-00	FHAC-M2SCLC03-00	3 meters	SC	LC
FHAC-M1SCLC05-00	FHAC-M2SCLC05-00	5 meters	SC	LC
FHAC-M1SCLC10-00	FHAC-M2SCLC10-00	10 meters	SC	LC
FHAC-M1SCLC20-00	FHAC-M2SCLC20-00	20 meters	SC	LC
FHAC-M1SCLC30-00	FHAC-M2SCLC30-00	30 meters	SC	LC

B.2.2 Long Wavelength: Singlemode Fiber-optic cable

The following table lists the order numbers for the simplex and duplex, 9/125 µm singlemode fiber-optic cables, for use with the long wavelength laser media interface.

Table B-8 Long Wavelength LC to LC

Simplex Part Number	Duplex Part Number	Length	Cable End 1	Cable End 2
FHAC-S1LC3000-00	FHAC-S2LC3000-00	3 meters	LC	LC
FHAC-S1LC5000-00	FHAC-S2LC5000-00	5 meters	LC	LC
FHAC-S1LC1001-00	FHAC-S2LC1001-00	10 meters	LC	LC
FHAC-S1LC2001-00	FHAC-S2LC2001-00	20 meters	LC	LC
FHAC-S1LC3001-00	FHAC-S2LC3001-00	30 meters	LC	LC
FHAC-S1LCxxxx-00	FHAC-S2LCxxxx-00	Custom	LC	LC

Table B-9 Long Wavelength SC to LC

Simplex Part Number	Duplex Part Number	Length	Cable End 1	Cable End 2
FHAC-S1SCLC01-00	FHAC-S2SCLC01-00	1 meter	SC	LC
FHAC-S1SCLC03-00	FHAC-S2SCLC03-00	3 meters	SC	LC
FHAC-S1SCLC05-00	FHAC-S2SCLC05-00	5 meters	SC	LC
FHAC-S1SCLC10-00	FHAC-S2SCLC10-00	10 meters	SC	LC
FHAC-S1SCLC20-00	FHAC-S2SCLC20-00	20 meters	SC	LC
FHAC-S1SCLC30-00	FHAC-S2SCLC30-00	30 meters	SC	LC

B.2.3 HSSDC Copper: 1.0625 Gbps

The following table lists the order numbers for the HSSDC copper, 150-ohm, 1.0625 Gbps equalized Shielded Quad cable

Table B-10 Shielded 150-Ohm Quad Copper Cable with HSSDC Connectors

Order Number	Description
FHAC-Q2HS1000-00	1 m HSSDC cable, equalized
FHAC-Q2HS3000-00	3 m HSSDC cable, equalized
FHAC-Q2HS5000-00	5 m HSSDC cable, equalized
FHAC-Q2HS1001-00	10 m HSSDC cable, equalized
FHAC-Q2HS2001-00	20 m HSSDC2 cable, equalized
FHAC-Q2HS2501-00	25 m HSSDC2 cable, equalized
FHAC-Q2HS3001-00	30 m HSSDC2 cable, equalized

B.2.4 HSSDC Copper: 2.125 Gbps

The following table lists the order numbers for the HSSDC copper, 150-ohm, 2.125 Gbps equalized Shielded Quad cable.

Table B-11 Shielded 150-Ohm Quad Copper Cable with HSSDC Connectors

Order Number	Description
FHAC-Q2HE1000-00	1 m HSSDC cable, equalized
FHAC-Q2HE3000-00	3 m HSSDC cable, equalized
FHAC-Q2HE5000-00	5 m HSSDC cable, equalized
FHAC-Q2HE1001-00	10 m HSSDC cable, equalized
FHAC-Q2HE1501-00	15 m HSSDC cable, equalized

GLOSSARY

1x3 ----------A 3-pin connector for use with copper media.

8B/10B ----------A data-encoding scheme developed by IBM for translating byte-wide data to an encoded 10-bit format.

AAL5----------ATM Adaptation Layer for computer data.

active ----------A term used to denote a port that is receiving a signal.

AL ----------See Arbitrated Loop.

ALPA ----------Arbitrated Loop Physical Address.

ANSI ----------American National Standards Institute.

AP ----------Access Point.

API ----------Applications Program Interface.

APID ----------Access Point Identification Number. A number ranging between 0 and 65535 that is assigned by the user to identify a process. All APID's attached to a single FX board must be unique.

arbitrated loop----------The simplest form of a Fabric topology. Has shared bandwidth, distributed topology. Interconnects NL_ports/FL_ports at the nodes/Fabric using unidirectional links. It has only one active L_port-L_port connection, so blocking is possible. A fairness algorithm ensures that no L_port is blocked from accessing the loop. Should any link in the loop fail, communication between all L_ports is terminated (see cross-point, point-to-point).

ASIC ----------Application Specific Integrated Circuit. An integrated circuit designed to perform a specific function. ASICs are typically made up of several interconnected building blocks and can be quite large and complex.

ATM ----------Asynchronous Transfer Mode. A network technology that transfers data in small 53-byte packets, and permits transmission over long distances. Proposed speeds range from 25 Mbps to 622 Mbps.

Auto-Speed Negotiation --------This feature enables FibreXpress FX200 cards to interoperate with existing FC devices at 1.0625 Gbps, and provides seamless transition to higher performance 2.125 Gbps devices.

bandwidth ----------The amount of data that can be transmitted over a channel.

baud----------A unit of speed in data transmission, usually equal to one bit per second.

Bi-Directional card ----------A FibreXtreme Simplex Link card with both source and destination capabilities.

BIOS ----------Basic Input/Output System.

bps----------bits per second.

broadcast----------Sending a transmission to all nodes on a network.

BSP----------Board Support Package. A set of software routines written by the OS vendor or SBC vendor that provides support for a particular SBC.

burst transfers ----------Messages are transmitted in a format that includes the initial address followed by all the data. Burst transfers eliminate the need for repeated addresses for each data block, permitting higher throughput.

channel ----------A point-to-point link that transports data from one point to another at the highest speed with the least delay, performing simple error correction in hardware. Channels are hardware intensive and have lower overhead than networks. Channels do not have the burden of station management.

channel network----------Combines the best attributes of both channel and network, giving high bandwidth, low latency I/O for client server. Performance is measured in transactions per second instead of packets per second.

circuit ----------Bi-directional path allowing communications between two L_Ports.

circuit-switched mode----------Data transfer through a dedicated connection (Class 1).

CMC ----------Common Mezzanine Card.

communications protocol-------A special sequence of control characters that are exchanged between a computer and a remote terminal in order to establish synchronous communication.

CRC----------Cyclic Redundancy Check. A code used to check for errors in Fibre Channel.

crossbar switch ----------Multipurpose, non-blocking 32-port cross-point switch for digital speeds up to 2.5 Gbps (See cross-point).

cross-point ----------Provides a bi-directional connection between a node (N_port) and the Fabric (F_port). Can be configured to be non-blocking by providing multiple paths between any two F_ports. Adding stations to a Fabric does not reduce the point-to-point channel bandwidth (see point-to-point).

datagram----------Type of data transfer for Class 3 service. Transfer has no confirmation of receipt and rapid data transmission.

dBm ----------decibels relative to one milliwatt.

destination only card ----------A FibreXtreme Simplex Link card that is only capable of receiving data.

direct connect links ----------An actual physical, dedicated connection between two devices with the entire bandwidth available to serve each direct link. Direct links provide a fast and reliable medium for sending large volumes of data.

DMA ----------Direct Memory Access.

DMA write----------The DMA engine on the bus controller writes the data from the host computer to the SRAM buffer, freeing the host CPU for other tasks. (FibreXpress board becomes a master for the bus.)

E_Port ----------Element Port. Used to connect fabric elements together.

ECL ----------Emitter Coupled Logic.

ethernet----------A widely used shared networking technology.

exchange ----------One or more sequences for a single operation that are not concurrent, but are grouped together.

F_Port ----------Fabric Port. The access point of the fabric for physically connecting the user's N_Port.

fabric----------A self-managed, active, intelligent switching mechanism that handles routing in Fibre Channel Networks.

fabric elements----------Another name for ports.

FC ----------Fibre Channel.

FC-AL ----------Fibre Channel Arbitrated Loop. Provides a low-cost way to attach multiple ports in a loop without hubs and switches.

FCP----------Fibre Channel Protocol. The mapping of the SCSI communication protocol over Fibre Channel.

FC-PH ----------Fibre Channel Physical interface. Fibre Channel Physical standard, consisting of the three lower levels, FC-0, FC-1, and FC-2.

FCSI----------Fibre Channel Systems Initiative is made up of IBM, Hewlett-Packard and Sun Microsystems. This group strives to advance Fibre Channel as an affordable, high-speed interconnection standard.

FC-SW----------Fibre Channel Switch Fabric standard. Formerly known as FC-XS: Fibre Channel Xpoint Switch. The crosspoint-switched fabric topology is the highest-performance Fibre Channel fabric, providing a choice of multiple path routings between pairs of F_ports.

Fibre Channel----------Fibre Channel (FC) is a serial data transfer interface technology operating at speeds up to 1 Gbps. It is defined as an open standard by ANSI. It operates over copper and fiber optic cabling at distances of up to 10 kilometers. Supported topologies include point-to-point, arbitrated-loop, and fabric switches.

FibreXpress ----------A Systran trademark name for a family of networking products that maximize the superior communication and interconnect capabilities of ANSI standard Fibre Channel. The FX200 series of 64-bit adapters support up to 200 MB per second (400 MB per second duplex) throughput. The FX100 series supports 100 MB per second throughput.

FibreXtreme----------A Systran trademark name for a family of networking products based on the original Simplex Link technology, Systran's FibreXtreme Serial FPDP Data Link moves data at a sustained 247 MB per second with microsecond latency. Supports up to 2.5 Gbps serial data link using a highly specialized communications protocol optimized for maximum data throughput.

FibreXtreme Simplex Link ----A high-speed, point-to-point, communication network capable of transfers in excess of 100 MB/s.

FIFO ----------first in first out

Firmware ----------Microprocessor executable code, typically for embedded type processors.

Flash ----------A type of Electrical Erasable Programmable Read Only Memory (EEPROM). Erased and written to in blocks vs. bytes.

FL_Port ----------Fabric Loop Port. Joins an arbitrated loop to the fabric.

FPDP----------Front Panel Data Port.

frame----------A linear set of transmitted bits that define a basic transport element. A frame is the smallest indivisible packet of data that is sent on the FC.

frame-switched mode ----------Data transfer is connectionless (Classes 2 and 3) and data transmission is in frames. The bandwidth is allocated on a link-by-link basis. Frames from same port are independently switched and may take different paths.

FTP application ----------A test application for transferring files from one computer to another.

FX ----------FibreXpress.

G_Port----------A port which can function as either an F_Port or an E_Port. Its function is defined at login.

Gbps----------Gigabits per second.

gigabit----------One billion bits, or one thousand megabits.

GLM ----------Gigabit per second Link Module. A Link Module that can be used for optical or copper media.

HANDLE ----------Abstraction for the *Handle* in Windows and *file descriptor* in Unix.

HBA----------Host Bus Adapter.

heartbeat----------A visual indicator that flashes periodically to indicate the embedded controller is functioning properly.

HIPPI ----------High Performance Parallel Interface. An 800 Mbps interface to supercomputer networks (previously called high-speed channel) developed by ANSI.

HSSDC ----------High Speed Serial Data Connectors and Cable Assemblies. A type of high-speed interconnect system which allows for transmission of data rates greater than 2 Gbps and up to 30 meters.

hunt group----------A group of lines that are linked so that one call to the group will find the line that is free. This provides the ability for more than one port to respond to the same alias address.

I/O ----------Input/Output.

IOCB----------I/O Control Block. A block of information stored in system memory, usually of fixed length, which contains control codes and data. The IOCB is created by a host computer and sent to some other computer. The IOCB contains command/instructions, data, and memory pointers intended to direct the other computer to perform some function.

inactive ----------A term used to denote a port that is not receiving a signal.

intermix ----------A Fibre-Channel-defined mode of service that reserves the full Fibre Channel bandwidth for a dedicated (Class 1) connection, but also allows connectionless (Class 2) traffic to share the link if the bandwidth is available.

IP ----------Internet Protocol is a data communications protocol.

IPI ----------Intelligent Peripheral Interface.

insertion delay ----------The amount of time the data is delayed for the insertion of FXSL framing protocol. It is measured from when the data becomes available at the FIFO to when the data is actually transmitted on the link. The actual values are either 188 ns in Mode-0 or Mode-1 (with no CRC), or 226 ns in Mode-2 or Mode-3 (with CRC).

KB ----------Kilobytes. IEEE convention: A capital K is used for binary (1024) kilo, and a lowercase k is used for decimal (1000) kilo.

Kb ----------Kilobits.

Kbps----------Kilobits per second.

L_Port ----------Loop Port. Either an FL_Port or an NL_Port that supports the arbitrated loop topology.

LAN ----------Local Area Network, typically less than 5 kilometers. Transmissions within a LAN are mostly digital, carrying data at rates above 1 Mbps.

latency ----------The delay between the initiation of data transmission and the receipt of data at its destination.

LCF----------Link_Control Facility. Provides logical interface between nodes and the rest of Fibre Channel.

Link Module----------A mezzanine board mounted on the board to interface between the board and the network.

longword ----------32-bit or 4-byte word.

LP----------Lightweight Protocol.

LX1500 ----------LinkXchange LX1500 Crossbar Switch.

LX2500 ----------LinkXchange LX2500 Crossbar Switch.

Mbps ----------Megabits per second.

MBps----------Megabytes per second.

MB----------Megabytes.

media----------Means of connecting nodes; either fibre optics, coaxial cable or unshielded twisted pair.

ms----------Milliseconds

mW ----------Milliwatt.

µs----------Microseconds

monitor ----------An application program used to display the status and change the configuration of the driver.

multicast----------A single transmission is sent to multiple destination N_ports, a one-to-many transmission. Multicasting provides a way for one host to send packets to a selective group of hosts.

N_Port ----------Node Port. A Fibre-Channel-defined entity at the node end of a link that connects to the fabric via an F-Port.

network----------Connects a group of nodes, providing the protocol that supports interaction among these nodes. Networks are software intensive, and have high overhead. Networks also operate in an environment of unanticipated connections. Networks have a limited ability to provide the I/O bandwidth required by today's applications and client/server architectures.

NL_Port ----------Node Loop Port. Joins nodes on an arbitrated loop.

node ----------A host computer and interface board. Each processor, disk array, workstation or any computing device is called a node. Connects to FC through a node port (N_Port).

normal write----------A host CPU writes data to the SRAM buffer through the bus and bus controller (FibreXpress board operates as a slave of the bus).

ns----------nanoseconds.

NVRAM----------Non-Volatile Random Access Memory. Generic term for memory that retains its contents when power is turned off.

OFC ----------Open Fibre Control. A safety interlock system used on some FC shortwave links.

one-to-many ----------One node transmits to multiple nodes. See broadcast, multicast.

operation ----------One of Fibre Channel's building blocks composed of one or more exchanges.

out-of-band control----------On the LinkXchange products, a method of issuing switch commands that does not use any bandwidth of the 32 switch ports.

PCB----------Printed Circuit Board.

PCI ----------Peripheral Component Interface.

PECL ----------Positive Emitter Coupled Logic.

PIO ----------Programmed Input/Output.

PMC----------PCI Mezzanine Card. Everything that is true for PCI cards is true for PMC except there is a footprint or card format change.

point-to-point ----------Bi-directional links that interconnect the N_ports of a pair of nodes. Non-blocking.

port----------A physical element through which information passes. It is an electrical or optical interface with a pair of wires or fibers—one each for incoming and outgoing data.

profiles----------Subsets of Fibre Channel standards that improve interoperability and simplify implementation. It is like a cross-section of FC, providing guidelines for implementing a particular application.

protocols----------Data transmission conventions encompassing timing, control, formatting, and data representation. This set of hardware and software interfaces in a terminal or computer allow it to transmit over a communication network, and these conventions collectively form a communications language.

retimed ----------"Retimed" port cards use a phase-locked loop to recover the clock from a serial data stream. They then use the recovered clock to strobe the data through a one-bit latch to minimize the accumulation of edge jitter. This process is sometimes called "reclocked." (Retimed port cards do *not* synchronize the data to a local crystal-controlled reference clock.) Non-retimed port cards do not clock the serial data stream at all. From a timing standpoint, they function as gate delays as the data passes asynchronously through them.

RISC ----------Reduced Instruction Set Computer. A type of microprocessor that executes a limited number of instructions that typically allows it to run faster than a Complex Instruction Set Computer (CISC).

RJ-45----------Short for Registered Jack-45. An eight-wire connector commonly used to connect computers onto a local-area network (LAN), especially Ethernet. RJ-45 connectors look similar to the RJ-11 connectors used for connecting telephone equipment, but they are somewhat wider.

SAP----------Service Access Point.

SBC----------Single Board Computer.

SCSI ----------Small Computer System Interface.

sequence ----------The unit of transfer, made up of one or more related frames for a single operation.

SFF ----------Small Form Factor. Based on SFF MSA.

SFF MSA----------Small Form Factor Transceiver Multisource Agreement (SFF MSA), July 5, 2000.

shared connect links ----------The ability to send and receive data without establishing a dedicated physical connection so that other devices can also use the medium. This shared link is more efficient for smaller data transmissions because the overhead of direct connect link is avoided.

SRAM----------Static Random Access Memory.

SRAM Transfer ----------Process in which the data is transferred from the host computer to the SRAM buffer by normal or by DMA write.

SFP ----------Small Form Factor Pluggable based on MultiSource Agreement (MSA), September 14, 2000, FO Transceiver Industry.

STP----------Shielded Twisted Pair. A type of cable media.

striping----------To multiply bandwidth by using multiple ports in parallel.

switched fabric----------(see the definition for “fabric”).

SYNC ----------FibreXtreme Simplex Link primitive used to synchronize the source and destination cards.

SYNC with DVALID----------A special case of the SYNC primitive occurring in the middle of a buffer of data.

source only card ----------A FibreXtreme Simplex Link card that is only capable of sending data.

TCP----------Transmission Control Protocol.

terminal application----------A test application that sends characters received from the keyboard and displays received characters.

throughput application ---------An application that tests the throughput for the given system.

time-out----------The time allotted for a native message to travel the network ring and return. If this time is exceeded, an automatic retransmission of the native message occurs.

topology----------Refers to the order of information flow due to logical and physical arrangement of stations on a network.

TTL ----------Transistor-Transistor Logic.

ULP ----------Upper Level Protocol.

VHDL----------Very high-speed integrated circuit Hardware Description Language.

VME ----------Acronym for VERSA-module Europe: bus architecture used in some computers.

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INDEX

8

8B/10B
conversion 2-7

A

address assignment mechanism 3-6
addressing
64-bit 2-5
airflow A-2
AL_PA aliases 2-5
ANSI 2-3
ANSI standard card 2-4
anti-static mat 3-1
API guide 3-6
applications 2-2, 2-9, 3-5, 3-6
benign environment 2-2
data warehouses 2-9
databases 2-9
data-intensive 2-1
digital imaging 2-9
digital networks 2-9
embedded military sensor 2-9
industrial 2-2
industrial control systems 2-9
network-based storage 2-9
operational 2-1
real time 2-9
recovery systems 2-9
server clusters 2-9
storage area network 2-9
storage backup systems 2-9
test board 3-6
arbitrated loop 2-5, 2-7, 2-10, 2-12, 2-13
failure 2-15
with hub 2-14
ASIC 2-8
JNIC-1560 ..... 2-6, 2-7, 3-6
PCI-to-FC 2-3, 2-4, 2-5
auto-speed negotiation 2-1, 2-3, 2-4, 2-5

B

backplane 2-6
host 3-1
baud rate
2.5 Gbps/port 2-16
broadcast 2-16
burst transfer 2-5

C

cable
equalized shielded quad B-4
fiber-optic 2-16, 3-4
FX200 DC B-2
length 2-16
long wavelength 3-5
multimode A-5, B-2
short wavelength 3-5
singlemode A-5, B-3
cable break 2-15
cable length A-5
maximum A-5
cache line streaming 2-5
clean cable ends 3-4
clean the connector 3-4
communications
fibre channel 2-3, 2-4
compatibility A-5
concurrent FCP 2-5
configuration 2-7
arbitrated loop 2-12
conformal coating 2-2, A-3, A-4
connector
duplex LC 2-6, A-5
fiber optic 3-4
HSSDC 3-5, A-5
convection airflow 2-2
CPU overhead 2-1
cross connection 2-13
custom software 3-6
customer support 3-6

D

data
transfer rate 2-1
data rate 2-5, 2-8
burst transfer 2-5
full duplex fibre channel 2-5
maximum A-5
data transfer 2-9
device driver 2-5, 2-7, 3-6
distributed processors 2-9
DMA 2-5
documentation
technical 1-3
dual-address cycle 2-5
dual-channel cards A-1, A-2, B-1, B-2
duplex B-2, B-3

E

EEPROM 2-6
electrical requirements A-1, A-2

electrostatic discharge 3-2
external components 2-6

F

fabric switch 2-9, 2-10
  cascade 2-9
faceplate 3-3
fault isolation 2-9
  I/O port 2-16
FCP protocol 2-6
features
  LX2500 2-16
fiber-optic
  cable 3-1, B-2, B-3
  connector 3-4
  transmitters 3-4
fibre channel
  analyzer mode 2-5
  hub 2-14
filter network 2-7
format conversion 2-7
front panel LED 2-8
full duplex 2-5

H

half duplex 2-5
hardware compatibility A-1, A-2
host
  bus adapter 2-1, 2-4
  high-performance 2-1
host bus adapter 2-3
  form factor 2-4
HSSDC A-5
  cable 2-16, 3-1
  cables 2-13, 2-16
  connector 2-16, 3-5, B-4
  media option 2-6, 2-7
  order numbers B-4
  receptacle 2-6, 3-5
HSSDC2
  media option 2-16
hub 2-14
hubs 2-9

I

initialization 2-7
initiator mode 2-5
installation
  FX200 card 3-3
interface
  electrical and mechanical 2-7
  host bus 2-5
  physical media 2-6, 2-16
interrupt 2-5
interrupting device 2-5
intrasystem connections 2-6
IP protocol 2-5
isolate failed node 2-15

L

laser 2-6
  long wavelength 2-6, 2-7, 2-9, 2-16, A-5, B-1, B-3
  short wavelength 2-6, 2-7, 2-16, A-5, B-1, B-2
laser light 2-8
LED
  link up 2-8
  rate 2-8
  signal detect 2-8
  status 2-4, 2-7
LinkXchange
  LX2500 crossbar switch 2-14, 2-15, 2-16
  LX2500 features 2-16
long wave optical transceivers 2-9
loop 2-16
loopback mode
  internal 2-5
loss of signal 2-15

M

mating connector 3-3
maximum data rate A-5
MD2 form-factor 2-3
media options 2-6, 2-7
memory
  PCI 2-5
modem 2-16
motherboard 3-2
mounting screw 3-2
mounting screws 3-3
MTBF A-2
  SL100 laser
    long wavelength A-2
    short wavelength A-2
  SL240 laser
    short wavelength A-2
multimode 3-5
  fiber 2-6

N

network line transmission rate A-1, A-2
noise content 2-7
non blocking
  I/O ports 2-16

O

on-card regulator 2-7
operating
  altitude A-3, A-4
  humidity A-1, A-2, A-3, A-4
  temperature A-1, A-2, A-3, A-4
  voltage A-2
operating system
  Digital UNIX 2-16
  Solaris 2-16
  VxWorks 2-16
  Windows 2000 2-16
  Windows NT 2-16
optical fiber
  multimode 2-16
order numbers B-4
  board configuration B-1, B-2
  multimode FO B-2
  singlemode FO B-3
out-of-band control 2-16

P

PCB 3-3
PCI
  BIOS 3-6
  bus initiator 2-5
  interface 2-5, 2-7
  memory map 3-6
  slot 2-3
peripherals 2-9
physical dimensions A-1, A-2
physical media 2-1, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 3-4
  interface specifications 2-1
physical media interface 3-1
PMC-compliant carrier 2-4, 3-3
point-to-point 2-5
  connection 2-10
  connection, independent 2-10
  dual connection 2-10, 2-12
  multiple 2-16
port failure
  single 2-15
power management registers 2-5
power up system 3-6
power usage A-1
programmable
  removal from loop 2-5
programmable priority 2-5
protocol
  fibre channel 2-1, 2-7
  internet 2-1, 2-6, 2-7
  IP 2-5

Q

quality 1-2, 1-3, 2-7

R

raw frame handling 2-5
receive and send buffers 2-7
receive
  power A-5
  wavelength A-5
receiver 3-4
receptacle
  HSSDC 3-5
RISC
  engine 2-3, 2-4
  I/O engine 2-1, 2-7
RS-232 2-16
ruggedization levels 2-1, A-3
ruggedized A-3, A-4
  level 1 ..... B-1
  level 2 ..... B-1

S

sample applications 3-6
SCSI
  FC-4 upper layer protocol 2-6
SCSI targets 2-5
SEEPROM 2-6, 2-7
SERDES 2-6, 2-7
serial FC data 2-7
serializer/deserializer 2-6, 2-7
shock 2-2, A-3, A-4
signal detect 2-15
signaling levels 2-5
simplex B-2, B-3
  cables 2-13
single board computer 2-1, 3-3
singlemode 3-5
small form factor 2-1, 2-4, 2-6, 2-7, B-1
  transceivers 2-1
small form factor pluggable 1-2, 2-3, B-1, B-2
software drivers 2-1, 2-16, 3-6
source code 3-6
specifications 2-1, 2-6
  average current A-1
  peak current A-1
SRAM 2-6, 2-7
  synchronous 2-7
status LED 2-3
stiffener rib

mechanical interface 2-4
stiffening rib 3-3, 3-4
on-board 2-4, 3-3
storage
altitude A-3, A-4
backup systems 2-9
devices 2-9
humidity A-1, A-2, A-3, A-4
temperature A-1, A-2, A-3, A-4
switched fabric 2-5

T

target 2-5
target mode
concurrent 2-5
temperature 2-2
test the card 3-6
thermal management A-2
topologies 2-10
topology
arbitrated loop 2-10, 2-13
point-to-point 2-10
switched fabric 2-10
transmit
power A-5
wavelength A-5
transmitter 3-4

U

universal PCI signaling 3-3
up-stream node 2-8

V

vibration 2-2, A-3, A-4
voltage regulator 2-7

W

weight A-1, A-2
world wide names 2-7
write applications 3-6

Z

zero-wait-state transfers 2-5

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