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Single LX2500 Crossbar Switch

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LX2500 Crossbar Switch
Hardware Reference Manual

Document No. F-T-MR-LX2500##-A-0-A4

FOREWORD

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(937) 252-5601

FCC

This product is intended for use in industrial, laboratory or military environments. This product uses and emits electromagnetic radiation, which may interfere with other radio and communication devices. The user may be in violation of FCC regulations if this device is used in other than the intended market environments.

CE

As a component part of another system, this product has no intrinsic function and is therefore not subject to the European Union CE EMC directive 89/336/EEC.

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1. INTRODUCTION

1.1 How to Use This Manual

1.1.1 Purpose

The purpose of this manual is to describe the LinkXchange LX2500 Crossbar Switch (LX2500), and to guide users through the process of unpacking, setting up, and operating the LX2500.

1.1.2 Scope

This manual contains the following information:

- Overview of LX2500 capabilities and features.
- Physical and functional description of the LX2500 components.
- Instructions on how to use the LX2500.
- User Control Interface.
- General LX2500 specifications.
- Data sheets for available LX2500 port cards.
- An illustration, pin assignments, and cable connections for the RS-232 Cable.
- Information about Systran's available LX2500 products.

The information in this manual is intended for information systems personnel, systems coordinators, or highly skilled network users.

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, an 'Active Low' is represented by prefixing the signal name with a slash (/). 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

The following documents are referred to in this specification.

- *FibreXpress FX100 Hardware Reference Manual for PCI and PMC Boards*, Systran Corporation (Doc. No. F-T-MR-F1PCIPMC).
- *FibreXpress Owner's Manual for the FX Sbus*, Systran Corporation (Doc No. F-T-MR-SBUS).
- *FibreXpress Owner's Manual for the FX VME6U*, Systran Corporation (Doc No. F-T-MU-VME6U).
- *FibreXpress Owner's Manual for the FX PCI/PMC Boards*, Systran Corporation (Doc No. F-T-MU-PCI/PMC).
- *FibreXtreme Simplex Link Hardware Reference Manual for PCI and PMC Cards*, Systran Corporation (Doc No. F-T-MR-S1PCIPMC).
- *FibreXtreme Simplex Link Hardware Reference Manual for VME and CMC FPDP Cards*, Systran Corporation (Doc No. F-T-MR-S1FPDP).
- *Fibre Channel, A Technical Overview* – available from Systran.
- *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 ANS 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.
- Fibre Channel Association - www.fibrechannel.com
- *ANSI Z136.2-1988 American National Standard for the Safe Use of Optical Fiber Communication Systems Using Laser Diode and LED Sources.*
- *Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange* – EIA Standard RS-232C.
- *IEC 825-1984 Radiation Safety of Laser Products, Equipment Classification, Requirements, and User's Guide,* 2 parts, 1993.
- Systran Corp. - www.systran.com

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Systran Corporate policy is to provide our customers with the highest quality products and services. In addition to the physical product, the company provides documentation, sales and marketing support, hardware and software technical support, and timely product delivery. Our quality commitment begins with product concept, and continues after receipt of the purchased product.

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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If you have any technical or non-technical questions or comments, contact us. Hours of operation are from 8:00 a.m. to 5:00 p.m. Eastern Standard/Daylight Time.

- Phone: (937) 252-5601 or (800) 252-5601
- E-mail: support@systran.com
- Fax: (937) 252-1349
- World Wide Web address: www.systran.com

1.5 Ordering Process

To learn more about Systran products or to place an order, please use the following contact information. Hours of operation are from 8:00 a.m. to 5:00 p.m. Eastern Standard/Daylight Time.

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- World Wide Web address: www.systran.com

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2. PRODUCT OVERVIEW

2.1 Overview

Systran's LX2500 Crossbar Switch (LX2500) is a multipurpose, non-blocking 32-port crosspoint switch for digital signals at speeds up to 2.5 gigabits per second (Gbps). Any of its 32 outputs can be connected to any one of its 32 inputs. The protocol or structure of data routed through the switch is ignored by the LX2500 and is unaltered by its passage through the switch. This allows the LX2500 to be used with many different types of networks and signals.

A single LX2500 switch holds up to eight port cards. Each port card provides the physical ports for four input-output pairs. While the crosspoint switch itself can operate from DC to 2.5 Gbps, different types of port cards impose different limitations on the range of data rates or the data format that they will pass.

The LX2500 has four main functions:

1. Route signals from port card inputs to the selected port card outputs.
2. Provide an out-of-band command line interface to the user.
3. Provide status and alarm information to the user.
4. Provide fault isolation when required.

See Appendix A for LX2500 hardware specifications.

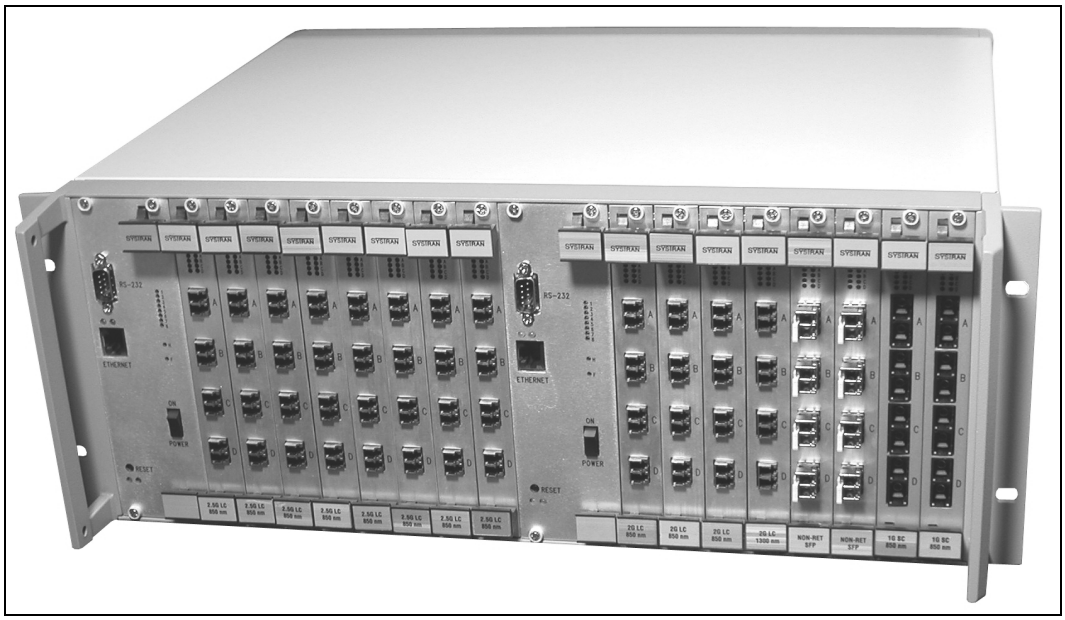

Figure 2-1 LX2500 Crossbar Switch

2.2 Features

The LX2500 switch has these features:

- Up to 32 non-blocking media-specific I/O ports.
- Up to 2.5 Gbps/port baud rate (port card dependent).
- 80 Gbps total bandwidth.
- Support for multiple point-to-point, loop, and multicast communication links simultaneously.
- Flexible automatic I/O Port fault isolation.
- Multiple media options.
- Hot-swappable port cards.
- Out-of-band control through an RS-232 port or Ethernet.
- Can be controlled remotely via telnet or web browser.

2.3 LX2500 Product Family

The LX2500 is packaged in a rack-mountable enclosure that houses one or two LX2500 switches. Port cards can be specified as a part of the LX2500 or ordered separately.

A version of the LX2500 with hot-swappable dual redundant power supplies is also available. See Appendix B for more information.

2.3.1 LX2500 Package

The rack-mountable enclosure comes with one or two LX2500 switches, as shown in Figure 2-2 and Figure 2-3. Each LX2500 switch has its own control panel, power switch, and power supply. When two LX2500 switches share an enclosure, they are independent—the only connection between them is a shared fan.

NOTE: Since the enclosure can hold one or two 32x32 switches, the phrase “LX2500 switch” is used in this manual when it is necessary to refer to one switch as a functional unit.

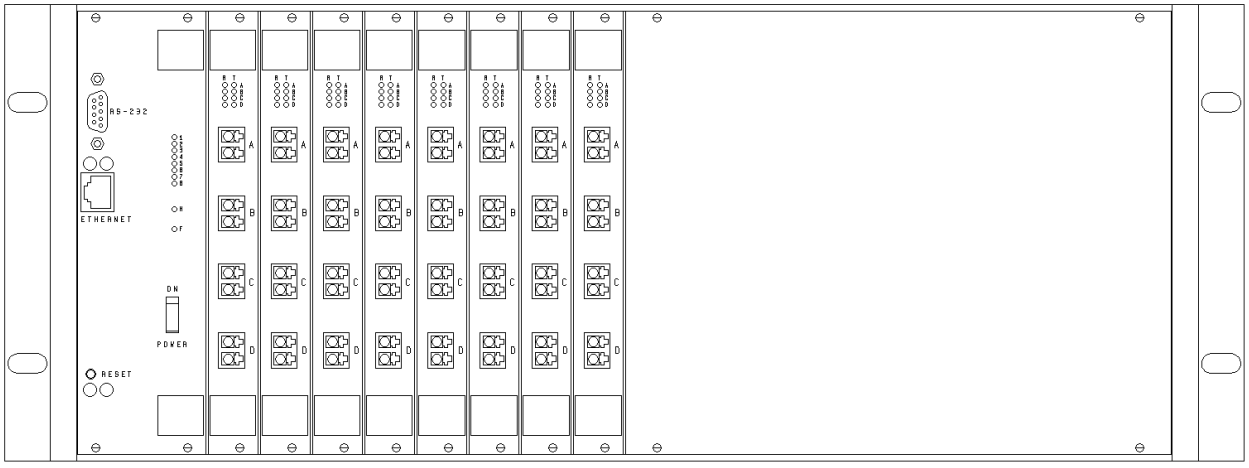

Figure 2-2 Single LX2500

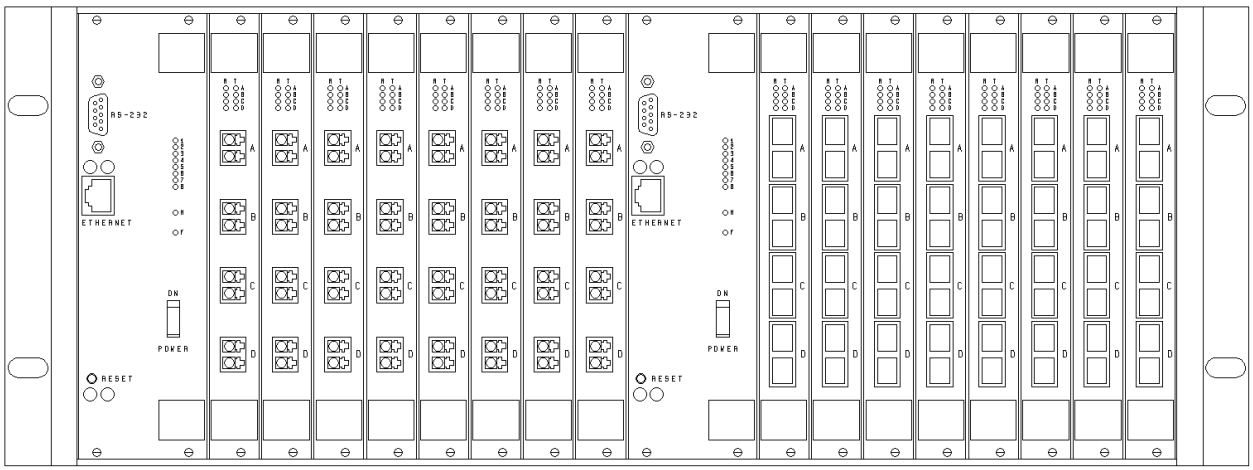

Figure 2-3 Dual LX2500

2.3.2 Port Cards

The following port cards are currently available for use with the LX2500:

- 2.5 Gbps LC Optical connectors, 850 nm
- 2.5 Gbps LC Optical connectors, 1300 nm
- 2.125 Gbps LC Optical connectors, 850 nm
- 2.125 Gbps LC Optical connectors, 1300 nm
- 1.0625 Gbps SC Optical connectors, 850 nm
- 1.0625 Gbps SC Optical connectors, 1300 nm
- Non-retimed with Small Form-factor Pluggable (SFP) receptacles

The 2.5 Gbps cards are compatible with Systran's FibreXtreme SL240 products. They can also be programmed to work at 1.25 Gbps, 625 Mbps, or 156.25 Mbps.

The 2.125 Gbps cards are compatible with Systran's FibreXpress FX200 products and other Fibre Channel products of that speed. It is also compatible with 1.0625 Gbps products.

The 1.0625 Gbps cards are compatible with Systran's FibreXtreme SL100 series, Simplex Link series, FibreXpress FX100 products, and other Fibre Channel products of that speed.

The non-retimed SFP cards can operate at any data rate up to 2.5 Gbps, depending on the type of transceiver modules plugged into them. SFP modules may be hot swapped.

For more detailed port card specifications see Appendix C.

2.4 User Control Interface

The LX2500 is controlled through an RS-232 or an Ethernet port. The RS-232 port offers a command line interface that allows a user to configure and receive status information from the LX2500. The Ethernet port allows users on a network to control the LX2500 using the command line interface (via Telnet) or a web browser.

The user-control interface has these features:

- On-line help for each command.
- Configurable status display.
- Configurable alarms (log messages and beeps).

- Configurable fault isolation (bypassing and/or alternative source attachment).
- Automatic restoration of the last configuration at power up.
- No user intervention required at startup.
- Four saved configurations.
- Multiple standard configurations.

See chapters 4 and 5 for a detailed description of this interface.

The LX2500 control panel contains the power switch, reset button, RS-232 and Ethernet connectors, and some indicator lights. It is described in Section 4.1.

The LX2500 port cards each contain status indicators for their ports. See the individual port card descriptions in Appendix C for details.

In addition to the interface ports, the LX2500 has a "Heartbeat" indicator, which flashes periodically to indicate that the LX2500's embedded controller is functioning properly, and a Reset pushbutton to reset the controller.

The port cards have indicators to show the status of each port. See the individual port card descriptions for details.

2.5 Example Applications

2.5.1 Crossbar Switch

The LX2500 can be used to connect multiple nodes (for example, in a Fibre Channel arbitrated loop) into one or more loops. Using the LX2500 this way provides a system with more stability and improves the user's ability to troubleshoot problems and make topological changes. Once the initial cabling is in place, the LX2500 makes administering the system much easier. A few of the advantages:

- Automatic fault isolation allows the loop to continue functioning after a node fails.
- Configurable alarms notify the administrator of node failures.
- A node can be added or dropped, without interrupting the loop operation, by issuing one out-of-band command.
- Different media interfaces can be mixed.

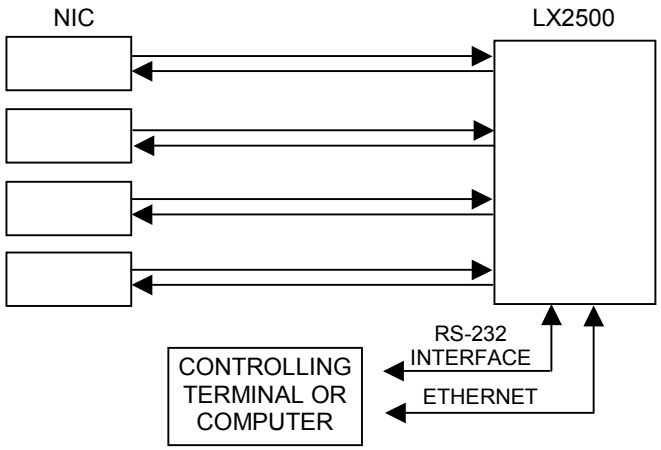

Figure 2-4 LX2500 Connected to Multiple Nodes

2.5.2 Data Broadcast

The LX2500 can replicate the output stream from a data source to multiple data sinks for redundancy or parallel processing.

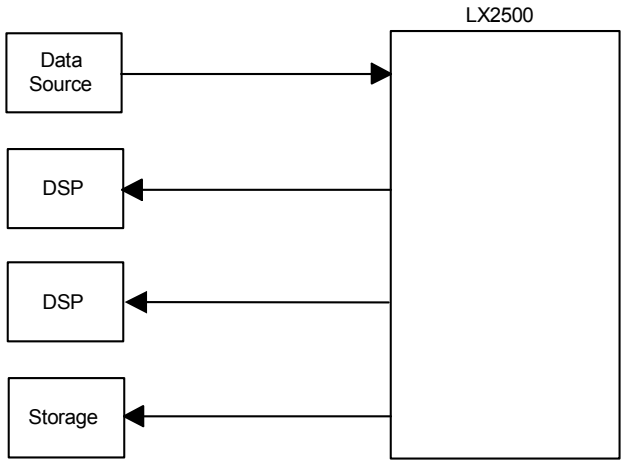

Figure 2-5 LX2500 Used for Data Broadcast

2.5.3 Patch Panel

The LX2500 can act as a patch panel to facilitate system debug or to allow scarce resources to be used in multiple configurations.

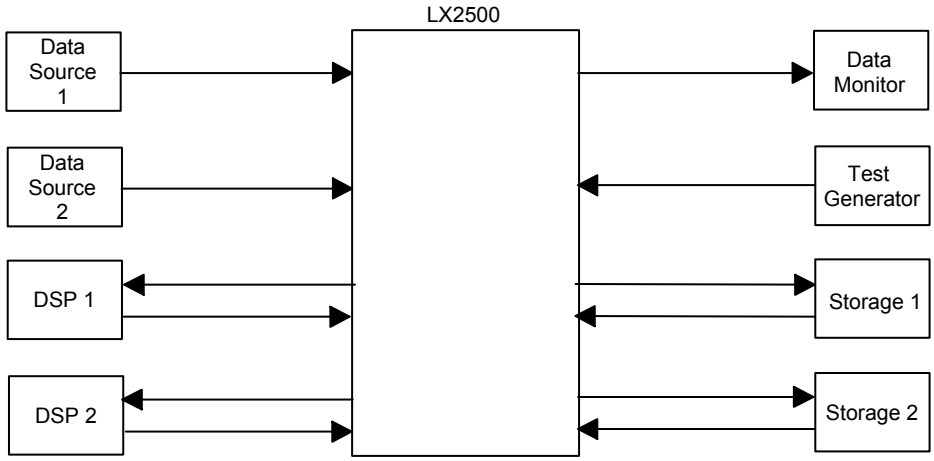

Figure 2-6 LX2500 Used as Patch Panel

2.5.4 Switching More than 32 Ports

Multiple LX2500 units can be cascaded together for applications requiring more than 32 ports. Figure 2-7 shows six 32-port LX2500 units combined to form a nonblocking 64-port crosspoint switch. This setup requires a maximum of three switch passes to perform point-to-point and loop configurations, and five passes to achieve multicast configurations.

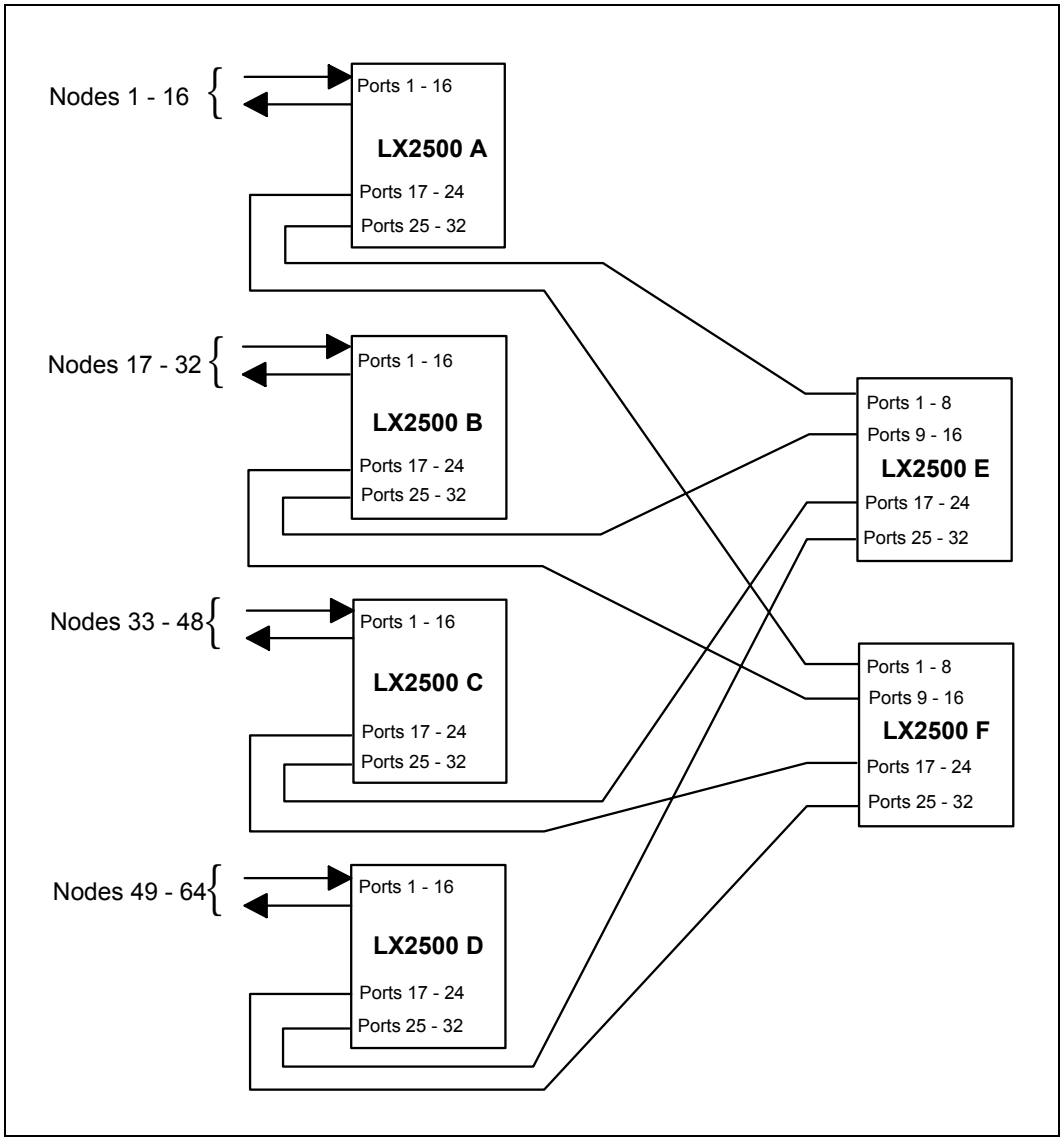

Figure 2-7 A 64-Port Crosspoint Switch Using Multiple LX2500 Units

A topology consisting of one large loop of more than 32 ports can be constructed very efficiently using the LX2500. Figure 2-8 shows four LX2500 units cascaded to form a 124-port switch. This topology is useful for forming very large arbitrated loop topologies.

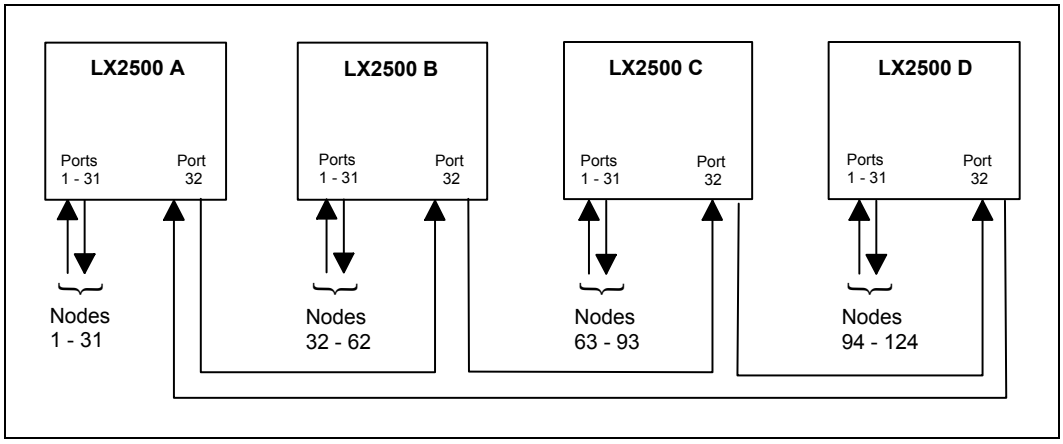

Figure 2-8 Loop Architecture with 124 Nodes Using Multiple LX2500 Units

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3. INSTALLATION

3.1 Overview

This chapter covers the following:

- Unpacking the LX2500
- Mounting or situating the LX2500
- Installing port cards in the LX2500
- Making connections
- Power-on and initial configuration

3.2 Unpacking the LX2500

CAUTION: Exercise care regarding the static environment. Use an anti-static mat connected to a wristband when handling or installing the LX2500.

When you unpack the LX2500, verify the following items are present:

- Enclosure with one or two LX2500 switches installed
- One power cord for each LX2500 switch
- Anti-skid feet (4)
- A copy of this hardware reference manual

Save the packing materials in case you need to return the unit. If the LX2500 was damaged in shipping, notify Systran Corporation or your supplier immediately.

3.3 Positioning the LX2500

The unit can be placed on a tabletop or mounted in a standard 19-inch rack. For use on a tabletop, snap the anti-skid feet into the four holes in the bottom of the enclosure.

3.3.1 Cooling Requirements

Cooling air enters and leaves the enclosure at the rear (see Figure 3-1). Make sure that sufficient airflow is available to the LX2500. Air must be able to flow past the rear of the enclosure so the LX2500 does not just re-circulate the same air. The air temperature at the inlet must not exceed 50° C.

3.3.2 Power Requirements

Power requirements for *each* LX2500 switch are:

- A properly wired, earth-grounded outlet.
- Input voltage: 90-135 or 180-270 VAC
- Line frequency: 47-63 Hz
- Current: 10A @ 115V; 5.5A @ 230V

The LX2500 power supplies automatically switch to accept power in either of the two voltage ranges. Note that an enclosure with two LX2500s installed needs two power outlets. Power supplies are not redundant and do not load-share.

3.4 Installing Port Cards in the LX2500

Port cards ordered as a part of your LX2500 will arrive already installed in the enclosure. If you need to install a separately ordered port card, follow these instructions:

CAUTION: Exercise care regarding the static environment. Use an anti-static mat connected to a wristband when handling or installing port card. Failure to do this may cause permanent damage to the components on 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. Visually inspect the board. If the card was damaged in shipping, notify Systran Corporation or your supplier immediately.
6. Save the shipping materials in case you need to return your port card.
7. Remove the LX2500 filler plate or port card that is to be replaced by the new port card.
8. Insert the port card into the desired slot.
9. Press the port card back until it is fully inserted into the LX2500.
10. Secure the new port card with two screws.

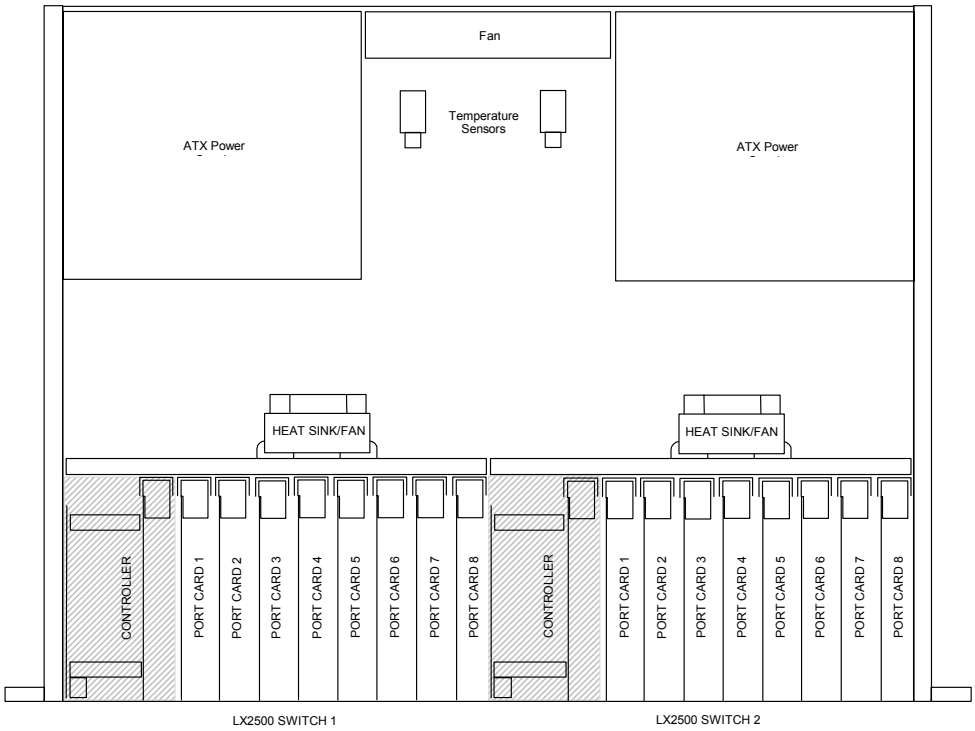

Figure 3-1 LX2500 Top View

3.5 Installing Pluggable Modules

Port cards that accept Small Form-factor Pluggable (SFP) transceiver modules may be shipped with no modules installed. SFP modules may be installed or removed at any time. See section 4.5 for more details.

3.6 Making Connections

The LX2500 can be configured and controlled through its RS-232 port or its Ethernet port (or through both simultaneously). If the LX2500 has been configured and there is no further need to reconfigure the system or monitor its status, the LX2500 can be run with the control cables disconnected.

3.6.1 RS-232 Port Connection

To control the LX2500 through its RS-232 port, connect a serial cable between the port and a serial terminal or a computer that can emulate a serial terminal. The terminal's port should be set to 8 bits, no parity, one stop bit. Its speed can be 9600, 19200, 38400, or 57600 bits per second.

The LX2500's RS-232 port is a nine-pin male connector with the same pinout as a standard PC serial port. If you connect it to a PC port, you'll need to use a null modem adapter or cable. For more details, see Appendix D.

3.6.2 Ethernet Connection

To control the LX2500 through its Ethernet port, connect a cable from the front panel RJ-45 connector to a 10Base-T Ethernet hub. Through this network connection you can interact with the LX2500 via telnet or a web browser.

If the network to which the LX2500 is attached has a DHCP server, the LX2500 can get its IP address from the server. Otherwise, the IP address must be configured with the **ipconfig** command (see Initial Configuration, below).

3.6.3 Signal Connections

The signals that the LX2500 actually switches enter and exit the system through the port cards. Different port cards have different requirements as to what type of connector and cable they interface to. See Appendix C for details.

3.7 Power-up and Initial Configuration

3.7.1 Power-up

Connect the LX2500 switch to a power outlet and turn on the power switch on its control panel. The Power Indicator light will light and the LX2500's processor will start to boot itself. After about 30 seconds the indicator lights will light up in sequence and the Heartbeat Indicator will start to flash. About 45 seconds from applying power the LX2500 will send a banner message to the RS-232 port, indicating that it is ready to accept commands.

3.7.2 Initiating Communications

If the LX2500 is attached to a network with a DHCP server, and you have a way to learn what IP address the server has assigned to the LX2500, you can use telnet or a web browser for the LX2500's initial configuration. Otherwise, the configuration must be done through the RS-232 port. This description assumes that the RS-232 port is being

used. If Telnet is available the same commands can be used. If the web browser interface is available the same configuration tasks can be performed, although the method of performing them is different.

When the LX2500's RS-232 port first comes up it attempts to print a prompt at 38400 bps. Press ENTER or send a Break to shift the port to a different speed. When the prompt is readable, hit ENTER to proceed.

3.7.3 Initial Configuration

TIME

The time and date are displayed in some status messages. To set the time, enter

```
time mm/dd/yy hh:mm
```

filling in *mm*, *dd*, *yy*, *hh*, and *mm* with the month, date, year, hour, and minute respectively. For example:

```
time 04/01/01 13:30
```

TERMINAL TYPE

You may optionally set the type of terminal or terminal emulator that is attached to the RS-232 port (terminal emulation for a Telnet session is set automatically). Enter:

```
term emul termid
term on
```

Fill in *termid* with the terminal type. For example:

```
term emul vt100
term on
```

For more details on dealing with the RS-232 port, see Section 3.6.1 and Appendix D.

IP CONFIGURATION

If you plan to use the LX2500's Ethernet port, the LX2500's IP interface must be configured. If a DHCP server is available on your network, the LX2500 will automatically take its configuration from the server. Otherwise, you must explicitly set the LX2500's IP address, net mask, gateway, and host name:

```
ipconfig addr ipaddr mask maskaddr gate gateaddr name hostname
```

For example:

```
ipconfig addr 192.168.0.5 mask 255.255.255.0 gate 192.168.0.1 name
switch1
```

3.8 Troubleshooting

If the LX2500 does not boot correctly, double-check cable and power connections. If problems persist, call Technical Support at **(937) 252-5601**.

3.9 Maintenance

Other than periodic cleaning, no routine maintenance is required for the LX2500.

4. OPERATION

4.1 Structure of the LX2500

A fully loaded LX2500 contains eight port cards, each port card containing four input/output ports, for a total of 32 ports. Port cards are numbered 1 through 8, and ports on each card are lettered A through D. Figure 4-1 shows an LX2500 full of optical port cards with the ports numbered.

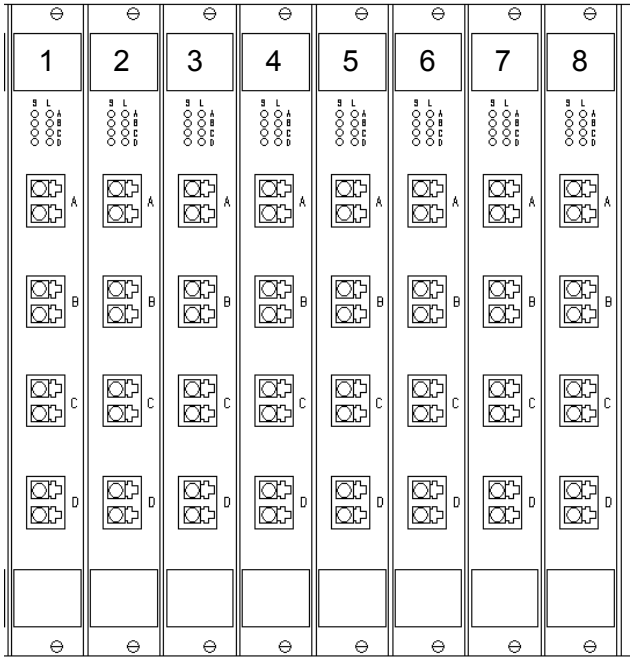

Figure 4-1 LX2500 Port Numbering

EYE SAFETY

The optoelectronic transceiver modules used in this product are class 1 laser products compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J. These components are also class 1 laser compliant according to International Safety Standard IEC-825-1. Class 1 lasers are considered incapable of producing damaging radiation under reasonably foreseeable conditions of operation.

Figure 4-2 is a drawing of the LX2500 control panel. Each LX2500 switch has a separate, independent control panel.

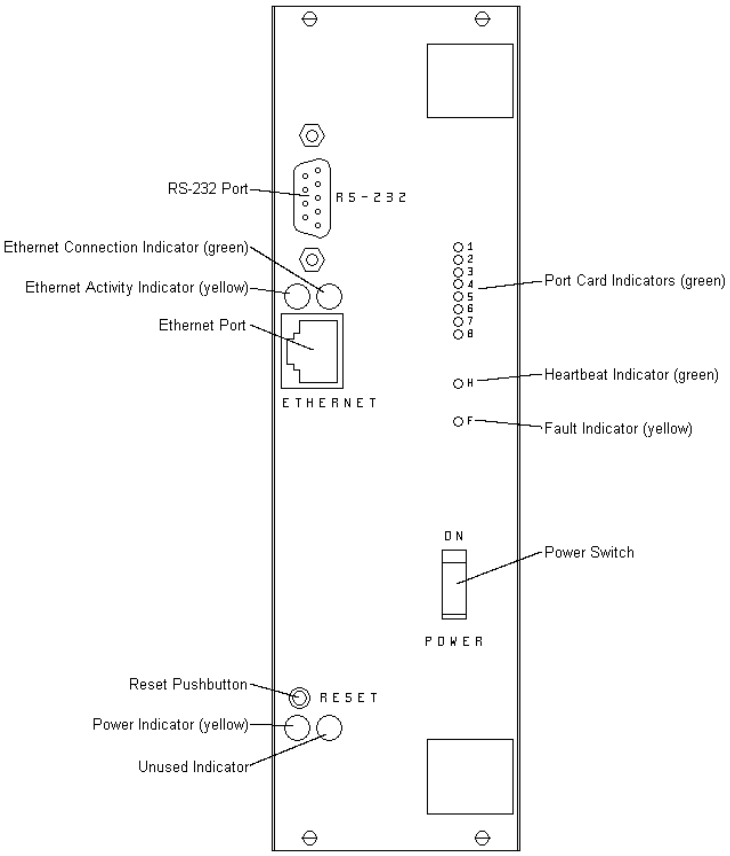

Figure 4-2 LX2500 Control Panel

RS-232 PORT .....A serial terminal or a computer emulating a serial terminal may be connected to this port to control the LX2500 using the Command Line Interface (CLI).

ETHERNET PORT (10Base-T) The LX2500 may be connected to a network via this port. The LX2500 can be controlled from another computer by using Telnet to access the CLI, or using a web browser.

ETHERNET CONNECTION INDICATOR .....Lights when an Ethernet connection is sensed.

ETHERNET ACTIVITY INDICATOR .....Blinks when the Ethernet is active.

RESET PUSHBUTTON ...Press to reset the controller.

POWER INDICATOR.....Lights when power is turned on.

PORT CARD INDICATORS Lights to indicate that the controller sees a working port card in the associated slot. (One for each port card slot.)

HEARTBEAT INDICATOR Blinks at a 0.5 Hz rate (one second on, one second off) to indicate that the controller program is running.

FAULT INDICATOR.....Blinks at about 1 Hz when a fault is detected.

POWER SWITCH .....Controls power for this switch. Note that when two LX2500 switches share an enclosure, each has its own separate power switch.

4.2 Making Connections with the Switch

This section refers to a port's receiver as its "input," and a port's transmitter as its "output." A port is "active" if a signal is detected at its input. If a port is "turned off," its transmitting laser is disabled.

Each port's output may be connected to any port's input or turned off. This connection may be unconditional, or it may be contingent upon which ports are active. Any number of outputs may be connected to a particular input. Connecting an output to an input does not disrupt the signals to any other outputs that are already connected to that input.

A port is "wrapped" if its output is connected to its own input.

Connections are controlled with the **port** command. The **port** command implements an if-then-else sort of control scheme that handles the contingent connection. For details and examples, see Chapter 5, Section 5.3.16.

"Loops" are a special case of the **port** commands, specialized for network ring topologies such as Fibre Channel's Arbitrated Loop, in which the communicating nodes are chained together in a loop. The **loop** version of the **port** command maintains the if-then-else tables for a set of ports to insert them into or remove them from a loop based on whether they are active or not. The **loop** also provides some special features (**break** and **iloop**) that are not available with the generic **port** command.

Example 1

Two network interface cards (NICs) can be unconditionally connected together as shown in Figure 4.3 with the commands:

```
port 1a < 1b
port 1b < 1a
```

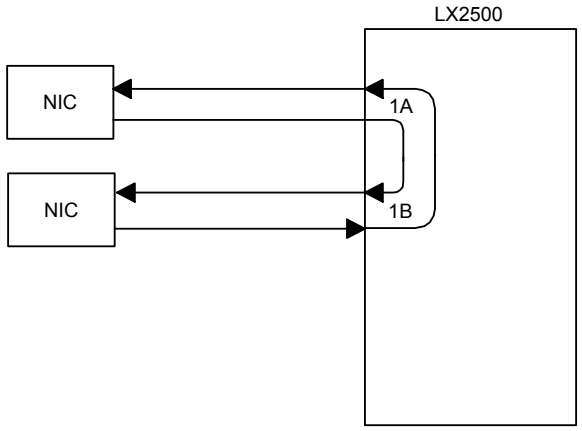

Figure 4-3 Two NIC Connection

Example 2

Three network cards can be connected together in a loop with fault recovery as shown in Figure 4.4 with the command

```
port 1a 1b 1c loop 1
```

If the NIC on port 1B is not transmitting, port 1B goes inactive and is removed from the loop, as shown in Figure 4.5. When the NIC starts transmitting again, it will be reconnected to the loop.

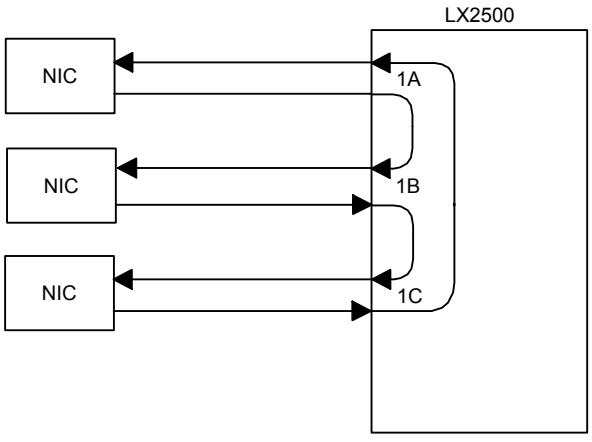

Figure 4-4 Three NIC Loop

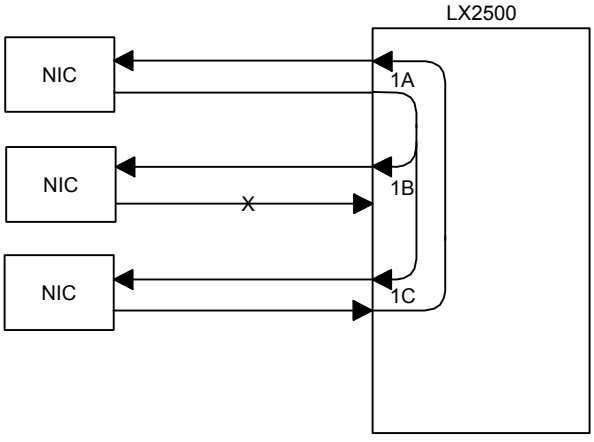

Figure 4-5 One NIC Not Transmitting

Example 3

Figure 4.6 shows a source of data being broadcast to multiple digital signal processors. If Source 1 stops transmitting, the data will be taken from Source 2 instead, as shown in Figure 4.7. DSP1 returns flow control information to both data sources. The commands to set up this connection are:

```
port 1c 1d 2a < 1a; 1b
port 1a < 1c if 1a; off
port 1b < off if 1a; 1c
```

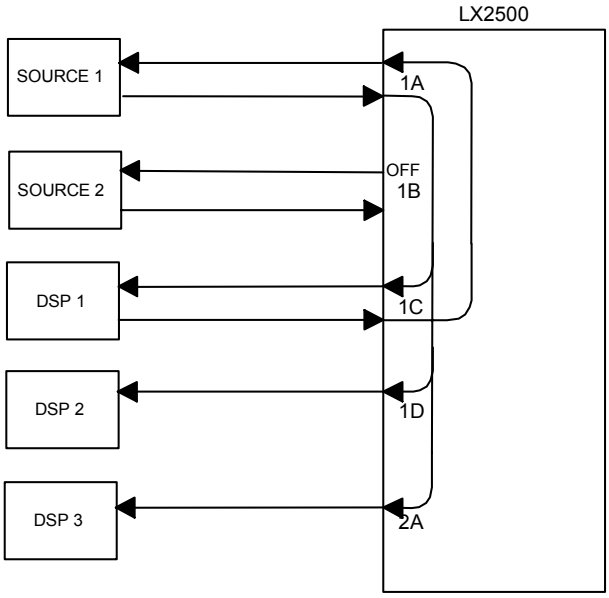

Figure 4-6 Multiple DSP Connection

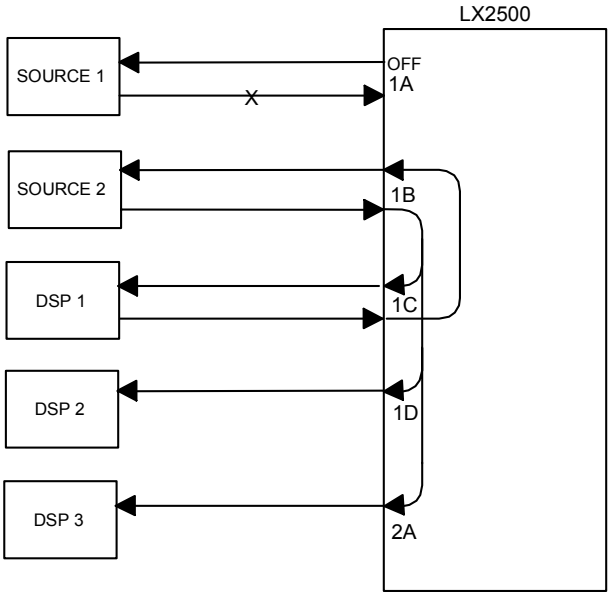

Figure 4-7 Source 1 Stops Transmitting

Example 4

Here's a somewhat more contrived example: Connect the outputs of ports 1B and 1C to 1A if port 2B is active; otherwise connect them to 2A if 2A is active; otherwise wrap them back on themselves. The command to do this is:

```
ports 1b 1c < 1a if 2b; 2a; wrap
```

The connections this command produces are shown in Figures 4.8, 4.9, and 4.10.

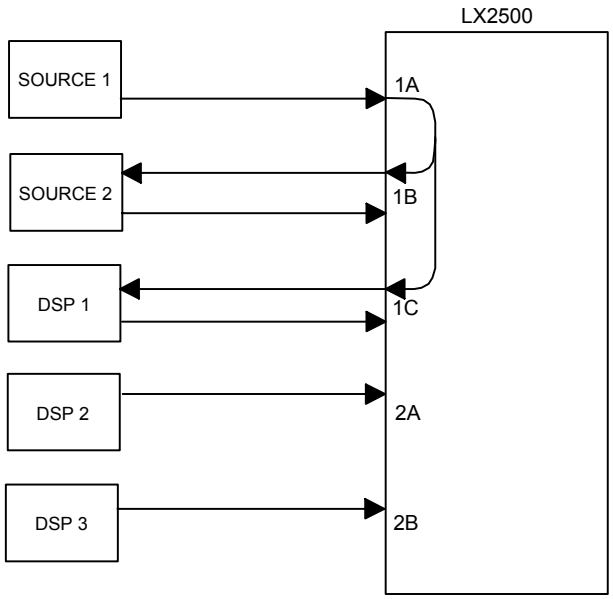

Figure 4-8 Contrived Control Example

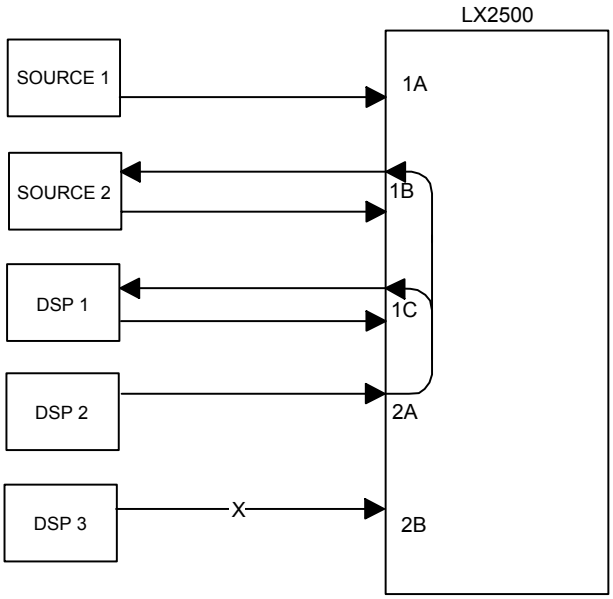

Figure 4-9 Control Stops Transmitting

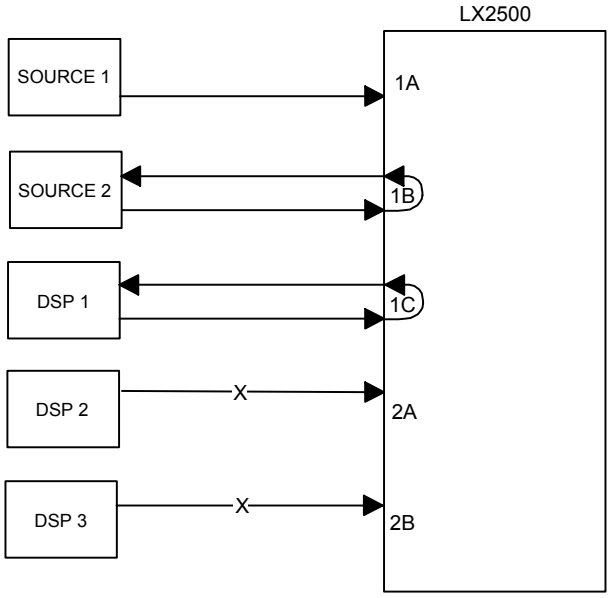

Figure 4-10 Source 2 Stops Transmitting

4.3 More About Configuring the Switch

4.3.1 Stored and Pre-programmed Configurations

The configuration that is actually applied to the switch is called the "current configuration". The current configuration is saved in nonvolatile memory so that it will persist through power cycles and resets.

The LX2500 also has four nonvolatile slots in which alternate switch configurations can be saved. The current configuration can be copied to a saved configuration slot with the **save** command. A saved configuration can be copied back into the current configuration with the **restore** command. Saved configurations can be edited or created with the **edit** command without affecting the operation of the current configuration. Edit mode is ended with the **exit** command.

The **preset** command will copy one of several pre-programmed configurations into the current configuration or, if you're in edit mode, into the saved configuration being edited. Perhaps the most useful of its options is **preset off**, which disconnects all the port outputs and turns them off. A special case is **preset fac**, which resets all controller variables to their factory-new values in addition to turning all ports off.

4.3.2 Other Port Features

SIGNAL DETECT DELAY

Sometimes an intermittent signal can cause a port's signal detect circuitry to "chatter", rapidly alternating between its active and inactive states. The LX2500's controller can be kept so busy processing this train of events that it becomes unresponsive. To prevent this problem, a signal detect delay can be individually set on each port. The port must be continuously active through the delay time before the port card reports the active status to the controller. For details on how to set signal detect delays, see the **delay** option of the **port** command in Chapter 5.

LOOP BREAKS

In some applications that use the LX2500's loop feature, the LX2500 can switch a node into or out of a loop so quickly that the other nodes don't register the change properly. The **break** option of the **ports/loops** command briefly turns off the transmitter of every member of a loop whenever a port is inserted into or removed from the loop. The break time is individually settable for each loop. See Chapter 5 for details.

INACTIVE LOOP PORTS

When a port is a member of a loop but inactive, it is switched out of the loop. What should its transmitter do in this case? The **iloop** option of the **ports/loops** command determines whether the transmitter transmits loop data or is turned off. (In Figure 4-5, port 1B has **iloop** set *on*.) See Chapter 5 for details.

4.4 Port Cards

Each LX2500 port card provides four input/output port pairs. Different models of port cards are available to accommodate various data connectors and data rates. See Appendix C for specific information on what port cards are available.

4.4.1 Hot-Swapping Port Cards

The LX2500's port cards may be hot-swapped. This means that they may be inserted into and removed from the switch while the switch is powered up and running, without interfering with the operation of the rest of the switch.

WARNING: The LX2500 controller card is **NOT** hot-swappable.

To remove a port card from the LX2500 with the power on:

1. Take the usual precautions against electrostatic discharge.
2. Unscrew the jackscrews at the top and bottom of the card's faceplate. The jackscrews are captive and should remain in the faceplate.
3. Pull the ejector handles apart to disengage the card from its connectors.
4. *Carefully* slide the card out of its slot. Remember that any port cards still in the switch are under power. Be careful not to cause shorts.

To insert a port card into the LX2500 with the power on:

1. Take the usual precautions against electrostatic discharge.
2. Carefully align the card with its card guides. It is important to take care here in order to keep the card from brushing against its neighbors and causing shorts.
3. Slide the card into its slot until it is fully seated. If you feel any unusual resistance as the card seats, remove it and examine its connectors and their mates on the backplane. It is possible for the connector pins to become slightly misaligned. It is much easier to fix them before they have been crushed by a mis-mating connector.
4. As the card seats, the LX2500 will detect its presence. The card's indicator lights will sequence and the card's indicator on the controller panel will light.
5. If the lights don't behave as described, there may be a problem with the card. Remove it and try again. If that doesn't work, try a different card.
6. Tighten the jackscrews at the top and bottom of the card.

4.4.2 Controlling Port Cards

The **cards** command provides a list of what port card is in each slot of the LX2500. It also allows you to set certain features on some cards. For information on settable features, see Section 5.3.4 and the port card descriptions in Appendix C.

4.5 Small Form-factor Pluggable (SFP) Transceiver Modules

SFP transceiver modules are hot pluggable and may be inserted into or removed from the card at any time. Always take the usual precautions against electrostatic discharge when handling SFP modules.

To insert an SFP module, hold the module with its top surface to the right and slide it into the receptacle on the port card. There will be a small click as the module latches into place.

To remove an SFP module, press or slide the latch release on the module. This is usually a button or tab on the bottom side of the module (left side as installed in the LX2500) that moves toward the rear of the system. The module will pop out slightly as the latch releases. Pull the module out of the receptacle.

SFP port cards are shipped with a Dust/EMI plug for each transceiver receptacle. Install these in empty receptacles to prevent contamination of internal components and to optimize EMI performance.

4.6 Customizing the Command Line Session

Several commands allow you to customize the interface as shown through the RS-232 port or a Telnet session.

- The **beep** command controls whether the display beeps when a port's activity state changes.
- The **display** command controls whether a line is printed when a port's activity state changes.
- The **echo** command controls whether input characters are echoed back to the terminal.
- The **term** command allows you to set the terminal emulation type and bit rate of the RS-232 port. (For Telnet sessions, the terminal emulation type is set automatically.) It also lets you turn terminal emulation off altogether, and refresh the display once or periodically.
- The **verbose** command lets you choose between longer, human-readable responses or shorter responses that are easier to parse with software.
- The **window** command controls whether switch connection information is shown in a dedicated window at the bottom of the screen.
- The **status** command scrolls into the command area a list of switch connection information similar to what the **window** command produces.

Details for all of these commands can be found in Chapter 5.

As an example, the following sequence might be useful in setting up the switch to be controlled be an external program.

```
beep off
echo off
term off
verbose off
window off
```

The **exit** command has two uses. When the **edit** command is used to edit a saved configuration, **exit** brings the switch out of edit mode. When the switch is not in edit mode, **exit** closes the Telnet session or closes and resets the RS-232 session.

4.7 Monitoring Temperatures and Fans

High-speed electronic circuits dissipate significant power, and adequate ventilation is necessary to keep them from overheating. The LX2500 has a fan in each power supply, a rear inlet fan that provides air to the port cards, and a fan/heat sink mounted directly on the crosspoint IC. Over-temperature protection is built into the power supplies and is not accessible to the user, but fan tachometers and temperature sensors allow you to monitor the thermal health of the remainder of the LX2500.

There are two fan tachometers, one on the inlet fan and one on the crosspoint fan. There are three temperature sensors: one to measure inlet air, one for the crosspoint, and one near the top center of the port card area. The fans and temp commands allow you to read the speeds and temperatures:

```
>>fans
Crosspoint fan: 3900 rpm
```

```
Inlet fan:      2700 rpm
```

```
>>temp
Crosspoint temp: 52 deg C
Port card temp:  46 deg C
Inlet temp:      27 deg C
```

If a fan speed is to low or a temperature is too high, an alarm is sounded and an alarm message is displayed. The alarm is silenced with the command **alarm quiet**; this quiets the alarm until the next time a fan becomes too slow or the temperature gets too high.

The **alarm** command lists the alarm thresholds. It is also be used to change the thresholds if you want an earlier warning or if you just want to hear what the alarm sounds like. The command **alarm defaults** sets the thresholds back to their default values.

If LX2500 temperatures rise too high, the LX2500 protects itself by automatically turning itself off. The **shutdown** command allows you to modify the temperature thresholds at which the automatic shutdown occurs. The command **shutdown defaults** sets the thresholds back to their default values.

4.8 Controlling Access to the LX2500

The LX2500's Ethernet port allows multiple remote users to control the LX2500 simultaneously. To help alleviate the confusion that could result from conflicting commands, the LX2500 provides several levels of access control.

Since access controls that are necessary in some applications may be unneeded and burdensome in others, most of the access controls can be enabled or disabled as needed. The factory default disables access controls as much as possible, so you can ignore them if you don't need them.

These access controls do not make LX2500 "secure" in any rigorous sense of the word. The only way to truly secure the LX2500 is to put it on a secure private network and restrict physical access to the box.

4.8.1 Access Levels and Passwords

Three different levels of access are defined for the LX2500:

Read	You can examine the configuration of the LX2500, but can't change anything.
Write	You can examine the configuration of the LX2500 and can also make normal changes to the LX2500's configuration.
Admin	You can deal directly with the underlying operating system to make administrative-level changes to the system, such as updating the control software.

The Read and Write access levels can each optionally have an associated password. The Admin level always has a password. The factory default is that no password is set for the Read or Write levels, and the Admin level password is "password." You can set any of these passwords (or remove the Read or Write passwords) using the **password** command of the command line interface (CLI). The **password** command requires either the password of the affected level or the Admin password before it carries out the change.

If neither a Read nor a Write password is set, then an RS-232 or Telnet connection comes up directly into the CLI with write access, without passing through a login screen. If a

Write password but no Read password is set, then an RS-232 or Telnet connection comes up directly into the CLI with read access. If a Read password is set, then an RS-232 or telnet connection first brings up a login screen, where the user can enter a **userid** of **read** or **write** or **admin**, and the associated password if there is one.

Once at the CLI, you can use the **access** command to move from one access level to another. If a password is set for the new level, the **access** command requests it.

Passwords are stored in nonvolatile memory and persist through resets and power cycles.

4.8.2 Exclusive Control

If more than one user has write access, they might send overlapping commands to the LX2500. This might be perfectly acceptable if, say, one person agrees to use slots 1 – 4 and another agrees to use slots 5 – 8. The factory default is that the LX2500 will execute the configuration commands of anyone with write access, in the order in which the commands are received: It is "unlocked."

To get exclusive control of the LX2500, you enter the **access lock** command. This command asks for a lock password, which can be anything (including just a carriage return) and is independent of any read or write password. Once the lock password is entered, you have exclusive write control of the LX2500. Other users, even users that are logged in with write access, can only run commands that use read access. Any commands that attempt to change the switch configuration do not execute for them.

When the system is locked, exclusive use can be taken over by another user by entering the **access lock** command and the lock password that was set when the system was locked.

To release exclusive control, anyone with write access can issue the **access unlock** command on any Telnet session or on the RS-232 port. The system asks for the lock password. If the password matches what was entered when the system was locked, the lock password is forgotten and the system is unlocked.

If the Telnet session with exclusive control ends without unlocking, the system remains locked with no user holding control. Another user can take control or unlock the system by using the **access lock** or **access unlock** command and entering the lock password.

Like the access passwords, locked or unlocked modes and the lock password persist over resets and power cycles.

4.8.3 Recovering from Forgotten Passwords

If the read, write, or lock password is forgotten, the admin password can be entered in the forgotten password's place. It can therefore be used to remove or change the forgotten password.

The procedure to recover from a forgotten admin password is more complicated:

1. Power down the LX2500 and take the usual precautions against electrostatic discharge.
2. Remove the controller card from the LX2500.
3. Remove the jumper from J4 on the controller card. Insert the controller card back into the LX2500.
4. Turn on the LX2500 and allow it to boot. Booting with the jumper removed totally re-initializes the LX2500's nonvolatile memory, restoring all options to

their factory settings. As a part of this, the admin password is reset to "password".

5. Power down the LX2500. Remove the controller card and replace the jumper on J4. Re-insert the controller card.

4.8.4 "Admin" Access

The Read and Write access levels both talk to the user through the command-line interface (CLI). The Admin access level drops you into a Linux shell with root access to the operating system. This is used to maintain the control software; for example, it can be used to apply a software update.

CAUTION: Since it works directly on the LX2500's operating system, Admin access gives you access to commands that can render the LX2500 totally nonfunctional. If you must use it, exercise extreme caution.

To return from admin mode, type **exit** or CTRL-D.

5. LX2500 COMMAND LINE INTERFACE

5.1 Introduction

This section describes the commands available in the LX2500's command line interface (CLI). The CLI is used to control the LX2500 through its RS-232 port or when connecting to the LX2500 with a Telnet session through the Ethernet. The CLI expects to interface with a video terminal or a program that emulates a video terminal.

Several options can be used to configure the CLI into a more compact and easily-parsed mode to make the LX2500 easier to control with a computer program.

5.1.1 Notation

[ ]	Indicates optional parameters.
Port#	Indicates a port number. For example, 1A, 4B, 8D.
Portlist	A list of one or more port numbers.
Loop#	Indicates a loop ID number. Valid numbers are 1 through 32.
Looplist	A list of one or more loop numbers.
Cfg#	Indicates a configuration number. Valid numbers are 1 through 4.
Slot#	Indicates a slot number. Valid numbers are 1 through 8.
Slotlist	A list of one or more slot numbers.

5.1.2 General Principles

- All lines are composed of ASCII characters and terminated by a carriage return.
- Lines may be up to 2048 characters long.
- Commands are case-insensitive.
- Commands and keywords may be abbreviated in many cases.
- Spaces may be dropped out of commands where doing so does not cause ambiguity. (Command names do not contain numerals, so "**p7C**" is equivalent to "**PORT 7C**".

5.2 Commands by Category

5.2.1 Access

access ..... Change read/write/admin access level; seize/release exclusive control of LX2500.
password ..... Set access passwords.

5.2.2 Configuration

alarm ..... Set thresholds for fan and temperature alarms.
beep ..... Control whether a beep is sent when a port's state changes.
cards ..... Display installed port cards or set controllable features.
checksum ..... Report port card FLASH checksums.
display ..... Control whether a line is printed when a port's state changes.
echo ..... Control whether characters are echoed back to the sender.
ipconfig ..... Set up the IP interface.
shutdown ..... Set the temperature thresholds at which the LX2500 automatically powers down.
term ..... Set the terminal type.
time ..... Set the time.
verbose ..... Set verbose/concise responses.
window ..... Control whether a status window is displayed at the bottom of the screen.

5.2.3 Routing

cc ..... Connect multiple ports in one command.
edit ..... Enter edit mode on one of four port configuration slots.
ports/loops ..... Set up port connections.
preset ..... Configure the ports into one of several preset standard configurations.
restore ..... Restore the port configuration from one of four saved slots.
save ..... Save the current port configuration to one of four slots.

5.2.4 Status

fans ..... Report fan speed.
status ..... Display port status.
temp ..... Report internal temperatures.
version ..... Report controller software version.

5.2.5 Miscellaneous

help ..... Display help for commands.
sfpdata ..... Displays the module definition data of SFP transceivers.
exit ..... Exit edit mode or close the session.

5.3 Alphabetic List of Commands

5.3.1 ACCESS

access [read | write | admin | lock | unlock]

This changes the access level of this session, or allows this session to seize or release exclusive control of the LX2500. See Section **4.8** for a description of what this means.

access

With no argument, the **access** command reports the current access level and lock status.

access read

This gives this session read-only access to the LX2500. If the read password is set, the system asks for the password first.

access write

This gives this session read-write access to the LX2500. If the write password is set, the system asks for the password first.

access admin

This asks for the admin password, then starts up an administration shell.

access lock

If the system is not presently locked, this command asks for a password under which to lock the system. (Responding with just a carriage return locks the system with no lock password.) If the system is locked and a lock password is set, it asks for the current lock password. In either case, the terminal that runs this command has exclusive control over the LX2500 until another **access lock** or **unlock** command is run.

access unlock

If the system is locked and a lock password is set, this asks for the current lock password. Then exclusive control of the system is released.

The factory default is: no read or write password set, admin password set to “password”, not locked.

Examples:

```
>>access
This session has READ/WRITE access. There is no access lock.
>>access write
Enter the WRITE password:
->....
This session has READ/WRITE access.
>>access lock
Enter a LOCK password or RETURN for no password:
->....
This session owns the access lock.
>>access unlock
Enter the LOCK password:
->.....
The access lock is released.
```

5.3.2 ALARM

alarm [fin | fxp | tcd | tin | txp [*Value*]]
alarm defaults
alarm disable
alarm quiet

This command has three variations.

alarm [fin | fxp | tcd | tin | txp [*Value*]]

This controls when a sensor reading causes an alarm. If the fan speed falls below the set limit, or the temperature exceeds the set limit, an alarm sounds and a notice is displayed.

The sensors are:

Name	Description	Range	Default Value
fin	Inlet fan speed	1500 – 4000 rpm	2000
fxp	Crosspoint fan speed	2000 – 5000 rpm	3000
tcd	Temperature of port card cage	1 – 70 °C	70
tin	Inlet air temperature	1 – 50 °C	50
txp	Crosspoint switch temperature	1 – 80 °C	80

If no value is specified, the current value is displayed. If no argument at all is specified, all current values are displayed.

Setting a value to zero disables the alarm for that sensor.

alarm defaults
This sets all five alarms to their default values.

alarm disable
This sets all five alarm values to zero, disabling them all.

alarm quiet
This temporarily quiets the audible alarm. The alarm remains silent until the next time an enabled sensor exceeds its limits.

Examples:

```
>>alarm defaults
>>alarm fxp 0
>>alarm
Crosspoint fan:  Disabled
Inlet fan:       2000 rpm
Crosspoint temp: 80 deg C
Port card temp:  70 deg C
Inlet temp:      50 deg C
```

5.3.3 BEEP

beep [on | off | 1 | 0]

This controls whether a beep is emitted when a port's state changes. If there is no argument, the current beep status is reported.

1 and **0** are synonyms for **on** and **off**, respectively.

A separate beep status is kept for the RS-232 session and for each active Telnet session. The RS-232 beep status is saved in non-volatile memory between sessions. A Telnet session's beep status is discarded when the Telnet session ends.

5.3.4 CARDS

cards [*Slotlist*] [**mbps** *bitrate* | **ratesel** *xxxx*]

This command displays installed port cards or sets controllable features.

Valid slot numbers are 1 through 8. If no slot list is supplied, the command is applied to all eight slots.

If one or more slot numbers are specified with no further operands, a description of the requested cards is given. For each card that has controllable settings, an additional line will be printed to show the setting.

Examples:

```
>>cards
1: 2.5 Gbps LC Card, 1300 nm.
   MBPS: 2500
2: -
3: 1.0625 Gbps SC Card, 850 nm.
4: -
5: -
6: 2.125 Gbps LC Card, 850 nm.
   MBPS: 2125
7: -
8: Non-Retimed SFP Card
   Ratesel: 1111

>>card 12 4
1: 2.5 Gbps LC Card, 1300 nm.
   MBPS: 2500
2: -
4: -
```

SETTABLE FEATURES:

Different cards have different settable features. The controller attempts to apply any listed settings to each card in the slot list. Settings are only applied if all settings in the command are valid for all the cards in the slot list; otherwise an error message is displayed and no change of settings is performed.

Settable features for **2.5 Gbps LC Card**:

mbps 2500	Data rate = 2.5 Gbps (default)
mbps 1250	Data rate = 1.25 Gbps
mbps 625	Data rate = 625 Mbps
mbps 156	Data rate = 156.25 Mbps

Settable features for **2 Gbps LC Card**:

mbps 2125	Data rate = 2.125 Gbps (default)
mbps 1062	Data rate = 1.0625 Gbps
mbps auto	Data rate is automatically set based on incoming data.

Settable features for **1 Gbps SC Card**:

None.

Settable features for **SFP** cards:

ratesel xxxx Rate select for ports ABCD.

See the individual card descriptions in Appendix C for explanations of the settable features.

Examples:

```
>>card 1 mbps 2500
```

Sets the card in slot 1 to a data rate of 2.5 Gbps.

```
>>card 6 mbps auto
```

Sets the card in slot 6 (a 2.125 Gbps card) to select its data rate automatically.

```
>>card 8 ratesel 0111
```

Sets the Rate Select inputs for ports A, B, C, and D of the card in slot 8 (a Non-Retimed SFP card) to 0, 1, 1, and 1 respectively.

5.3.5 CC

cc *Portlist*
cc *Portlist* r

This command provides a convenient shortcut to interconnect multiple ports.

cc *Portlist*

This version of the command configures the listed ports into a permanent (unconditional) loop. If the ***portlist*** is empty, the command does nothing.

cc *Portlist* r

In this case the ***portlist*** must contain 32 ports. The list is used as a routing vector. The first port in the list will become the input for 1A, the second port will become the input for 1B, and so on through the 32nd port, which will become the input for port 8D.

Examples:

This command:

```
cc 1a 1b 1c 1d
```

…is equivalent to this set of commands:

```
port 1a < 1d
port 1b < 1a
port 1c < 1b
port 1d < 1c
```

In this series of four commands, all ports are turned off, then two **cc** commands are run to create two separate loops. The **st** command shows the resulting connections.

```
>>p all < off
>>cc 1a1b1c1d
>>cc 2a3a4a5a6a7a8a
>>st
  1A<1D   2A<8A   3A<2A   4A<3A   5A<4A   6A<5A   7A<6A   8A<7A
  1B<1A   2B<     3B<     4B<     5B<     6B<     7B<     8B<
  1C<2B   2C<     3C<     4C<     5C<     6C<     7C<     8C<
  1D<1C   2D<     3D<     4D<     5D<     6D<     7D<     8D<
```

This use of **cc** with the **r** suffix makes a connection on each port, as shown by the **st** command.

```
>>cc 1a1a1a1a1b1b1b1b1c1c1c1c1d1d1d1d2a2a2a2a2b2b2b2b2c2c2c2c2d2d2d2d r
>>st
  1A<1A   2A<1B   3A<1C   4A<1D   5A<2A   6A<2B   7A<2C   8A<2D
  1B<1A   2B<1B   3B<1C   4B<1D   5B<2A   6B<2B   7B<2C   8B<2D
  1C<1A   2C<1B   3C<1C   4C<1D   5C<2A   6C<2B   7C<2C   8C<2D
  1D<1A   2D<1B   3D<1C   4D<1D   5D<2A   6D<2B   7D<2C   8D<2D
```

5.3.6 CHECKSUM

checksum [*Slotlist*]

This reports the FLASH checksum for the cards in the specified slots. If no slot is specified, reports all available checksums.

Examples:

```
>>checksum
1: 42d8
2: -
3: f189
4: -
5: -
6: a35d
7: -
8: -
```

(This command is intended primarily for use by Systran support and production personnel. The actual checksums reported are likely to differ from this example.)

5.3.7 DISPLAY or DS (Display State Changes)

display [**on** | **off** | **1** | **0**]

This controls whether a line is printed when a port's state changes. If there is no argument, the current display status is reported.

1 and **0** are synonyms for **on** and **off**, respectively.

A separate display status is kept for the RS-232 session and for each active Telnet session. The RS-232 display status is saved in non-volatile memory between sessions. A Telnet session's display status is discarded when the Telnet session ends.

Example:

```
>>display on
>>
Signal found on port 1A at 04/01/2001 09:47:12
>>
Signal lost  on port 1A at 04/11/2001 17:47:10
>>
```

5.3.8 ECHO

echo [**on** | **off** | **1** | **0**]

This controls whether characters are echoed back to the sender. If used with no arguments, the current echo status is reported.

1 and **0** are synonyms for **on** and **off**, respectively.

A separate echo status is kept for the RS-232 session and for each active Telnet session. The RS-232 echo status is saved in non-volatile memory between sessions. A Telnet session's echo status is discarded when the Telnet session ends.

5.3.9 EDIT

edit ***Cfg#***

This command enters Edit Mode on one of the four saved configuration slots. When in edit mode, commands that would change the switch configuration are applied to the saved configuration instead. In this way a new configuration can be built up without disturbing the current configuration.

When in edit mode, the **loops**, **ports**, and **preset** commands are applied to the configuration being edited rather than to the current configuration. The **exit** command ends edit mode rather than ending the command session. All other commands behave normally.

The command prompt in edit mode changes to indicate which slot you are editing.

If the session ends through a power-off or a Telnet disconnection, edit mode is terminated.

Example:

```
>>edit 1
Editing configuration 1.
1>p3a<4b
1>(etc.)
1>exit
Done editing configuration 1.
>>
```

5.3.10 EXIT

exit

If the LX2500 is in Edit mode, that mode is exited. Otherwise, the current terminal session is ended. On a Telnet session, the connection is closed. On an RS-232 session, the session closes and restarts.

5.3.11 FANS

fans

This reports the speed of the cooling fans. Each LX2500 has a fan on its crosspoint IC. There is also an air inlet fan at the rear of the box. When two LX2500 switches are in the same enclosure, they have separate crosspoint fans but both monitor the same inlet fan.

```
>>fans
Crosspoint fan: 3900 rpm
Inlet fan:      2700 rpm
```

5.3.12 HELP or ?

help [***Command Name***]

With no operand, this displays a list of commands. If a command name is specified, displays help for that particular command.

5.3.13 IPCONFIG

ipconfig [dhcp]

ipconfig [addr *Ipaddr*] [mask *Ipaddr*] [gate *Ipaddr*] [name *Hostname*]

This command sets up the IP interface for the LX2500.

ipconfig [dhcp]

This sets the LX2500 to get its IP configuration from a DHCP server. This is the factory default.

ipconfig [addr *Ipaddr*] [mask *Ipaddr*] [gate *Ipaddr*] [name *Hostname*]

This explicitly sets the LX2500's IP address, net mask, gateway address, and hostname. One or more parameters may be specified on the command line. Any parameters that are not specified will be prompted for. This particular form of the command requires that all its arguments be separated by spaces.

ipconfig

This reports the current IP configuration.

NOTE: If the **ipconfig** command is entered from a Telnet session, the session will exit when the IP address changes.

Examples:

```
>>ipconfig dhcp
DHCP/BOOTP: Enabled
IP addr:    192.168.5.47
IP mask:    255.255.255.0
IP gateway: 198.168.5.1
Hostname:   lx2500

>>ipconfig addr 198.168.0.5
Enter the IP netmask or hit return to keep "255.255.255.0".
:>
Enter the gateway IP address or hit return to keep "198.168.5.1".
:>
Enter the hostname or hit return to keep "lx2500".
:>switch1

>> ipconfig
DHCP/BOOTP: Disabled
IP addr:    192.168.0.5
IP mask:    255.255.255.0
IP gateway: 198.168.5.1
Hostname:   switch1
```

5.3.14 LOOPS

See **PORTS**.

5.3.15 PASSWORD

Password [read | write | admin]

This sets a password for one of the three access levels. If no argument is supplied, the system asks which password to change. The system then asks for the current password for that level (for the read and write levels, the admin password may be supplied instead).

Then it asks for the new password, and then asks for it again to make sure it's typed correctly.

For the read and write levels, password protection can be disabled by just hitting return when the new password is requested. The admin password cannot be disabled.

Passwords are not echoed to the display as they are typed.

The factory defaults are no password for read and write, and an admin password of "password".

See Section 4.8 for a description of how passwords are used.

5.3.16 PORTS

ports ***Portlist*** **<** ***PortA*** **[if** ***PortB*****][; [etc.]]**
ports ***Portlist***
ports ***Portlist*** **delay [***ms***]**
ports ***Portlist*** **iloop [on | off]**
ports ***Portlist*** **loops** ***Loop#***
[ports] loops [*Looplist***]**
[ports] loops [*Looplist***] iloop [on | off]**
[ports] loops [*Looplist***] break [***ms***]**

This command is used in several different forms.

NOTE: For forms of this command that begin with "**ports loops**", the keyword "**ports**" at the beginning of the command is optional.

ports ***Portlist*** **<** ***PortA*** **[if** ***PortB*****][; [etc.]]**

This is the general port connection command. It is used to describe which port's receiver is to be connected to the transmitter(s) in ***Portlist***. It may describe a simple unconditional connection or a conditional series of connections based on what receivers show active signals.

If more than one port is listed in ***Portlist***, the same connection is made to each listed port. If no ***portlist*** is given, the same connection is made for all ports.

After the first "***PortA*** **[if** ***PortB*****]**" clause, additional clauses may be appended separated by semicolons. The semicolons have the effect of an ELSE. If the optional "**[if** ***PortB*****]**" is not included in a clause that is followed by a semicolon, "**if** ***PortA***" is implied. See the examples below for an explanation of what these clauses can do.

The keyword "**wrap**" may be used as a synonym to connect the port's transmitter to its own receiver.

The keyword "**off**" may be used in place of "***PortA***" to turn the port's output off: No connection is made to the port's transmitter, and its laser, if it has one, is turned off. If a command ends with "**if** ***Port#***" or a semicolon, "**; off**" is implied.

While a conditional clause like "**off if 1a;**" is legal, the shortened clause "**off;**" (implying "**off if off;**"?) is meaningless and will be ignored unless it is at the end of the command, where it is simply interpreted as "**off**".

If a port is referenced in a slot that presently has no port card plugged in, commands are accepted and saved. The ports of an empty slot are always considered to be inactive. A card may be plugged into that slot later, and then the configuration will be used.

ports ***Portlist***

This command shows how the ports in ***Portlist*** are currently configured. If no ***portlist*** is given, all ports are shown.

ports ***Portlist*** **delay** [**ms**]

This sets the signal detect delay interval in milliseconds for the specified ports. If this delay is non-zero, a port's signal detect must be continuously true for at least the delay interval before the port is considered active. This can be used to solve problems caused by chattering ports. The valid range for the delay is 0 – 1275 ms. The **delay** setting will be rounded down to the next multiple of 5 ms.

There is no delay on the active-to-inactive transition.

The factory default delay interval is 0 ms (no delay). If no interval is specified in this command, the delay settings for the specified ports are displayed. If no ***Portlist*** is specified, the command applies to all ports.

LOOPS:

The **loops** option creates a circular chain of ports. If there is a signal detected on the port's receiver, the port is inserted into the loop; otherwise, the port is isolated from the loop. One application for loops is creating Fibre Channel arbitrated loops.

ports ***Portlist*** **loops** ***Loop#***

This adds the specified port to the specified loop. Legal loop numbers are 1 through 32. At least one port must be specified in the ***Portlist***.

[**ports**] **loops** [***Looplist***]

This lists the members of a loop or loops. If no loop is specified, lists all loops that have one or more members.

ports [***Portlist***] **iloop** [**on** | **off**]
[**ports**] **loops** [***Looplist***] **iloop** [**on** | **off**]

This command controls whether, when a port is a member of a loop and its input is inactive, the port's transmitter continues to transmit or is turned off. The ***Portlist*** form of the command sets the listed ports; the ***Looplist*** form sets all ports that are presently in the listed loops. The factory default setting for all ports is **off**.

[**ports**] **loops** [***Looplist***] **break** [***ms***]

This sets the break delay for the specified loop(s). If no loop is specified, the break delay is set for all loops. The break delay is specified in milliseconds, with a valid range of 0 to 5000. The factory default break delay is zero (no break).

If a non-zero break delay is set for the loop, then whenever a port is added to or deleted from the loop the transmitters of all members of the loop are turned off for the specified number of milliseconds. This feature can be used to force the loop to re-initialize.

To remove a port from a loop, use the **port** command to turn it off or assign a different connection to it.

PORTS Examples:

Definitions: A port's *input* is its receiver; a port's *output* is its transmitter. A port is *active* if a signal is detected at its input. If a port is turned off, its transmitting laser is disabled.

```
port 1a < 1a
port 1a < wrap
p1a<w
```

Three equivalent ways to unconditionally wrap port 1A.

```
port 1b < off
```

Unconditionally turn port 1B's transmitter off.

```
port 2b < 5d
```

Unconditionally connects port 2B's output (transmitter) to port 5D's input (receiver).

```
port 3c < 5d; off
port 3c < 5d;
```

(Both are equivalent.) Connects the output of 3C to the input of 5D if 5D is active; otherwise turns 3C off.

```
port 4d < 1a; 2b; 3c;
```

If 1A is active, connects output 4D to input 1A; otherwise if 2B is active, connects output 4D to input 2B; otherwise if 3C is active, connects output 4D to input 3C; otherwise turns 4D off.

```
port 5a < 1a; 2b; 3c
```

If 1A is active, connects output 5A to input 1A; otherwise if 2B is active, connects output 5A to input 2B; otherwise connects 5A to input 3C.

```
port 6b < 1a if 3a; wrap if 4b; 3c
```

If 3A is active, connects output 6B to input 1A; otherwise if 4B is active, connects output 6B to input 6B; otherwise connects output 6B to input 3C.

```
port 7c < 1a if 3a; 2b if 4b
port 7c < 1a if 3a; 2b if 4b;
```

(Both are equivalent.) If 3A is active connects output 7C to input 1A; otherwise if 4B is active, connects output 7C to input 2B; otherwise turns 7C off.

```
ports 8a 8b 8c 8d < 1a if 4a; wrap
```

If 4A is active, broadcasts input A1 to outputs 8A, 8B, 8C, and 8D; otherwise wrap each of the four ports.

Given the above commands, the **ports** ***Portlist*** command is used to read each port's configuration. If the terminal permits it, the part of the configuration that is currently in effect is shown in boldface or emphasized:

```
>>port 1a
1A < 1A
>>port 1b
1B < OFF
>>ports 2b 3c
2B < 5D
3C < 5D IF 5D; OFF
>>port 4d
4D < 1A IF 1A; 2B IF 2B; 3C IF 3C; OFF
>>port 5a
5A < 1A IF 1A; 2B IF 2B; 3C
>>port 6b
6B < 1A IF 3A; 6B IF 4B; 3C
>>port 7c
7C < 1A IF 3A; 2B IF 4B; OFF
>>port 8a
8A < 1A IF 4A; 8A
>>port 8b
8B < 1A IF 4A; 8B
```

If some sort of boldface or emphasis mode is not available on the terminal or if the terminal is in dumb mode, then the active part of the configuration is shown in uppercase and the remainder is in lowercase.

```
>>port 4d
4D < 1a if 1a; 2B IF 2B; 3c if 3c; off
```

The **ports** ***Portlist*** **delay** command shows the signal detect delay settings:

```
ports 1a 8a delay
1A: 0 ms
8A: 50 ms
```

LOOP Examples:

```
ports 1a 2a loop 1
P 4A L 1
P3AL1
```

Ports 1A and 2A are added to Loop 1, and then port 4A is added to loop 1, then port 3A is added. (Capital letters are not required for these commands; they're used here to make it easier to distinguish between "L" and "1".) Assuming that Loop 1 started with no members, these three commands create a connection similar to the following **PORT** commands:

```
port 1a < 2a; 3a; 4a; 1a
port 2a < 3a; 4a; 1a; 2a
port 3a < 4a; 1a; 2a; 3a
port 4a < 1a; 2a; 3a; 4a
```

Note that the ports are connected in the loop in alphanumerical order, from 1A through 8D, regardless of the order in which they are added to the loop.

A loop built with the **loop** option is different from a loop built with **port** commands in two ways:

1. If a loop member's input is inactive and **iloop** for that port is set **off**, the port's output is turned off.
2. Only the **loop** option provides the **break** function when a port is inserted into or removed from the loop.

```
loop 1 break 50
```

The break time for loop 1 is set to 50 milliseconds.

```
loop 1 iloop off
```

The transmitter of each of the ports on loop 1 is turned off when its input is inactive. This command *only affects whatever ports are in loop 1 at the time the command is issued*. This is because **iloop** is a property of the individual ports, not of the loop. There are situations where it may be desirable for different ports on the same loop to behave differently.

```
port 4a iloop on
```

Port 4A's transmitter will remain on when it is in a loop and its input is inactive. What it transmits will be determined by the equivalent **port** command, as shown above.

Given these commands:

```
ports 1a 2a 4a 3a loop 1
ports 5a 6a 5c 6c 5b loop 4
loop 1 iloop on
port 3b loop 1
loop 4 break 100
```

We can use the **loop**[***Looplist***] command to read each port's configuration. The command displays in boldface loop members that are currently active.

```
>>LOOP 1
 1: 1A 2A 3A 3B 4A
>>L4
 4: 5A 5B 5C 6A 6C
>>LOOP 5
 5: EMPTY
>>LOOP
 1: 1A 2A 3A 3B 4A
 4: 5A 5B 5C 6A 6C
```

If the **ports** ***Port#*** command is used on a loop member, it tells you which loop it is in, with the port name in boldface if the port is active:

```
>>port 1a
1A LOOP 1
```

If some sort of boldface or emphasis mode is not available on the terminal or the terminal is in dumb mode, then the active ports will be shown in uppercase and the remainder will be in lowercase.

```
>>LOOP 1
 1: 1A 2A 3a 3b 4A

>>ports 1a 5c
1A LOOP 1
5c LOOP 4
```

Other forms of the command can read back the **break** and **iloop** settings:

```
>>LOOP 1 4 5 break
 1:    0 ms
 4:  100 ms
 5:    0 ms

>>LOOP 1 iloop
1A: on
2A: on
3A: on
3B: off
4A: on

>>ports 1a 3b iloop
1A: on
3B: off
```

5.3.17 PRESET or SC (Standard Configuration)

preset ol | w | pl | off | fac

This command puts the ports in a predetermined standard configuration:

OL	One Loop: all ports are added to loop 1.
W	Wrap: All ports are unconditionally wrapped.
PL	Permanent Loop: All ports are unconditionally connected in a loop.
OFF	Disconnect all outputs and turn them off.
FAC	Turn all ports off *and* initialize all controller variables except passwords to their factory-new values.

5.3.18 RESTORE

restore ***Cfg#***

This restores the configuration from one of four slots.

5.3.19 SAVE

save ***Cfg#***

This saves the current configuration to one of four slots.

5.3.20 SFPDATA

sfpdata [***Portlist***]

This command displays the module definition data that is built into many Small Form-factor Pluggable (SFP) transceivers. The module definition data describes the capabilities of the module, as well as its part number, serial number, and manufacturer's name. For a description of the module definition data, see Appendix E.

If module definition data is not available, an appropriate message is returned. If module definition data is available, the first 96 bytes of data are displayed. Data fields defined as ASCII strings are shown as characters; all other fields are shown in hexadecimal. The two checksum fields are compared against the data.

If no ports are specified, data is displayed for all four ports on each SFP card in the switch.

Example:

In this example, slot 1 does not contain an SFP card. Slot 8 does contain an SFP card, but port 8A does not contain a transceiver. Port 8B contains a transceiver that does not offer module definition data; in this case the static values of the transceiver's three Module Definition pins are displayed because some vendors assign meaning to them. Port 8C contains a module with module definition data. For some reason one of its checksums has failed.

```
>>sfpdata 1a 8a 8b 8c
1A: Not an SFP module.
8A: No SFP module found.
8B: No SFP data available (ModDef[0 1 2] = [0 1 1]).
8C: Addr Value                          Addr Value
       0 03                               36 00
       1 04                               37 00 00 00
       2 07                               40 XYZ-25-1A-L
       3 00 01 00 00 00 00 00 00          56 000A
      11 00                               60 00 00 00
      12 0B                               63 BF (check code OK)
```

```
      13 19                                64 00 1A
      14 00                                66 00
      15 00                                67 00
      16 0F                                68 1234
      17 0A                                84 010401
      18 00                                92 00 00 00
      19 00                                95 00 (check code fails)
      20 SFP Vendor Corp
```

5.3.21 SHUTDOWN

shutdown [tcd | tin | txp [*Value*]]

This controls the temperature limits at which the LX2500 automatically turns itself off. Each LX2500 has three temperature sensors, one on its crosspoint IC (TXP), one in the port card area on the front of the backplane (TCD), and one at the air inlet (TIN).

If no value is specified, the current value is displayed. If no argument at all is specified, all three current values are displayed.

The input ranges are:

Name	Description	Range	Default Value
tcd	Temperature of port card cage	1 – 80°C	80
tin	Inlet air temperature	1 – 50°C	disabled
txp	Crosspoint switch temperature	1 – 90°C	90

Setting **tin** to a value of zero disables the shutdown for that sensor. **tcd** and **txp** cannot be disabled; attempting to set them to zero actually sets them to their maximum value.

shutdown defaults

Sets all three shutdown thresholds to their default values.

shutdown reboot

The LX2500 controller immediately reboots itself.

shutdown now

The LX2500 immediately tries to shut itself down.

5.3.22 STATUS

status

This causes port status information to scroll onto the screen. If the Display Window is on, the window is updated.

5.3.23 TEMP

temp

This reports LX2500 temperatures. Each LX2500 has three temperature sensors, one on its crosspoint IC, one in the port card area on the front of the backplane, and one at the air inlet. Temperatures are reported in degrees Celsius.

```
>>temp
Crosspoint temp: 52 deg C
Port card temp:  46 deg C
```

```
Inlet temp:      27 deg C
```

5.3.24 TERM

term [on | off | 1 | 0 | refresh [*Value*]]
term emul [*Termid*]
term speed [9600 | 19200 | 38400 | 57600]

term

With no argument this displays the current on/off and refresh settings for this (Telnet or RS-232) port.

term on or **term 1**

This enables terminal emulation for this port.

term off or **term 0**

This disables terminal emulation for this port and writes to the terminal in dumb mode. Setting **term off** temporarily disables the display window (see the **window** command) and the command history function. It also causes **term refresh** to be ignored.

term refresh

This immediately redraws the display.

term refresh *Value*

This automatically refreshes the display every *Value* seconds. A value of zero turns off automatic refreshes.

term emul *Termid*

This sets the terminal emulation to use on the RS-232 port, *even if it is entered from a Telnet session*. (The terminal emulation type for the Telnet session itself is set automatically when the session is established.) The new emulation does not take effect until a new RS-232 session is started by exiting the present one or resetting/repowering the LX2500. If a ***Termid*** is not specified, the current emulation is reported.

term speed [9600 | 19200 | 38400 | 57600]

This sets the serial data rate of the RS-232 port in bits per second, even if it is entered from a Telnet session. The new speed takes effect immediately. If a speed is not specified, the current speed is reported.

A separate term status is kept for the RS-232 session and for each active Telnet session. The RS-232 term status is saved in non-volatile memory between sessions. A Telnet session's term status is discarded when the Telnet session ends.

Factory defaults are:

term on
term refresh 0
term set vt100 (affects RS-232 only)
term speed 19200 (affects RS-232 only)

Examples:

```
>>term
```

```
on refresh=0
>>term emul
vt100
>>term speed
19200
```

5.3.25 TIME

time [*mm/dd/yy*] [*hh:mm*[*:ss*]]

With no arguments, displays the time. With arguments, sets the time. No provision is made for time zones or Daylight Savings Time.

5.3.26 VERBOSE

verbose [on | off | 1 | 0]

This command controls whether the system responds in verbose mode. If there is no argument, the current verbose status is reported.

verbose on

This is intended for interaction with a person. The system outputs shown above all assume that the system is being verbose.

verbose off

This is intended to be easily parsed by software driving the switch. See Section 5.4 for a description of the non-verbose responses.

1 and **0** are synonyms for **on** and **off**, respectively.

A separate verbose status is kept for the RS-232 session and for each active Telnet session. The RS-232 verbose status is saved in non-volatile memory between sessions. A Telnet session's verbose status is discarded when the Telnet session ends.

5.3.27 VERSION

version

Displays the controller software version.

Example:

```
>>version
LX2500 Controller Software v1.00 20010401. Copyright (c) 2001 by
Systran Corporation.
```

5.3.28 WINDOW or DW (Display Window)

window [on | off | 1 | 0]

This controls whether the bottom portion of the display is dedicated to a status display window. If used with no arguments, the current window status is reported.

1 and **0** are synonyms for **on** and **off**, respectively.

A separate window status is kept for the RS-232 session and for each active Telnet session. The RS-232 window status is saved in non-volatile memory between sessions. A Telnet session's window status is discarded when the Telnet session ends.

The status display window uses the bottom five lines of the screen to show how the ports are presently connected. Each output is shown with the input to which it is connected.

If a port's input is active, it is displayed as bold/emphasized wherever its name is mentioned. Ports that are turned off are shown with no input.

```
============================================================
1A<1A   2A<1B   3A<2D   4A<4A   5A<5A   6A<6A   7A<7A   8A<
1B<1C   2B<2B   3B<2D   4B<4B   5B<5B   6B<6B   7B<7B   8B<
1C<2A   2C<2C   3C<2D   4C<4C   5C<5C   6C<6C   7C<7C   8C<
1D<1D   2D<2D   3D<2D   4D<4D   5D<5D   6D<6D   7D<7D   8D<
```

If a slot is empty, its ports are not shown.

```
============================================================
1A<1A   2A<1B   3A<2D   4A<4A             6A<6A             8A<
1B<1C   2B<2B   3B<2D   4B<4B             6B<6B             8B<
1C<2A   2C<2C   3C<2D   4C<4C             6C<6C             8C<
1D<1D   2D<2D   3D<2D   4D<4D             6D<6D             8D<
```

If boldface is not available, lower/upper case is used.

```
============================================================
1A<1A   2A<1B   3a<2D   4a<4a             6a<6a             8a<
1B<1C   2b<2b   3b<2D   4b<4b             6b<6b             8b<
1C<2A   2c<2c   3c<2D   4c<4c             6c<6c             8c<
1d<1d   2D<2D   3d<2d   4d<4d             6d<6d             8d<
```

The **status** command scrolls the same four lines of information onto the screen, without the dividing line of '=' symbols.

5.3.29 Compatibility Commands

The following commands are included for compatibility with Systran's LX1500 switch:

ds.....Synonym for **display**.
dw.....Synonym for **window**.
sc.....Synonym for **preset**.

5.4 Non-Verbose Responses

This section lists the responses of each command in non-verbose mode. Where a command or a version of a command is not mentioned, its response is the same as in verbose mode.

ACCESS

This is the same as in verbose mode, except there is no confirmation of changed access.

ALARM

The alarm command with no arguments responds with five fixed-length fields on a single line, listing the settings for crosspoint fan, inlet fan, crosspoint temperature, port card temperature, and inlet temperature in that order. If an alarm is disabled it is displayed as zeros.

```
>>alarm
0000 2000 +080 +070 +050
```

EDIT

No "Editing Configuration *n*." message is sent.

EXIT

When exiting edit mode, no "Done editing Configuration *n*." message is sent.

FANS

The command responds with two fixed-length fields, listing the speeds for crosspoint fan and inlet fan in that order.

```
>>fans
3900 2700
```

PORTS AND LOOPS

ports [***portlist***]

This command outputs one line per listed port. Each clause of the port's configuration is reported as a string of five characters, where the first pair of characters is the port connected to, and the second pair is the port on which that connection is conditional. '00' in the first two characters indicates "off"; '00' in the second pair indicates that the clause is unconditional. The fifth character is a '+' if this clause is active or a '.' if it is not. For ports that are members of a loop, the response is 'LP' followed by the two-digit decimal loop number, followed by a '+' if this port is active or a '.' if it is not.

Examples:

Command	Verbose Response	Non-verbose response
PORT 1A	1A < 1A	1A00+
PORT 1B	1B < OFF	0000+
PORTS 2B 3C	2B < 5D 3C < 5D IF 5D; OFF	5D00+ 5D5D+0000.
PORT 4D	4D < 1A IF 1A; 2B IF 2B; 3C IF 3C; OFF	1A1A.2B2B+3C3C.0000.
PORT 5A	5A < 1A IF 1A; 2B IF 2B; 3C	1A1A.2B2B.3C00+
PORT 6B	6B < 1A IF 3A; 6B IF 4B; 3C	1A3A+6B4B.3C00.
PORT 7C	1A IF 3A; 2B IF 4B; OFF	1A3A.2B4B.0000+
PORT 8A	1A IF 4A; 8A	1A4A+8A00.
PORT 2A	2A LOOP 1	LP01+

ports [***portlist***] **delay**

This outputs one line per listed port. Each line contains a port number, a colon, and the delay in milliseconds zero-filled to four characters.

```
>>ports 1a 1b 1c delay
1A:0000
1B:0010
1C:1275
```

[**ports**] **loops** [***looplist***]

This outputs one line per listed loop. If no loop is specified, it outputs one line for each loop that has one or more members. The loop number is specified by two numerals, with a leading zero if necessary, followed by a colon. Each loop member is then indicated by a three character string, where the first two characters are the port ID and the third character is a '+' if this member is active or a '.' if it is not.

Examples:

Command	Verbose Response	Non-verbose response
LOOP 1	1: **1A 2A** 3A **4A**	01:1A+2A+3A.4A+
LOOP 4	4: 5A **5B** 5C **6A 6C**	04:5A.5B+5C.6A+6C+
LOOP 5	5: -	05:
LOOP	1: **1A 2A** 3A **4A** 4: 5A **5B** 5C **6A 6C**	01:1A+2A+3A.4A+ 04:5A.5B+5C.6A+6C+

port [*portlist*] iloop
loop [looplist] iloop

This outputs one line per listed port. Each line contains a port number, a colon, and either a '+' if **iloop** is on for that port or '.' if **iloop** is off.

```
>>loop 1 iloop
1A:+
2A:+
3A:+
4A:.
```

loops [*looplist*] break

This outputs one line per listed port. Each line contains a two-digit loop number, a colon, and the break time in milliseconds zero-filled to four characters.

```
>>loops 1 5 15 break
01:0000
05:0010
15:5000
```

PRESET

This command gives no response in non-verbose mode.

RESTORE

This command gives no response in non-verbose mode.

SAVE

This command gives no response in non-verbose mode.

SFPDATA

For non-SFP slots, "X" is returned. For empty SFP receptacles, "-" is returned. For SFP transceivers with no module definition data, "M" is returned, followed by ones or zeroes representing the static logic levels on the transceiver's MOD_DEF pins 0, 1, and 2. For SFP transceivers with module definition data, the data is output in one continuous string of hexadecimal characters.

Example:

```
>>sfpdata 1a 8a 8b 8c
1A: X
8A: -
8B: M011
8C: 030407000100000000000000B1900000F0A0000534650205665 6E646F7220
436F72702000000000058595A2D32352D31412D4C20202020203030304100000 0BF
001A000031323334303130343031202000000000
```

SHUTDOWN

The shutdown command with no arguments responds with three fixed-length fields on a single line, listing the settings for crosspoint temperature, port card temperature, and inlet temperature in that order. If the inlet temperature threshold is disabled it is displayed as zeros.

```
>>shutdown
+090 +080 +000
```

STATUS

This returns one 96-character line, with three characters for each port in order 1A, 1B, … 8D. For each port, the first two characters indicate the port is connected to, or '00' if the port is turned off or 'XX' if the port is not installed. The third character is '+' if this port's input is active, '.' if this port's input is not active, or 'X' if the port is not installed.

Example:

If the verbose response would be:

1A<1A	**2A<1B**	3A<**2D**	4A<4A	6A<	8A<
1B<1C	2B<	3B<**2D**	4B<4B	6B<	8B<
1C<2A	2C<	3C<**2D**	4C<4C	6C<	8C<
1D<1D	**2D<2D**	3D<**2D**	4D<4D	6D<	8D<

Then the non-verbose response is this single line:

```
1A+1C+2A+1D.1B+00.00.2D+2D.2D.2D.2D.4A.4B.4C.4D.XXXXXXXXXXXX00.00.00.
00.XXXXXXXXXXXX00.00.00.00.
```

TEMP

This command returns three fixed-length fields on a single line, listing the readings for crosspoint temperature, port card temperature, and inlet temperature in that order.

```
>>temp
+052 +046 +027
```

5.5 Keyword Abbreviations

In general, you only need to enter enough letters of a command or keyword to allow the LX2500 to distinguish it from other keywords. In the following table, the minimum required portion of each word is indicated by capitals.

5.5.1 Commands

ACcess
Alarm
Beep
CARDs (Cards when a space follows)
CC
CHecksum
Display (also **DS**)
ECho
EDit
EXit
Fans
Help
IPconfig
Loops
PASSWORD
Ports
PReset (also **SC**)
REStore
SAve
SFPdata
SHUTDown
STatus
TEMp
TERm
TIme
VERBOse
VERSion
WINDOw (also **DW**)

5.5.2 Other keywords

Address
ALL
Auto
Admin
BReak
DEfaults
DELay
Dhcp
DIsable
EMUL
FAC
FIn
FXp
Gateway
ILOOP
Lock
Mask
Mbps
Name
NOW
OFf
ON
Ol
Pl
Quiet
Ratesel
REBoot
REFresh
Read
SPeed
TCd
TIn
TXp
Unlock
Wrap
Write

EXAMPLE

The **EDIT** command may be entered as "**ed**", "**edi**", or "**edit**".

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6. LX2500 BROWSER INTERFACE

6.1 Introduction

This section describes how to use the LX2500's web browser interface. The browser interface allows the LX2500 to be controlled in a more graphical and, presumably, more intuitive manner than the Command Line Interface.

The browser interface is designed for a screen resolution of at least 800 x 600 pixels. It works with Microsoft Internet Explorer 4.0 and later, and Netscape 4.06 and later.

6.2 Accessing the Browser Interface

To make the browser interface accessible, the LX2500 must be connected to your network and the IP interface must be configured (see Sections 3.7.3 and 5.3.13). If the LX2500's IP address is assigned by a DHCP server, you'll have to ascertain the address either from the server or from the LX2500 itself through its **ipconfig** command.

Enter the LX2500's IP address into your browser in the same way you would enter a web address. The full URL for the LX2500 would be something like "http://192.168.0.5/" but the IP address alone is sufficient. Like any other URL, the LX2500's address can be bookmarked to make it more convenient to return to. You can also assign a host name to the LX2500 on your local name server so the switch can be referenced by name rather than by numerical address.

6.3 Exploring the Interface

6.3.1 Home Window

Putting the LX2500's IP address into a browser takes you to the LX2500's home window, as shown in Figure 6-1. From here you can click on **Command Reference** for online help, or **Switch** to control the LX2500. Clicking on **Switch** opens a separate browser window to make it easier to go back and forth between controlling the switch and reading the online help.

6.3.2 Switch Window

The Switch window (see Figure 6-2) is where you interact with the switch. The central frame shows the port cards in the switch—in this example, there are cards installed in slots 1, 2, 3, 4, 5, 6, and 8. For each port, the "T" indicator turns red and gets larger if that port's transmitter is turned on, and the "R" indicator turns green and gets larger if that port is active (its receiver senses a signal).

Empty SFP receptacles are indicated by a black rectangle.

The upper right frame of the switch window shows temperature and fan status. It displays current readings, alarm thresholds, and whether the alarm thresholds are exceeded.

Both the port card frame and the temp/fan frame are updated automatically every 60 seconds.

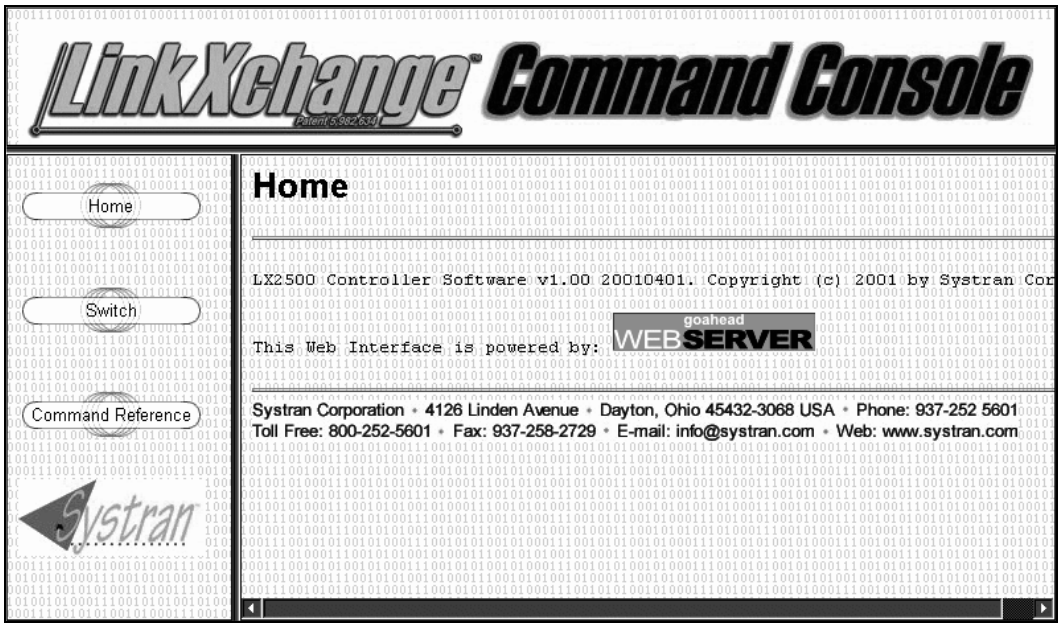

Figure 6-1 The LX2500's Home Window

Clicking on a port in the port card window brings that port up in the lower frame, where you can read or change the connection rules for that port. Each port can either have a set of explicit connection rules or be associated with a loop. Figure 6-2 shows an example where port 1A has three connection rules. The equivalent command line interface command to create these rules would be

```
port 1a < 1b if 1b; 1c if 1c; off
```

This tells the LX2500 to connect port 1A's transmitter to port 1B's receiver if port 1B is active; otherwise connect port 1A's transmitter to port 1C's receiver if port 1C is active; otherwise turn port 1A's transmitter off.

To add a rule, type the new rule in the '**Ins**' box and then type the position number of where you want to insert it to in the '**Num**' box and click the **Submit** button. The new rule will be inserted into the chain at that position.

To edit one of the rules, type the new rule into the box you wish to edit and click the **Submit** button. You can also remove a rule by deleting the rule from the box and then click the **Submit** button. The system adds or deletes rule boxes as needed, up to a limit of 33 rules.

The acceptable rule formats are

- Port# if Port#
- Port#
- off
- loop Loop#

All rules but the last must be the "*Port#* if *Port#*" form. The final rule must be "*Port#*" or "off." The LX2500 automatically adds an "off" rule to the end if the last rule would otherwise be an *if* rule. If "loop *Loop#*" is entered, it replaces all other rules.

For SFP ports, this frame also has an **SFP Data** button. Clicking this button pops up a new window to display this port's transceiver module definition data.

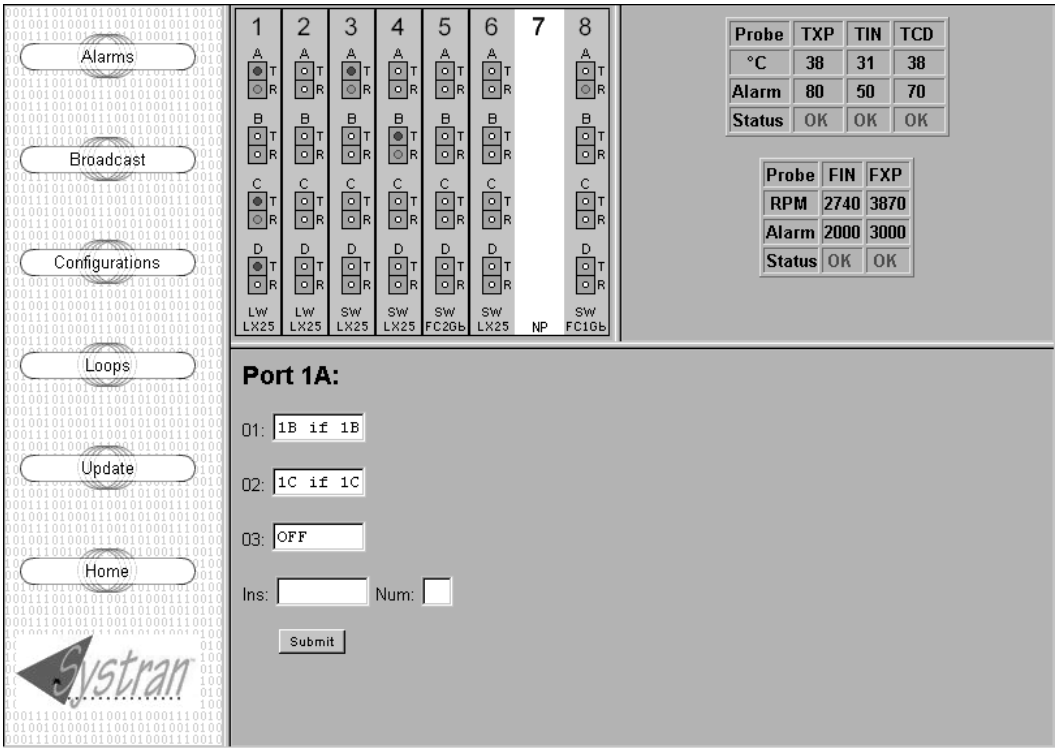

Figure 6-2 LX2500 Switch Window

Clicking on the slot number brings up information on the port card, as shown in Figure 6-3. From here you can read the type of card, its status, and its FLASH checksum. If the card has programmable features, they can be configured here.

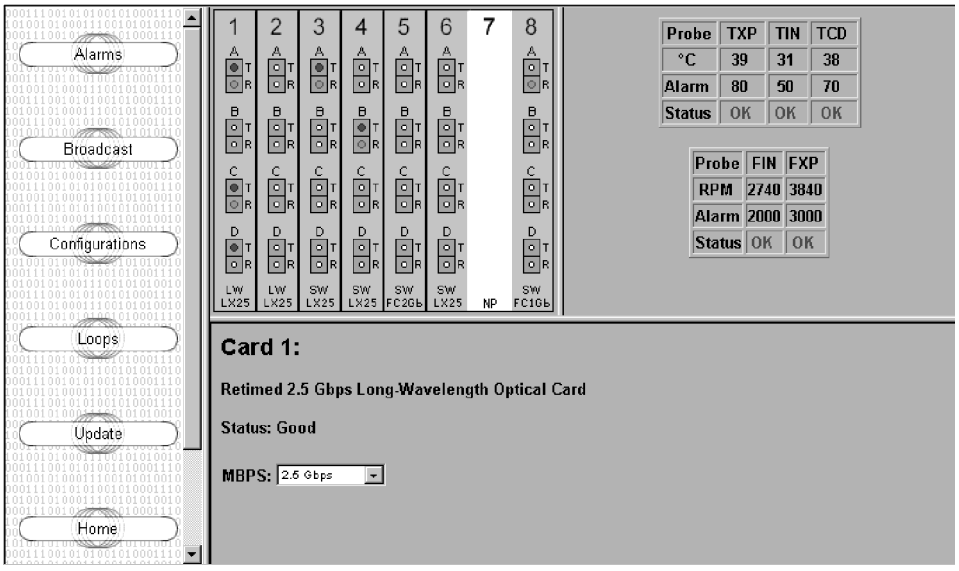

Figure 6-3 Card Information

Clicking on **Alarms** in the left-side frame changes the lower frame to alarm information, as shown in Figure 6-4. To change alarm or shutdown thresholds, overtype the new values into their boxes and click the **Submit** button.

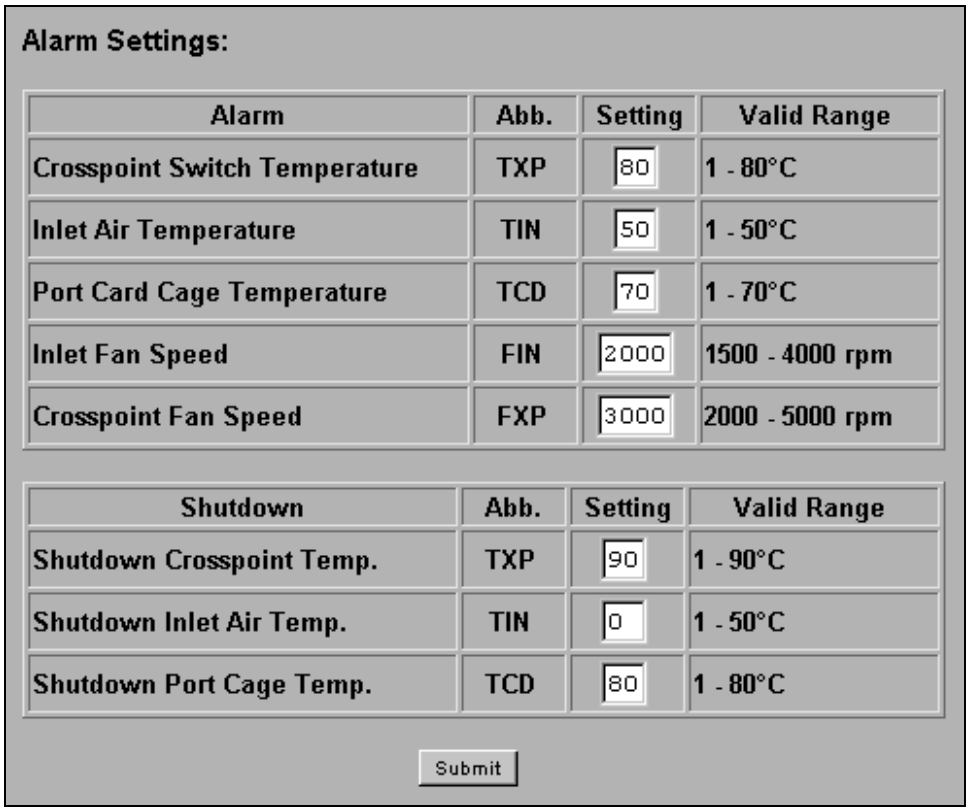

Figure 6-4 LX2500 "Alarms" Frame

Clicking on **Broadcast** in the left-side frame changes the lower frame to a broadcast setup frame. Pick any input port with the selector at the top, and the chart shows a check mark for each output port that is connected to it. Click on the check boxes to select or de-select them, and then click on the **Submit** button to update the switch.

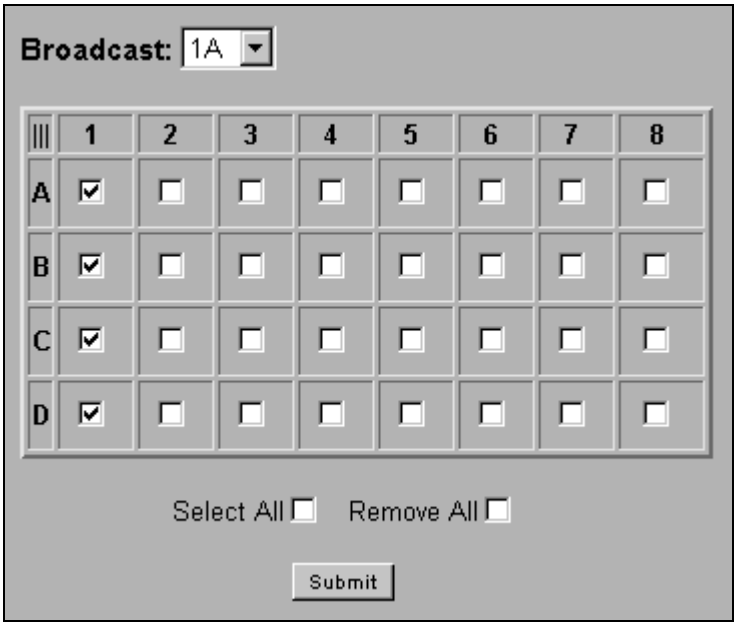

Figure 6-5 LX2500 "Broadcast" Frame

Clicking on **Configurations** in the left-side frame changes the lower frame to a configuration save/restore frame. Here you can save the current switch configuration to one of four slots, recall the configuration from the slots, or recall one of the preset configurations.

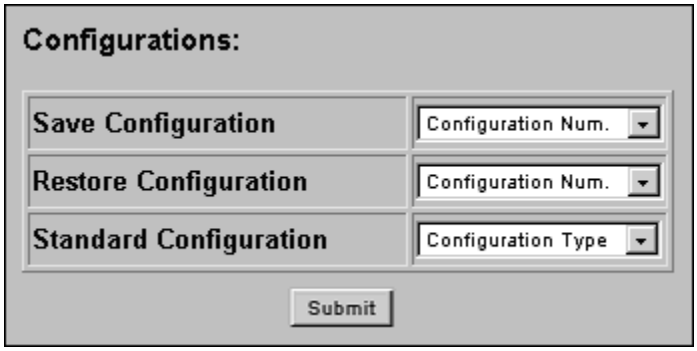

Figure 6-6 LX2500 "Configurations" Frame

Clicking on **Loop** in the left-side frame changes the lower frame to a loop setup frame. Pick a loop number from 1 to 32 with the selector at the top, and the chart shows a check mark for each port that is a member of that loop. Click on the check boxes to select or de-select them, and then click on the **Submit** button to update the switch.

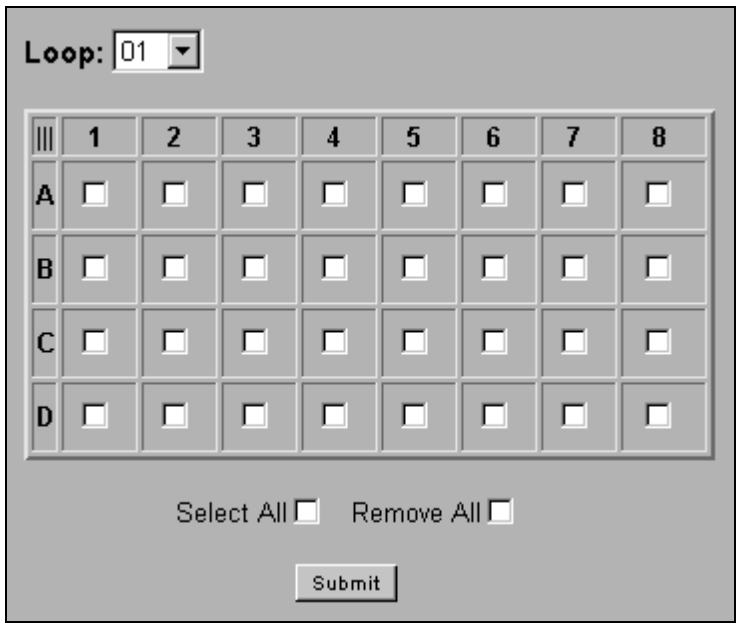

Figure 6-7 LX2500 "Loops" Frame

Clicking on **Update** in the left-side frame immediately updates all windows. Clicking on **Home** brings the Home window back to the top of the display.

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APPENDIX A

SPECIFICATIONS

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FIGURES

A.1 LX2500 Hardware Specifications

Physical Dimensions:
- With handles, mounting ears, and feet: ..... 19.05” wide by 7.30” tall by 15.85” deep (484 mm by 186 mm by 403 mm)
- Box only: ..... 17.75” wide by 7.0” tall by 14.15” deep (451 mm by 178 mm by 359 mm)

Weight: ..... See Table F-1 and examples in Appendix F.

Power Requirements:
- Input voltage: ..... 90-135 or 180-270 VAC, 47-63 Hz
- Input current per supply: ..... 10.0 A max at 115 V, 5.5 A max at 230 V

Power Supply Efficiency: ..... 70% (See Table F-1 and examples in Appendix F)

Storage Temperature Range: ..... -20° to +80° C

Operating Temperature Range: ..... 0° to +50° C

Storage Humidity Range: ..... 5% to 95% (noncondensing)

Operating Humidity Range: ..... 10% to 90% (noncondensing)

Data Rates: ..... Up to 2.5 Gbps (port card dependent)

Total Bandwidth: ..... 80 Gbps with 32 ports

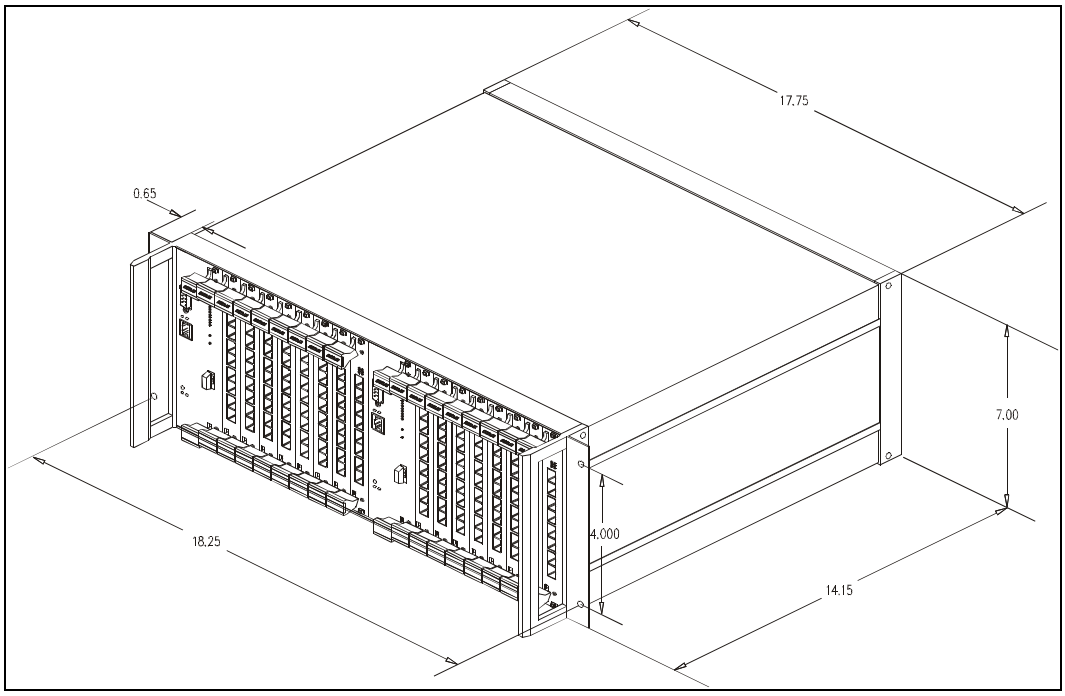

Figure A-1 LX2500 Dimensions

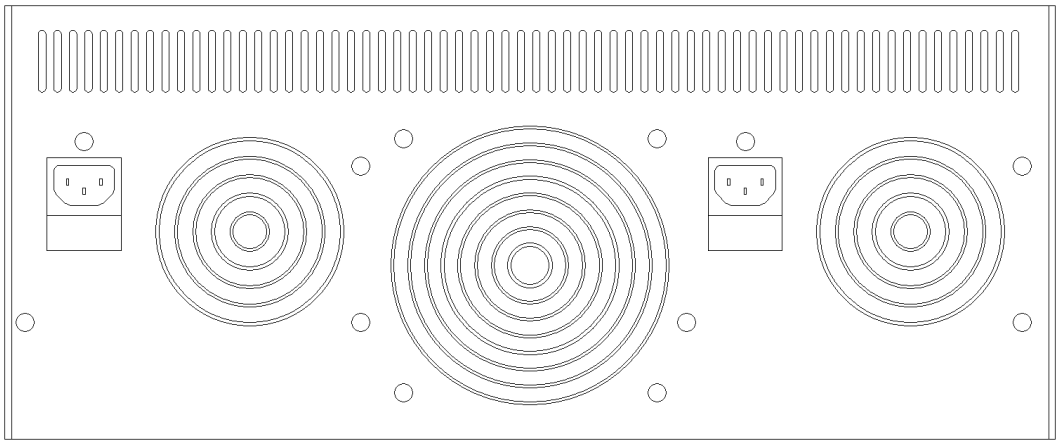

Figure A-2 LX2500 Rear Panel

APPENDIX B

REDUNDANT POWER SUPPLIES

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FIGURES

B.1 Overview

The LX2500 is available with hot-pluggable, dual redundant power supplies. Redundant power supplies allow the LX2500 to continue to operate even if a power supply or power input circuit fails. In normal operation, the two modules in a redundant supply share the task of powering their switch, but if one module fails the surviving module carries the full load. The failed module can be replaced with a working unit without interrupting the LX2500's operation.

Since each switch in an LX2500 has its own separate power supply, a dual LX2500 with redundant power supplies comes with two separate swappable power supply pairs, and uses four line cords for AC power. A connector for each supply on the rear panel allows you to remotely sense when a power supply has failed.

B.2 Installation

Install an LX2500 with redundant power supplies in the same way as a standard LX2500, with the following additional details:

- Connect an AC power cord (provided) from each three-conductor power receptacle to a source of AC power that meets these requirements:
  - A properly wired, earth-grounded outlet.
  - Input voltage: 95 – 264 VAC.
  - Line frequency: 47 – 63 Hz.
  - Input waveform: Sine wave, modified sine wave or square wave.
  - Approximately 2 A at 110 VAC or 1 A at 220 VAC.
- If redundant AC power circuits are available, make use of the redundancy by connecting each of the two modules in a supply to a different circuit.
- Enable each module by turning its power switch ON. (The LX2500's front-panel power switch controls whether system power is on or off.)
- To remotely monitor power supply status, connect a cable from each supply's status output connector to your monitoring circuit.

For use in power calculations such as that in section B.6, the efficiency of the redundant power supply is approximately 68 percent.

B.3 Rear Panel

Figure B-1 shows the rear panel of a dual LX2500 with redundant power supplies. Each supply powers the switch on its side of the box. There is no interconnection between the two supplies, except that both supplies are wired to the central fan.

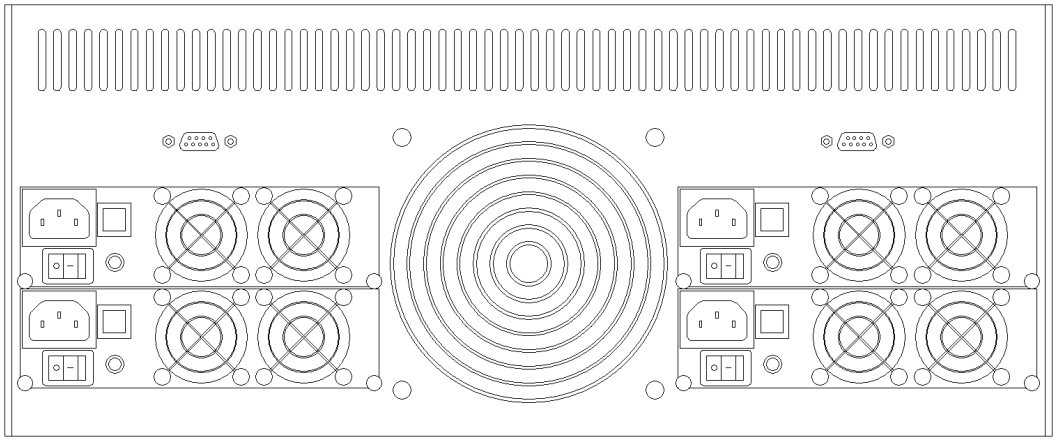

Figure B-1 Rear panel, dual LX2500 with redundant power supplies

B.3.1 Power Supplies

Figure B-2 shows the faceplate of one of the redundant power supply modules. The **Power Switch** controls power to its module, and can be used to disable the module to test the redundancy circuitry. The **Status LED** lights when the module is functioning.

If a module fails, the power supply sounds an audible alarm as well as turning off the failing module's status LED. Pushing the **Alarm Reset** pushbutton will quiet the audible alarm.

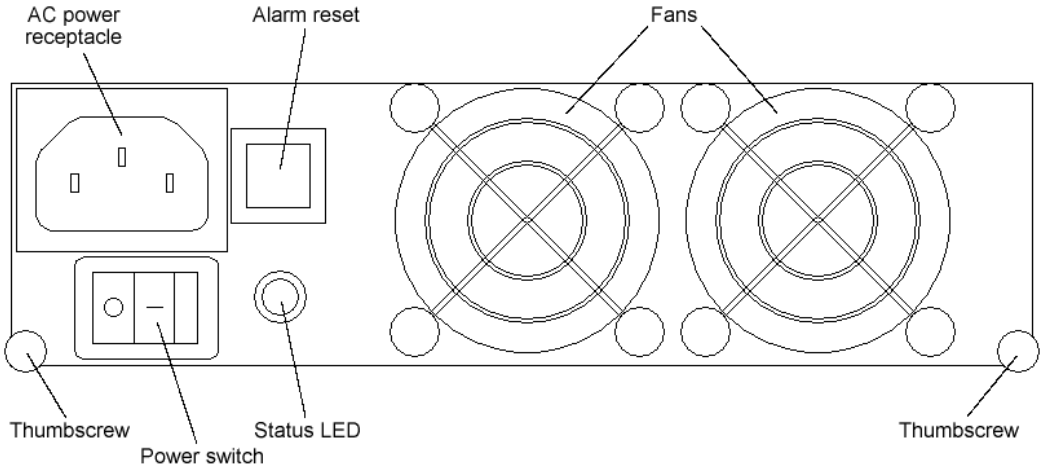

Figure B-2 Redundant Power Supply Module

B.3.2 Status Output Connectors

A status output connector for each power supply allows the supply's status to be remotely sensed. The connector is a female DB-9, with pins numbered as shown in Figure B-3. The connector brings out +5V from the supply, and the contacts of a SPDT relay. The relay is active only when both modules of its power supply are functioning (that is, when both Status LEDs are on). In other words, when both modules of the power supply are working, connector pins 2 and 3 are shorted together.

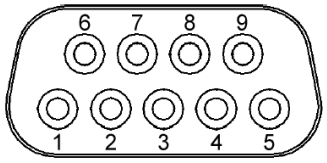

Figure B-3 Status Output Connector (DB-9 female)

Pin	Function
1	Relay NC (inactive) contact
2	Relay NO (active) contact
3	Relay common contact
4	No connection
5	Power supply common
6	330 ohms to +5 V
7	330 ohms to +5 V
8	No connection
9	No connection

B.4 Swapping Out a Power Module

To swap out a power supply module, follow these steps:

1. Turn off the module's power switch and remove the AC power cord.
2. Remove the two thumbscrews holding the module in place.
3. Pull the module out of the power supply frame.
4. Insert the new module and make sure it is completely seated.
5. Replace the two thumbscrews.
6. Connect the AC line cord and turn on the power switch.

B.5 Replacement Power Modules

Contact Systran Technical Support for replacement power modules at (800) 252-5601.

B.6 Sample Weight and Power Calculation

Sometimes it is helpful to know how much an LX2500 product weighs and how much AC and DC power an LX2500 product consumes. It is not practical to list the weight and power consumption for all product combinations; therefore, the following examples are provided to illustrate how to make these calculations. Refer to Appendix F, Table F-1, for weights and power data.

FHS3-AAAA0000-25 WITH FHS3-EEEEEEEE-21

This combination consists of a dual LX2500 with redundant power supplies (FHS3-xxxxxxxx-25 with FHS3-xxxxxxxx-21), four type "A" port cards (FHSA-S25MW000-00), eight type "E" port cards (FHSE-S24MW000-00), and four blank filler plates.

Item	Quantity	Weight (each) (lbs)	Total
FHS3-xxxxxxxx-25 FHS3-xxxxxxxx-21	1	32.2	32.2
Type "A" port card	4	0.4	1.6
Type "E" port card	8	0.4	3.2
Blank filler plates	4	Negligible	0
			37.0 lbs (16.8 kg)

Item	Quantity	Power (each) (W_{DC})	Total
FHS3-xxxxxxxx-25 FHS3-xxxxxxxx-21	1	56.2	56.2
Type "A" port card	4	7.3	29.2
Type "E" port card	8	8.0	64.0
			149.4 W_{DC}

The AC power consumed is:

$$149.4\,W \times \frac{1}{0.68} = 219.7\,W_{AC}$$ **Equation 1**

APPENDIX C

AVAILABLE PORT CARDS

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FIGURES

C.1 1.0625 Gbps SC Port Card

The 1.0625 Gbps SC Port Card interfaces to 1.0625 Gbps Fibre Channel and related signals, using SC optical connectors. It is available with 850 nm (multimode) or 1300 nm (multimode or single-mode) optical transceivers.

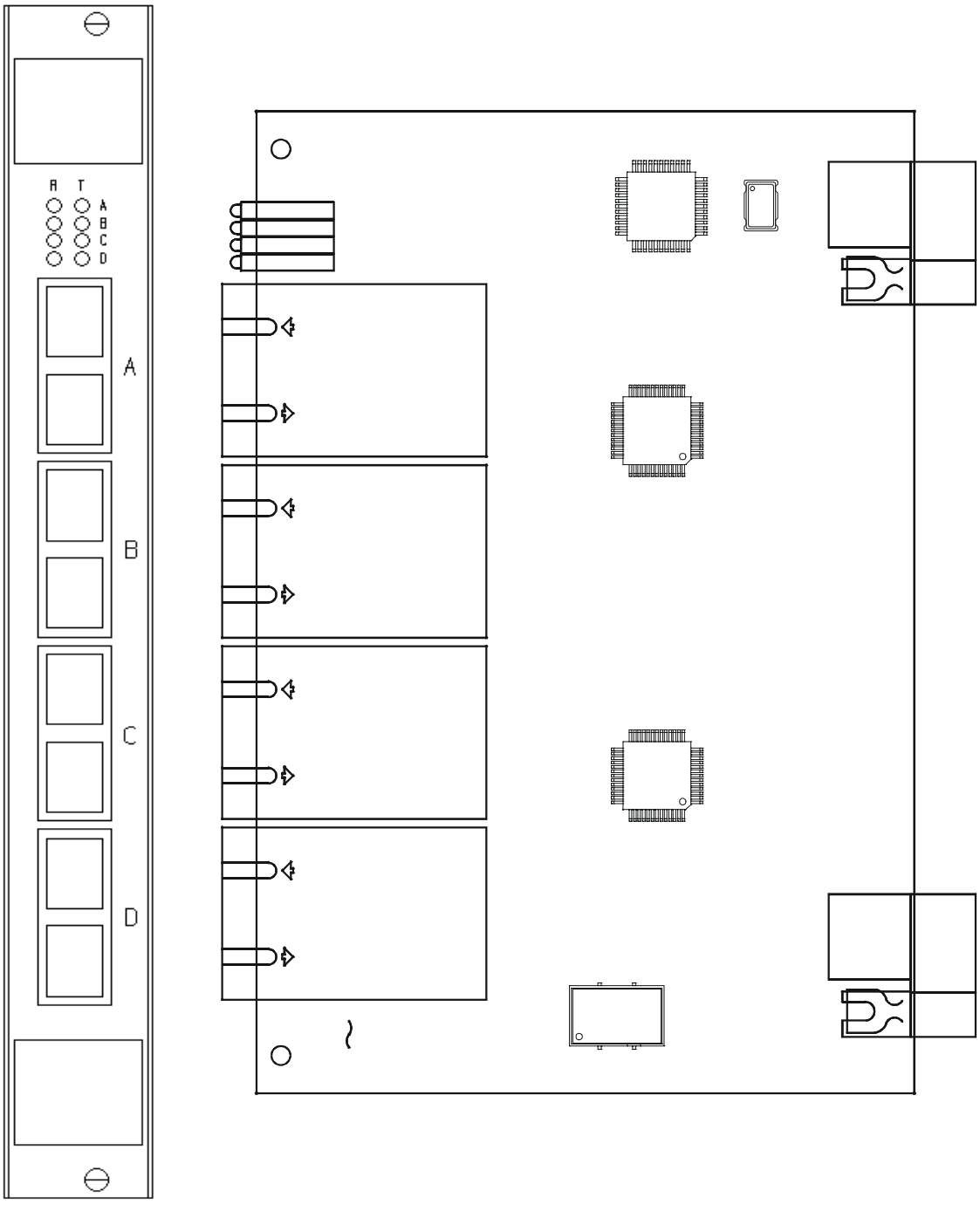

Figure C-1 1.0625 Gbps SC Port Card

FEATURES:

- 1.0625 Gbps data rate.
- Four bi-directional ports per card.
- Repeater circuits on outgoing data reduce jitter and signal distortion.
- Fits in one Systran LX2500 port card slot.
- Compatible with 1.0625 Gbps Fibre Channel and FibreXtreme (Serial FPDP)

OPERATING CONSTRAINTS:

Maximum Switch Passes: 5
Power Consumption:..... 8 W (0.86 A @ 5 V plus 1.12 A @ 3.3 V)
Weight:..... 0.4 lbs (0.18 kg)
Operating Temperature Range:..... 0° to 50° C
Storage Temperature Range:..... -40° to 85° C
Operating Humidity Range:..... 5% to 95% (noncondensing)
Storage Humidity Range:..... 0% to 95% (noncondensing)
Maximum Data Run Length: ..... 10 bits

INTERFACE DESCRIPTION:

Connector:..... Duplex SC

850 nm:
Media: ..... 50 µm or 62.5 µm multimode fiber
Fibre Channel Formats:..... 100-M5-SN-I (1 Gbps, 50 µm fiber)
100-M6-SN-I (1 Gbps, 62.5 µm fiber)
Maximum Fiber Length: ..... 500 meters with 50 µm fiber
300 meters with 62.5 µm fiber
Transmit Wavelength: ..... 830 to 860 nm
Transmit Power: ..... -10 to -4 dbm
Receive Wavelength:..... 770 to 860 nm
Receive Sensitivity:..... -16 to 0 dbm

1300 nm:
Media: ..... 9 µm single-mode fiber*
Fibre Channel Formats:..... 100-SM-LL-I (1 Gbps, single-mode fiber, intermediate distance)
100-SM-LC-L (1 Gbps, single-mode fiber, low cost long distance)
Maximum Fiber Length: ..... 10 km
Transmit Wavelength: ..... 1285 to 1330 nm
Transmit Power: ..... -9 to –3 dBm
Receive Wavelength:..... 1100 to 1600 nm
Receive Sensitivity:..... -20 to –3 dBm

* (1300 nm cards are also usable with multimode fiber.)

PANEL:

Duplex SC optical ports A, B, C, and D.

One “R” and one “T” LED for each port.

- “R” LEDs illuminate when the port’s receiver senses an incoming signal.
- “T” LEDs illuminate when the port’s transmit laser is turned on.

PROGRAMMABLE FEATURES:

None.

TESTED APPLICATIONS:

The 1.0625 Gbps SC Port Card has been tested and found to work in the following applications:

- 1.0625 Gbps Fibre Channel using an optical interface.
- 1.0625 Gbps Systran FibreXtreme SL100 and Simplex Link Series using an optical interface.

The above list contains all of the applications that were tested by the time this manual was printed. New applications are being tested continuously. For an up-to-date list of tested applications, please contact Systran at **(800) 252-5601**.

C.2 2.125 Gbps LC Port Card

The 2.125 Gbps LC Port Card interfaces to 2.125 Gbps and 1.0625 Gbps Fibre Channel and related signals, using LC optical connectors. It is available with 850 nm (multimode) or 1300 nm (multimode or single-mode) optical transceivers.

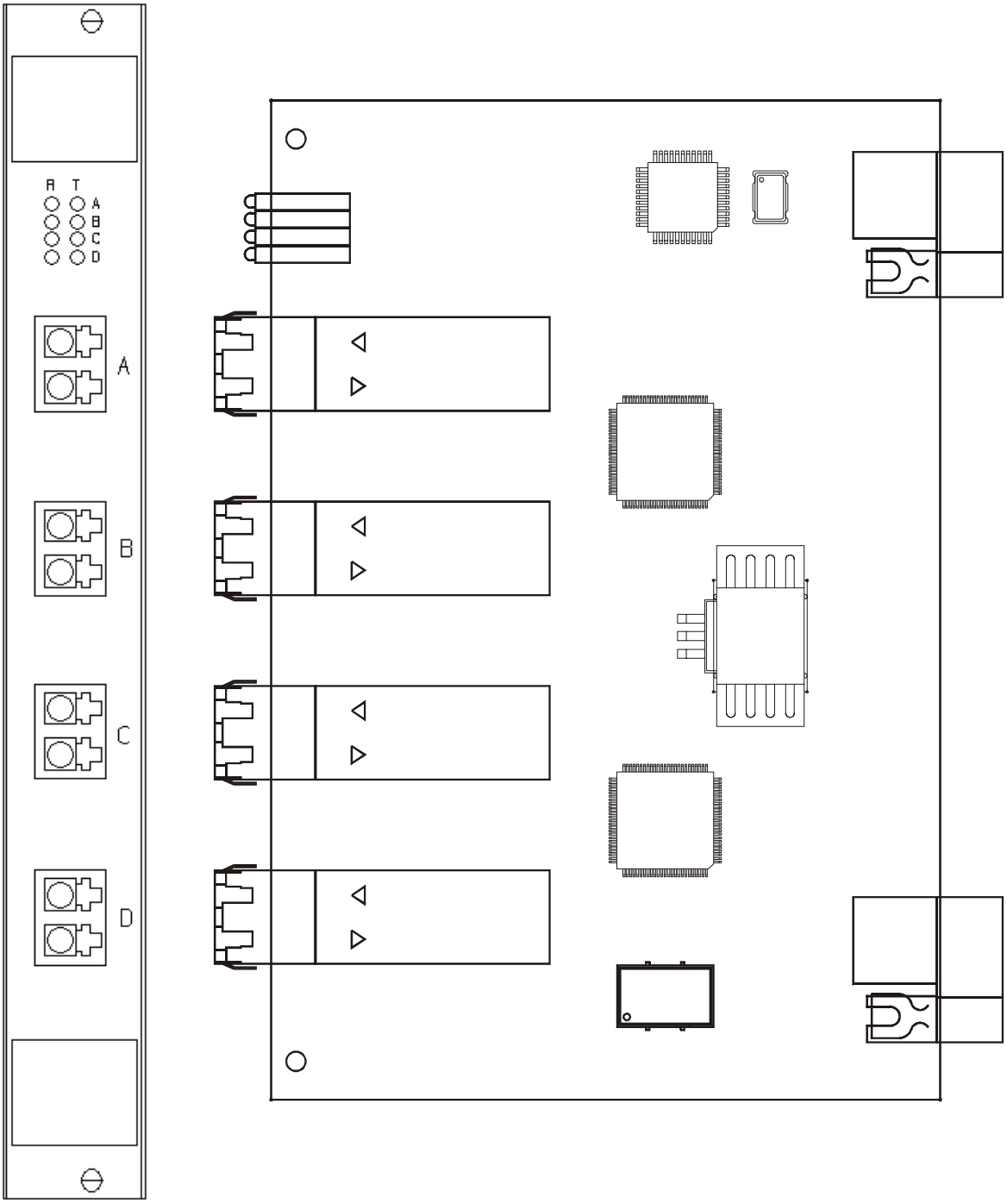

Figure C-2 2.125 Gbps LC Port Card

FEATURES:

- 2.125 Gbps or 1.0625 Gbps data rate.
- Data rate can be fixed or set to automatically match data stream.
- Four bi-directional ports per card.
- Repeater circuits on outgoing data reduce jitter and signal distortion.
- Fits in one Systran LX2500 port card slot.
- Compatible with 2.125 Gbps and 1.0625 Gbps Fibre Channel, and 1.0625 Gbps FibreXtreme (Serial FPDP).

OPERATING CONSTRAINTS:

Maximum Switch Passes: 5
Power Consumption:..... 7.3 W (0.86 A @ 5 V plus 1 A @ 3.3 V)
Weight:..... 0.4 lbs (0.18 kg)
Operating Temperature Range:..... 0° to 50° C
Storage Temperature Range:..... -40° to 85° C
Operating Humidity Range:..... 5% to 95% (noncondensing)
Storage Humidity Range:..... 0% to 95% (noncondensing)
Maximum Data Run Length: ..... 10 bits

INTERFACE DESCRIPTION:

Connector:..... Duplex LC

850 nm:

Media: ..... 50 µm or 62.5 µm multimode fiber
- Fibre Channel Formats:..... 100-M5-SN-I (1 Gbps, 50 µm multimode fiber)
  100-M6-SN-I (1 Gbps, 62.5 µm multimode fiber)
  200-M5-SN-I (2 Gbps, 50 µm multimode fiber)
  200-M6-SN-I (2 Gbps, 62.5 µm multimode fiber)
- Maximum Fiber Length: ..... 100-M5-SN-I: 500 meters
  100-M6-SN-I: 300 meters
  200-M5-SN-I: 300 meters
  200-M6-SN-I: 150 meters
- Transmit Wavelength: ..... 830 to 860 nm
- Transmit Power: ..... -10 to -4 dbm
- Receive Wavelength:..... 770 to 860 nm
- Receive Sensitivity:..... -14 to 0 dbm

1300 nm:

Media: ..... 9 µm single-mode fiber
- Formats:..... 100-SM-LC-L (1 Gbps, single-mode fiber, low cost long distance)
  200-SM-LC-I (2 Gbps, single-mode fiber, low cost long distance)
- Maximum Fiber Length: ..... 10 km
- Transmit Wavelength: ..... 1285 to 1330 nm
- Transmit Power: ..... –12 to –3 dBm
- Receive Wavelength:..... 1100 to 1600 nm
- Receive Sensitivity:..... –19 to –3 dBm

PANEL:

Duplex LC optical ports A, B, C, and D.

One "R" and one "T" LED for each port.

- "R" LEDs illuminate when the port's receiver senses an incoming signal.
- "T" LEDs illuminate when the port's transmit laser is turned on.

PROGRAMMABLE FEATURES:

Port speed is programmable.

cards [*Slotlist*] mbps 1062.....sets all four ports to 1.0625 Gbps.
cards [*Slotlist*] mbps 2125.....sets all four ports to 2.125 Gbps.
cards [*Slotlist*] mbps auto.....sets all four ports to automatically choose their speed.

Speed setting applies to the reclocking function in the output path of the card. The input path is not reclocked.

NOTE: The only way to run output ports on the same card at different speeds is to set them in **auto** mode.

TESTED APPLICATIONS:

The 2.125 Gbps LC Port Card has been tested and found to work in the following applications:

- 1.0625 Gbps Fibre Channel using an optical interface.
- 2.125 Gbps Fibre Channel using an optical interface.
- 1.0625 Gbps Systran FibreXtreme SL100 and Simplex Link Series using an optical interface.

The above list contains all of the applications that were tested by the time this manual was printed. New applications are being tested continuously. For an up-to-date list of tested applications, please contact Systran at **(800) 252-5601**.

C.3 2.5 Gbps LC Port Card

The 2.5 Gbps LC Port Card interfaces to 2.5 Gbps Serial FPDP ports such as Systran's SL240 and similar devices, using LC optical connectors. It is available with 850 nm (multimode) or 1300 nm (multimode or single-mode) optical transceivers.

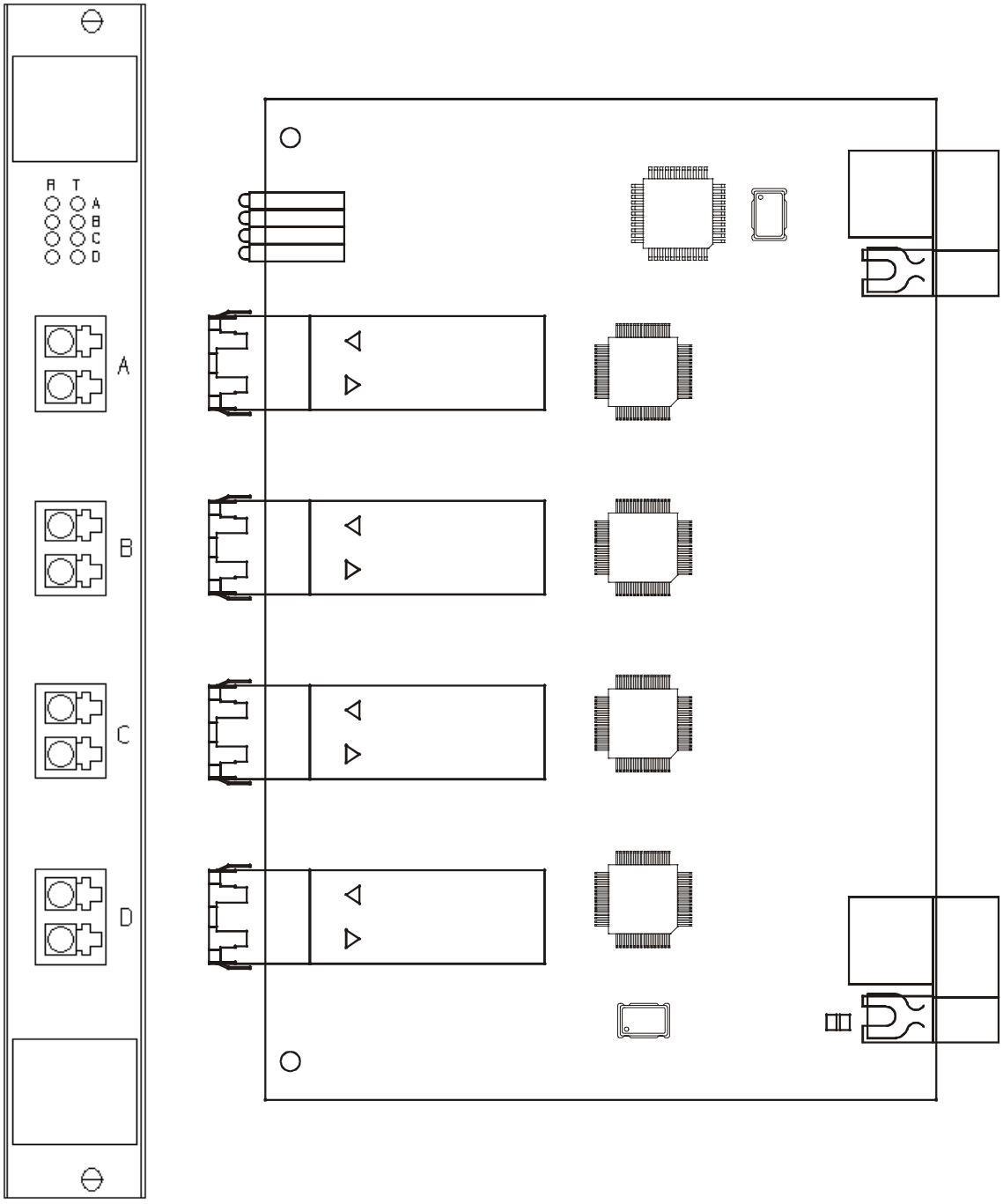

Figure C-3 2. 5 Gbps LC Port Card

FEATURES:

- 2.5 Gbps, 1.25 Gbps, 625 Mbps, and 156.25 Mbps data rates.
- Data rate of entire card is programmed by the user.
- Four bi-directional ports per card.
- Repeater circuits on outgoing data reduce jitter and signal distortion.
- Fits in one Systran LX2500 port card slot.
- Compatible with 2.5 Gbps FibreXtreme SL240 and similar devices.

OPERATING CONSTRAINTS:

Maximum Switch Passes: 5
Power Consumption:
1300 nm..... 8.1 W (0.1 A @ 5 V plus 2.3 A @ 3.3 V)
850 nm..... 8.4 W (0.1 A @ 5 V plus 2.38 A @ 3.3 V)
Weight:..... 0.3 lbs (0.14 kg)
Operating Temperature Range:..... 0° to 50° C
Storage Temperature Range:..... -40° to 85° C
Operating Humidity Range:..... 5% to 95% (noncondensing)
Storage Humidity Range:..... 0% to 95% (noncondensing)
Maximum Data Run Length: ..... 10 bits

INTERFACE DESCRIPTION:

Connector:..... Duplex LC

850 nm:
Media: ..... 50 µm or 62.5 µm multimode fiber
Maximum Fiber Length: ..... 150 m with 50 µm fiber
100 m with 62.5 µm fiber
Transmit Wavelength: ..... 830 to 860 nm
Transmit Power: ..... -8 to -4 dbm
Receive Wavelength:..... 770 to 860 nm
Receive Sensitivity:..... -12 to 0 dbm

1300 nm:
Media: ..... 9 µm single-mode fiber
Maximum Fiber Length: ..... 10 km
Transmit Wavelength: ..... 1285 to 1335 nm
Transmit Power: ..... -7.5 to –3 dBm
Receive Wavelength:..... 1270 to 1355 nm
Receive Sensitivity:..... -18 to –3 dBm

PANEL:

Duplex LC optical ports A, B, C, and D.

One “R” and one “T” LED for each port.

- “R” LEDs illuminate when the port’s receiver senses an incoming signal.
- “T” LEDs illuminate when the port’s transmit laser is turned on.

PROGRAMMABLE FEATURES:

Port speed is programmable.

cards [*Slotlist*] mbps 2500.....sets all four ports to 2.5 Gbps.
cards [*Slotlist*] mbps 1250.....sets all four ports to 1.25 Gbps.
cards [*Slotlist*] mbps 625.....sets all four ports to 625 Mbps.
cards [*Slotlist*] mbps 156.....sets all four ports to 156.25 Mbps.

Speed setting applies to the reclocking function in the output path of the card. The input path is not reclocked.

TESTED APPLICATIONS:

The 2.5 Gbps LC Port Card has been tested and found to work in the following applications:

- 2.5 Gbps Systran FibreXtreme SL240 Series using an optical interface.

The above list contains all of the applications that were tested by the time this manual was printed. New applications are being tested continuously. For an up-to-date list of tested applications, please contact Systran at **(800) 252-5601**.

C.4 Non-Retimed SFP Port Card

The Non-Retimed Small Form Factor Pluggable (SFP) Port Card uses pluggable transceiver modules to interface to a variety of media at data rates up to 2.5 Gbps.

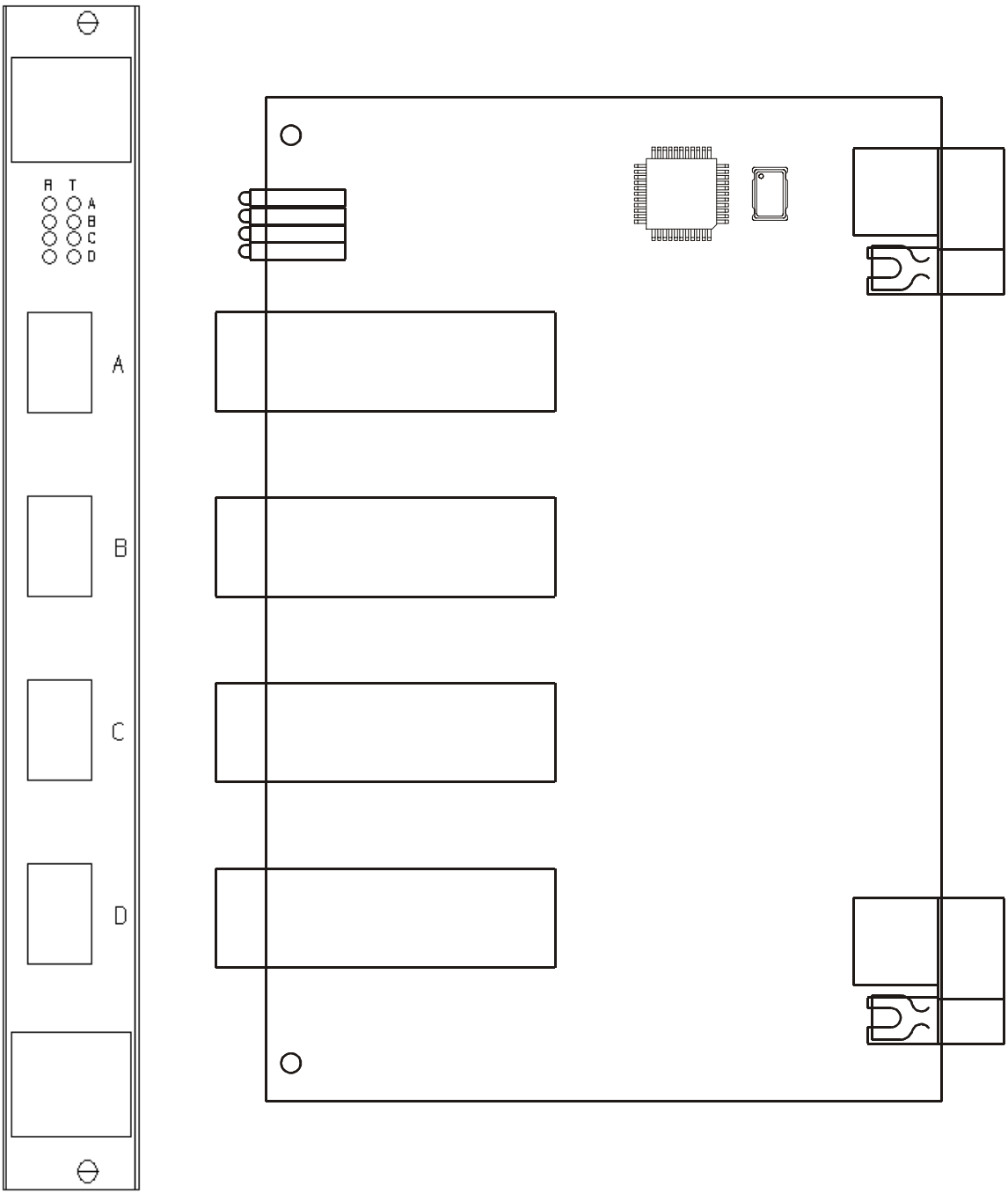

Figure C-4 Non-Retimed SFP Port Card

FEATURES:

- Four bi-directional ports per card.
- Data rates up to 2.5 Gbps, depending on the pluggable transceiver.
- Individual transceivers are hot-pluggable.
- "Rate Select" input of each transceiver can be programmed by the user.
- Fits in one Systran LX2500 port card slot.
- Compatibility depends on pluggable module.

OPERATING CONSTRAINTS:

Maximum Switch Passes: ..... Depends on data rate (Typically two at 2.125 Gbps and 2.5 Gbps)
Power Consumption:..... 4.9 W (0.04 A @ 5 V plus 1.42 A @ 3.3 V)
Weight (with Systran transceivers):..... 0.4 lbs (0.18 kg)
Operating Temperature Range:..... 0° to 50° C
Storage Temperature Range:..... -40° to 85° C
Operating Humidity Range:..... 5% to 95% (noncondensing)
Storage Humidity Range:..... 0% to 95% (noncondensing)

SFP MODULES:

The Non-Retimed SFP card is available as Duplex LC, 850 nm, 1.0625/2.125 Gbps, multi-mode optical. Other types of SFP modules, available from various vendors, can be used with this card.

PANEL:

SPF ports A, B, C, and D.

One "R" and one "T" LED for each port.

- "R" LEDs illuminate when the port's receiver senses an incoming signal.
- "T" LEDs illuminate when the port's transmit laser is turned on.

PROGRAMMABLE FEATURES:

Some SFP modules from some vendors implement a "Rate Select" input. Setting the input to '1' allows full receiver bandwidth; setting the input to '0' reduces receiver bandwidth to improve input sensitivity at a lower data rate. Other SFP modules ignore the "Rate Select" input.

Rate select signals to each module are programmable with the **cards** command, for example:

cards [*Slotlist*] ratesel 1100

The final operand is a list of the bits for ports A, B, C, and D in that order. The factory default for Rate Select is 1111.

TESTED APPLICATIONS:

The 2.5 Gbps LC Port Card has been tested and found to work in the following applications:

- 1.0625 Gbps Fibre Channel using an optical interface.
- 2.125 Gbps Fibre Channel using an optical interface.

The above list contains all of the applications that were tested by the time this manual was printed. New applications are being tested continuously. For an up-to-date list of tested applications, please contact Systran at **(800) 252-5601**.

APPENDIX D

THE RS-232 INTERFACE

TABLE OF CONTENTS

FIGURES

TABLES

D.1 Overview

This appendix describes the LX2500's RS-232 port and how it connects to a video terminal or a computer emulating such a terminal.

D.2 The RS-232 Connector

The LX2500's RS-232 port uses a male DB-9 connector, the same connector and pinout as is commonly found on personal computers. Pin assignments are shown in Table D-1.

Table D-1 LX2500 Pin Assignments

Pin	Signal	Direction
1	DCD	in
2	RxD	in
3	TxD	out
4	DTR	out
5	GND	
6	DSR	in
7	RTS	out
8	CTS	in
9	RI	in

D.3 Cable Connections

The null modem cable shown in Figure D-1 can be used to connect the LX2500 DB-9 connector to a personal computer's DB-9 serial port.

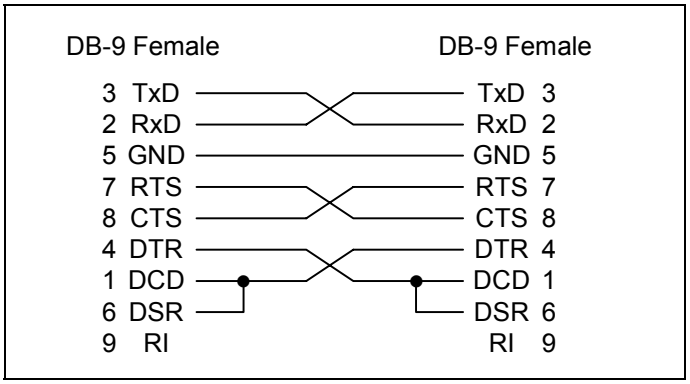

Figure D-1 DB-9-to-DB-9 Null Modem Cable

The similar cable shown in Figure D-2 can be used to connect the LX2500 to a terminal that uses the traditional male DB-25 connector and pin assignments. Both of these cables are widely available off the shelf.

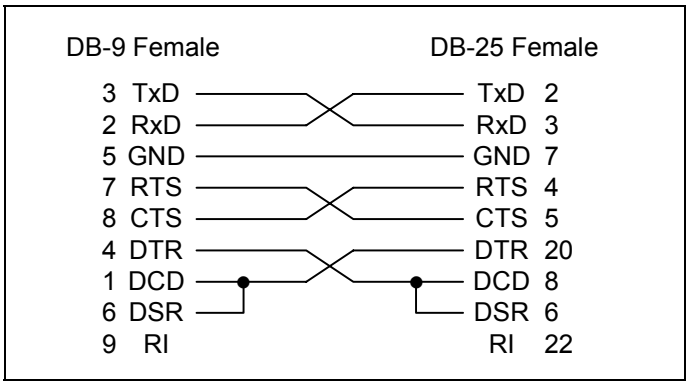

Figure D-2 DB-9-to-DB-25 Null Modem Cable

D.4 Data Rates and Format

D.4.1 Setting the Data Rate

The data rate on the RS-232 port can be set to 9600, 19200, 38400, or 57600 bits per second (bps). The factory default data rate is 19200 bps. The last rate used is remembered through power cycles and resets.

The data rate can be set with the **term speed** command; for example, **term speed 9600**. The command can be entered from the RS-232 port itself or from a Telnet session on the Ethernet port; in either case it affects the RS-232 port only.

Another way to change the data rate is to send a **Break** signal to the RS-232 port. (Most terminals and terminal emulator programs have a facility for doing this.) Each time the LX2500 receives a **Break**, it cycles to its next data rate and outputs a line reporting the current rate. When you get a readable report, you've found the right data rate.

D.4.2 Data Format

The serial data format is eight bits, no parity, one stop bit. Neither hardware nor software flow control is used.

D.5 Terminal Type

During Command Line Interface sessions, the LX2500 sends control characters to move the cursor around the screen (unless terminal emulation is turned off with the **term off** command). Different types of terminals use different sets of control characters. The terminal type is set automatically for Telnet sessions through the Ethernet port, but the LX2500 has no way to automatically determine what type of terminal is connected to its RS-232 port. The **term emul** command lets you tell the LX2500 what type of terminal or emulator the RS-232 port is driving. The factory default terminal type is *vt100*, a type that is often offered by terminal emulator software.

Many other terminal types are available. To see the full list, use the command **access admin** to drop into the administration shell, and issue the command **terminals**. This produces a long list of every terminal type available in the LX2500's library. You can pipe this output through other operating system commands to make it more manageable.

For example, use

```
terminals | more
```

to look at the output one screen at a time (press **space** for the next page, '**q**' or to quit out of the pager). Use the following to list every terminal type that contains the string "vt100".

```
terminals | grep vt100
```

Type **exit** to leave the administration shell and return to the command line interface.

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APPENDIX E

SFP MODULE DEFINITION DATA

E.1 SFP Module Definition Data

This table lists the module definition data fields displayed by the LX2500 for Small Form-factor Pluggable transceivers. For more details on the meaning of each field, see the *Small Form-Factor Pluggable (SFP) Transceiver MultiSource Agreement*, September 14, 2000.

Table E-1 SFP Module Definition Data Fields

Data Address	Field Size (Bytes)	Name of Field	Description of Field
BASE ID FIELDS			
0	1	Identifier	Type of serial transceiver
1	1	Ext. Identifier	Extended identifier type of serial transceiver
2	1	Connector	Code for connector type
3-10	8	Transceiver	Code for electronic compatibility or optical compatibility
11	1	Encoding	Code for serial encoding algorithm
12	1	BR, Nominal	Nominal bit rate, units of 100 Mbits/sec
13	1	Reserved	
14	1	Length (9 µm) - km	Link length supported for 9/125 µm fiber, units of km
15	1	Length (9 µm)	Link length supported for 9/125 µm fiber, units of 100 m
16	1	Length (50 µm)	Link length supported for 50/125 µm fiber, units of 10 m
17	1	Length (62.5 µm)	Link length supported for 62.5/125 µm fiber, units of 10 m
18	1	Length (Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor name	SFP transceiver vendor name (ASCII)
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor IEEE company ID
40-55	16	Vendor PN	Part number provided by SFP transceiver vendor (ASCII)
56-59	4	Vendor rev	Revision level for part number provided by vendor (ASCII)
60-62	3	Reserved	
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)
EXTENDED ID FIELDS			
64-65	2	Options	Indicates which optional SFP signals are implemented
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number provided by vendor (ASCII)
84-91	8	Date code	Vendor's manufacturing date code (ASCII)
92-94	3	Reserved	
95	1	CC_EXT	Check code for Extended ID Fields (addresses 64 to 94)

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APPENDIX F

ORDERING INFORMATION

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TABLES

F.1 Order Numbers

This appendix lists the order numbers for Systran's LX2500 products and accessories. For an up-to-date list or for inquiries about these products, contact Systran Sales.

F.1.1 LX2500 Units

The LX2500 is available as one or two independent switches in a rack-mountable enclosure. These are shown in the LX2500 Unit section of Table F-1. For each LX2500 part number, the "xxxxxxxx" field specifies the port cards that are to be installed in the LX2500's eight slots. From left to right, the x's specify the cards for slots one through eight. For slots where a "0" is specified, a blank filler plate is installed instead of a port card. Values for "x" for each type of port card are shown in the port card section of Table F-1.

NOTE: The weight of blank filler plates is negligible.

The LX2500 is also available as a dual unit with hot-swappable redundant power supplies (see Appendix B for details).

F.1.2 LX2500 Port Cards

Port cards can be ordered separately, as shown in the LX2500 Port Card section of Table F-1, or as part of the LX2500 unit.

F.1.3 Cables

Systran sells a wide variety of optical and copper cables for use with its networking products. Contact Systran Sales for details.

Table F-1 LX2500 Order Numbers

LX2500 UNITS

Order Number	Description	Weight (lbs)	Power (W_{DC})
FHS3-xxxxxxxx-10	Single LX2500.	19	30.7
FHS3-xxxxxxxx-20 FHS3-xxxxxxxx-21	Dual LX2500. Both numbers must be ordered together, in order to specify port cards or filler plates for all sixteen slots.	25	56.2
FHS3-xxxxxxxx-25 FHS3-xxxxxxxx-26	Dual LX2500 with redundant power supplies. Both numbers must be ordered together.	32.2	56.2

LX2500 PORT CARDS

Order Number	x	Description	Weight (lbs)	Power (W_{DC})
N/A	0	No card	N/A	N/A
FHSA-S25MW000-00	A	2.125 Gbps duplex LC, 850 nm	0.4	7.3
FHSB-S25SW000-00	B	2.125 Gbps duplex LC, 1300 nm	0.4	7.3
FHSC-S26MW000-00	C	2. 5 Gbps duplex LC, 850 nm	0.3	8.4
FHSD-S26SW000-00	D	2. 5 Gbps duplex LC, 1300 nm	0.3	8.1
FHSE-S24MW000-00	E	1.0625 Gbps duplex SC, 850 nm	0.4	8.0
FHSF-S24SW000-00	F	1.0625 Gbps duplex SC, 1300 nm	0.4	8.0
FHSG-S26MW000-00	G	Non-retimed SFP w/ 2.125 Gbps LC 850 nm transceivers	0.4*	4.9*

* Using transceivers purchased from Systran

F.2 Sample Weight Calculations

Sometimes it is helpful to know how much an LX2500 product weighs. It is not practical to list the weights for all product combinations; therefore the following three examples illustrate how to calculate the weight. Refer to Table F-1 for weights.

EXAMPLE 1: FHS3-AAAA0000-10

This combination consists of a single LX2500 (FHS3-xxxxxxxx-10), four type "A" port cards (FHSA-S25MW000-00), and four blank filler plates.

Item	Quantity	Weight (each) (lbs)	Total
FHS3-xxxxxxxx-10	1	19.0	19.0
Type "A" port card	4	0.4	1.6
Blank filler plates	4	Negligible	0
			20.6 lbs (9.3 kg)

EXAMPLE 2: FHS3-AAAA0000-20

This combination consists of a dual LX2500 (FHS3-xxxxxxxx-20), four type "A" port cards (FHSA-S25MW000-00), and four blank filler plates.

Item	Quantity	Weight (each) (lbs)	Total
FHS3-xxxxxxxx-20	1	25.0	25.0
Type "A" port card	4	0.4	1.6
Blank filler plates	4	Negligible	0
			26.6 lbs (12.1 kg)

EXAMPLE 3: FHS3-AAAA0000-20 WITH FHS3-EEEEEEEE-21

This combination consists of a dual LX2500 (FHS3-xxxxxxxx-20 with FHS3-xxxxxxxx-21), four type "A" port cards (FHSA-S25MW000-00), eight type "E" port cards (FHSE-S24MW000-00), and four blank filler plates.

Item	Quantity	Weight (each) (lbs)	Total
FHS3-xxxxxxxx-20 FHS3-xxxxxxxx-21	1	25.0	25.0
Type "A" port card	4	0.4	1.6
Type "E" port card	8	0.4	3.2
Blank filler plates	4	Negligible	0
			29.8 lbs (13.5 kg)

F.3 Sample Power Calculations

The specifications in Appendix A gives the maximum AC input current requirement, but sometimes it is helpful to know how much AC and DC power an LX2500 product actually consumes. It is not practical to list the power consumptions for all product combinations. Therefore, the following three examples illustrate how to calculate the power consumption. Refer to Table F-1 for power data.

EXAMPLE 1: FHS3-AAAA0000-10

This combination consists of a single LX2500 (FHS3-xxxxxxxx-10), and four type "A" port cards (FHSA-S25MW000-00).

Item	Quantity	Power (each) (W_{DC})	Total
FHS3-xxxxxxxx-10	1	30.7	30.7
Type "A" port card	4	7.3	29.2
			59.9 W_{DC}

This is the total DC power consumed. To calculate the AC power consumed, multiply the DC power consumed by the reciprocal of the power supply efficiency (see Appendix A). The result in this case is:

$$59.9\,W \times \frac{1}{0.70} = 85.6\,W_{AC} \qquad \textbf{Equation 2}$$

EXAMPLE 2: FHS3-AAAA0000-20

This combination consists of a dual LX2500 (FHS3-xxxxxxxx-20), and four type "A" port cards (FHSA-S25MW000-00).

NOTE: Although the –20 product has a second power supply, it is not powered on, so the power consumed by this combination is the same as for the FHS3-AAAA0000-10 in example 1 above.

EXAMPLE 3: FHS3-AAAA0000-20 WITH FHS3-EEEEEEEE-21

This combination consists of a dual LX2500 (FHS3-xxxxxxxx-20 with FHS3-xxxxxxxx-21), four type "A" port cards (FHSA-S25MW000-00), and eight type "E" port cards (FHSE-S24MW000-00).

Item	Quantity	Power (each) (W_{DC})	Total
FHS3-xxxxxxxx-20 FHS3-xxxxxxxx-21	1	56.2	56.2
Type "A" port card	4	7.3	29.2
Type "E" port card	8	8.0	64.0
			149.4 W_{DC}

The AC power consumed is:

$$149.4\,W \times \frac{1}{0.70} = 213.4\,W_{AC} \qquad \textbf{Equation 3}$$

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----------Arbitrated Loop. Fibre Channel topology where L_Ports use arbitration to establish a point-to-point circuit without hubs or switches.

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.

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--------Automatic detection and switching to the appropriate transfer rate. Alternatively, device speed may be fixed at 2Gb/s or 1Gb/s, or configurable through utility.

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.

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 the Fibre Channel family of products.

FibreXtreme----------A Systran trademark name for the Simplex Link family of products.

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.

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

HSSDC2----------High Speed Serial Data Connectors and Cable Assemblies. A type of high-speed interconnect system which allows for transmission of data rates greater than 2.125 Gbps and up to 15 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 (binary = 1,024).

kB----------Kilobytes (decimal = 1,000).

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.

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.

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.

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.

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

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.

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.

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).

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.

SFP ----------Small Form-factor Pluggable transceiver modules.

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.

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.

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

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

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

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