LX1500 Managed Hub
Hardware Reference Manual

Document No. F-T-MR-LXNTS###-A-0-A9

FOREWORD

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Systran Corporation
4126 Linden Avenue
Dayton, OH 45432-3068 USA
(800) 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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APPENDICES

FIGURES

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1. INTRODUCTION

1.1 How to Use This Manual

1.1.1 Purpose

The purpose of this manual is to introduce users to the LinkXchange™ LX1500 Managed Hub (LX1500) and to guide users through the process of unpacking, setting up, and operating the LX1500.

1.1.2 Scope

This manual contains the following information:

- Overview of LX1500 capabilities and features.
- Physical and functional description of the LX1500 components.
- Instructions on how to use the LX1500.
- Introduction.
- Product Overview.
- Installation.
- Operation.
- User Control Interface.
- General LX1500 specifications.
- Data sheets for available LX1500 port cards.
- An illustration, pin assignments, and cable connections for the RS-232 Cable.
- Information about Systran's available LX1500 products.
- A list and definitions of words, phrases, and terms used in Systran's manuals.
- A list of key words referenced in this manual.

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: *OpenConnect()*
- Data types are italicized: *int*
- Function parameters are bolded: **Action**
- Path names are italicized: *utility/sw/cfg*
- File names are bolded: **config.c**
- Absolute path file names are italicized and bolded: ***utility/sw/cfg/config.c***
- Hexadecimal values are written with the word hex italicized and following the value with a font size one smaller than the context: FB001040 *hex*
- Code and monitor screen displays of input and output are boxed and indented on a separate line. Text that is bolded represent user input. Text that the computer displays on the screen is not bolded.

```
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.
- For signals on hardware products, an 'Active Low' is represented by prefixing the signal name with a slash (/): /SYNC

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.
- *FibreXpress Owner's Manual for the FX Sbus*, Systran Corporation.
- *FibreXpress Owner's Manual for the FX VME6U*, Systran Corporation.
- *FibreXpress Owner's Manual for the FX PCI/PMC Boards*, Systran Corporation.
- *FibreXtreme Simplex Link Hardware Reference Manual for PCI and PMC Cards*, Systran Corporation.
- *FibreXtreme Simplex Link Hardware Reference Manual for VME and CMC FPDP Cards*, Systran Corporation.
- *SCRAMNet Network PMC & ½ Length PCI Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ EISA Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ GIO32 Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ ISA Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ Network PCI Bus Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ Rehostable Adapter Reference Manual*, Systran Corporation.
- *SCRAMNet+ Sbus Hardware Interface Reference Manual*, Systran Corporation.
- *SCRAMNet+ VME3U Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+ VME6U Hardware Reference Manual*, Systran Corporation.
- *SCRAMNet+^{2x} Network Hardware Reference for PCI Bus*, Systran Corporation.
- *SCRAMNet+^{2x} Network Hardware Reference for PMC Bus*, Systran Corporation.
- Systran Corp. - www.systran.com
- *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.

1.3 Quality Assurance

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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.

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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.

Although we have attempted to make this document comprehensive, you may have specific problems or issues this document does not satisfactorily cover. Our goal is to offer a combination of products and services that provide complete, easy-to-use solutions for your application.

If you have any technical or non-technical questions or comments (including software), 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**

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.

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

2. PRODUCT OVERVIEW

2.1 LX1500 Managed Hub Overview

Systran's LX1500 Managed Hub (LX1500) is a multipurpose, non-blocking 32-port crosspoint switch for digital signals at speeds up to 1.5 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 hub is ignored by the LX1500 and is unaltered by its passage through the hub. As a result, the LX1500 can be used with many different types of networks and signals.

A single LX1500 can hold 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 1.5 Gbps, different types of port cards impose different limitations on the range of data rates or the data format that they will pass.

The LX1500 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.

2.2 LX1500 Features

The LX1500 has the following features:

- Up to 32 nonblocking media-specific I/O ports.
- Up to 1.5 Gbps/port baud rate (port card dependent).
- 48 Gbps total bandwidth.
- Support for multiple point-to-point, loop, and broadcast communication links simultaneously.
- Automatic I/O Port fault isolation.
- Multiple media options.
- Out-of-band control through an RS-232 port.
- Can be connected to a modem and controlled from a remote location.

2.3 LX1500 Product Family

The LX1500 is available in a rack-mountable enclosure or as a bare "base unit" that can be custom-mounted. Port cards can be specified as a part of the LX1500 or ordered separately.

2.3.1 Rack-mountable LX1500

The rack-mountable enclosure comes with one or two LX1500 units, as shown in Figure 2-1 and Figure 2-2. Each LX1500 unit has its own control panel, power switch, and power supply. When two LX1500 units share an enclosure, they are independent – there is no interconnection between them.

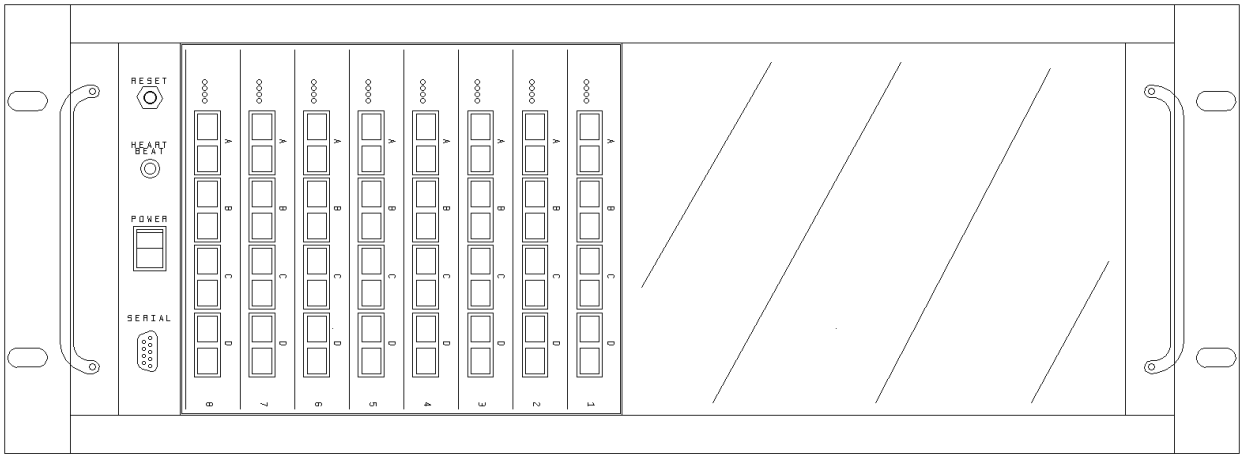

Figure 2-1 Single LX1500 Unit in Rack-Mountable Enclosure

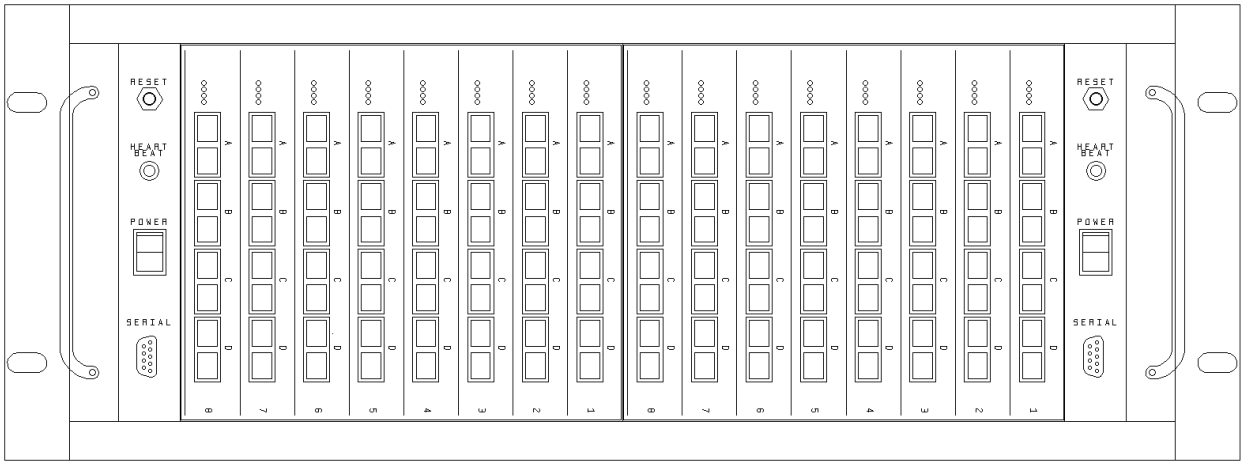

Figure 2-2 Two LX1500 Units in Rack-Mountable Enclosure

2.3.2 LX1500 Base Unit

The LX1500 base unit is designed to be mountable in any disk drive bay that will hold four “half-height” 5.25-inch disk drives.

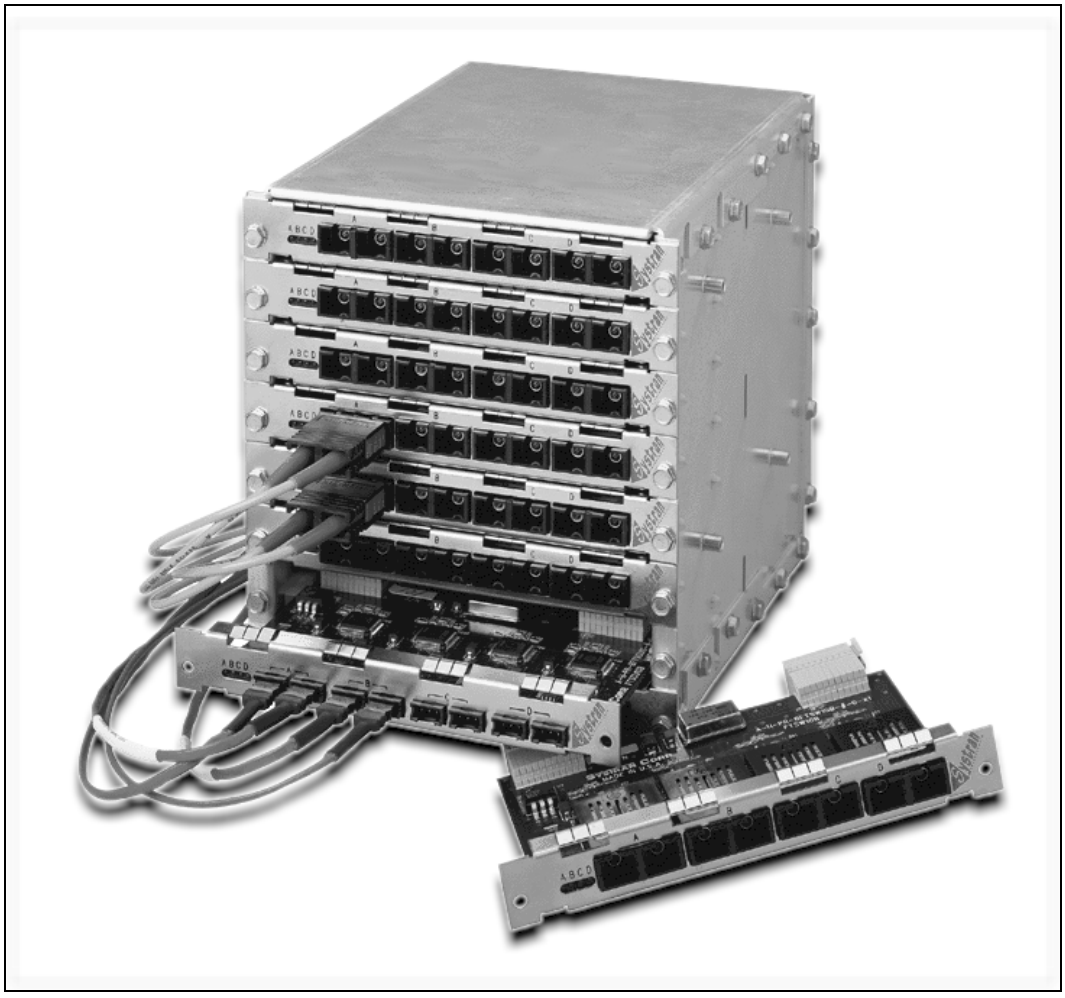

Figure 2-3 LX1500 Base Unit with Eight Optical Port Cards

2.3.3 Port Cards

The following port cards are currently available for use with the LX1500:

- Retimed Shortwave Optical
- Non-Retimed Shortwave Optical
- Retimed Longwave Optical
- Retimed HSSDC Copper
- Retimed 1x3 Copper
- Non-Retimed 1x3 Copper
- SCRAMNet+ Standard Link
- SCRAMNet+ Long Link
- SCRAMNet+ Coax

Retimed port cards are optimized for use with 8/10 encoded data at 1.0625 Gbps. They are compatible with Fibre Channel and with Systran's FibreXtreme Simplex Link cards. Non-retimed cards can be used over a range of bit rates.

SCRAMNet+ port cards are designed to work with Systran's SCRAMNet+ networking products.

2.4 User Control Interface

The LX1500 is controlled through an RS-232 port separate from the 32 data ports. It provides a command line interface that allows the user to configure and receive status information from the LX1500. This command line interface has the following 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 chapter 5. for a detailed description of this interface.

In addition to the RS-232 interface, the LX1500 has a "Heartbeat" indicator, which flashes periodically to indicate that the LX1500's embedded controller is functioning properly, and a Reset pushbutton to reset the controller.

Most port cards have an indicator for each port that lights when a signal is detected on the associated input. The SCRAMNet+ port card indicators are slightly more elaborate; see section B.3 for details.

2.5 Example Applications

2.5.1 Network Hub With Local Control

The simplest way to control the LX1500 is by a local VT-100 compliant terminal (or a computer emulating such a terminal) connected to the LX1500 with an RS-232 cable. Connecting a terminal to the LX1500 allows a network administrator to quickly configure or check the status of the LX1500.

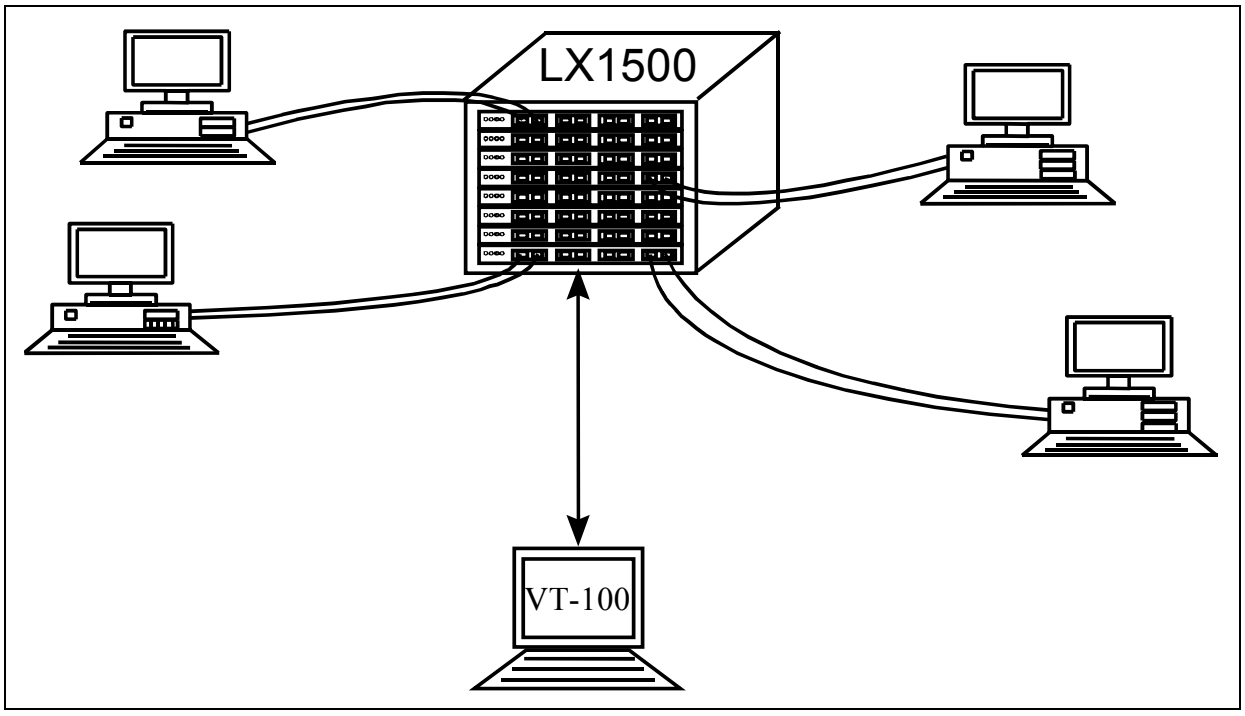

Figure 2-4 Network Hub With Local Control

2.5.2 Remotely Controlled Network Hub

To allow for multiple remote access points, a modem can be connected to the LX1500 RS-232 port. This allows control of the LX1500 from multiple locations and with no distance limitation. An example of an LX1500 network configuration with multiple control access points is presented in Figure 2-5.

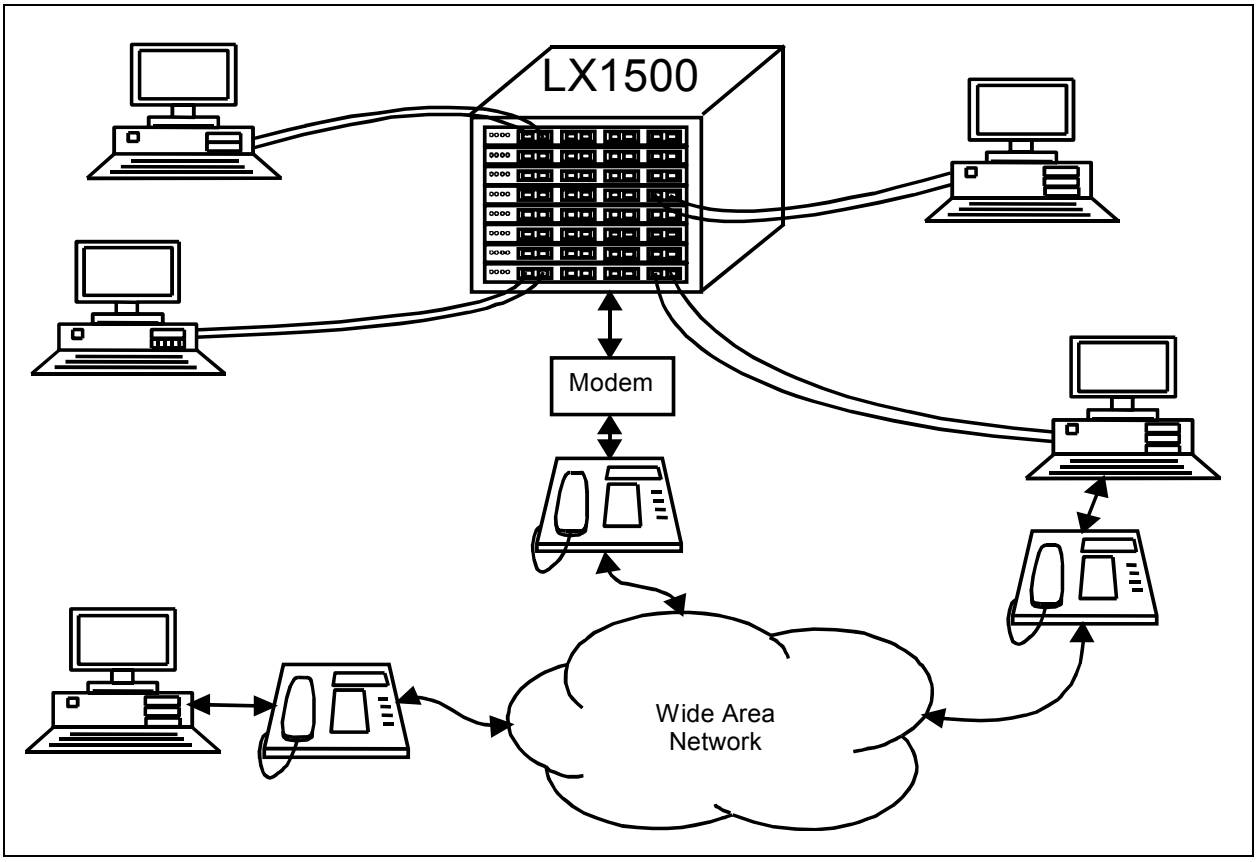

Figure 2-5 Remotely Controlled LX1500

2.5.3 Unattended Network Hub

The LX1500 configures itself to a predefined configuration upon power-on without any external intervention and is capable of isolating ports in the event of signal loss. These features enable reliable loop operation in the event of node failures, making the LX1500 ideal for applications where permanent connections are required and external intervention is not available in the case of an error.

2.5.4 Fibre Channel Arbitrated Loop Hub

Using the LX1500 as a Fibre Channel arbitrated loop hub 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 LX1500 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 new node can be added, without interrupting the loop operation, by issuing one out-of-band command.
- Different media interfaces can be mixed.

2.5.5 Getting More than 32 Ports

Multiple LX1500 units can be cascaded together for applications requiring more than 32 ports. Figure 2-6 shows six 32-port LX1500 units combined to form a nonblocking 64-port cross point switch. This setup requires a maximum of three passes to perform point-to-point and loop configurations, and five passes to achieve multicast configurations.

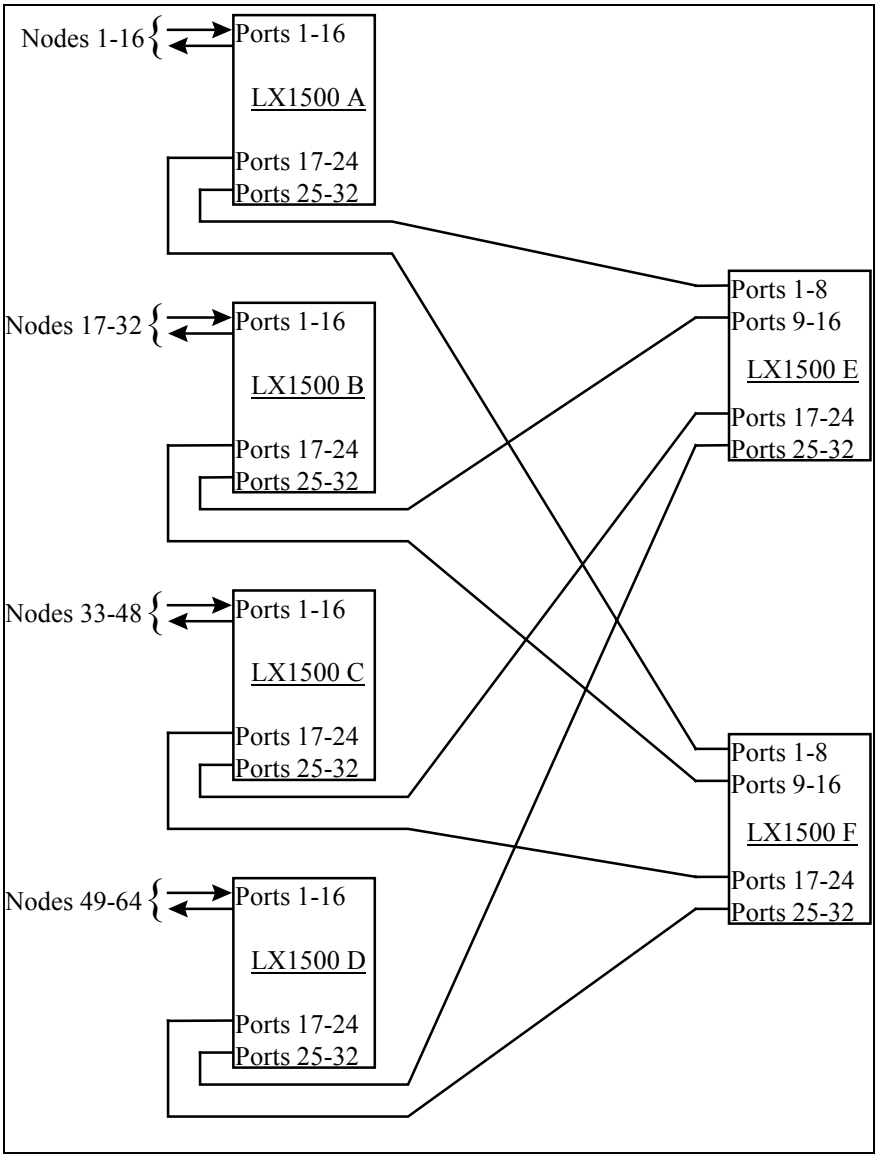

Figure 2-6 A 64-Port Crosspoint Switch Using Multiple LX1500 Units

A topology consisting of one large loop of more than 32 ports can be constructed very efficiently using the LX1500. Figure 2-7 show four LX1500 units cascaded to form a 124-port switch. This topology is useful for forming very large arbitrated loop topologies.

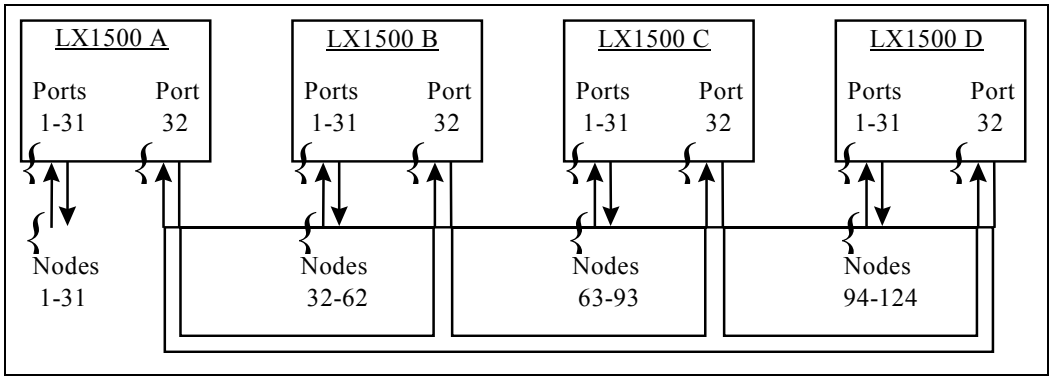

Figure 2-7 Loop Architecture with 124 Nodes Using Multiple LX1500 Units

3. INSTALLATION

3.1 Overview

The LX1500 and components can be shipped in a variety of configurations, including:

- Single LX1500 in rack-mountable enclosure.
- Dual LX1500 in rack-mountable enclosure.
- LX1500 base unit.
- Port cards shipped separately from the LX1500.

3.2 Installation of Rack-mountable LX1500

3.2.1 Mount the LX1500

The rack-mountable LX1500 may be bolted into a standard 19-inch equipment rack or placed on a tabletop. Cooling air enters the enclosure through the rear and is exhausted through the front; make sure that the air flow is not blocked.

3.2.2 Connect the RS-232 Cable(s)

Each LX1500 unit requires its own connection to a controlling terminal, modem, or computer port. The terminal must be a VT-100 compatible terminal or a computer emulating one. Systran does not provide cables for making these connections. For details about cable requirements, refer to Appendix C.

3.2.3 Connect Power to the LX1500(s)

Rack-mountable enclosures have two power supplies, regardless of whether one or two LX1500 units are installed in the enclosure. Make sure the voltage selection switch on both power supplies is set to 115 or 230 volts as appropriate for your local power. Attach the supplied line cords to the power supplies and plug the cords into an electrical outlet. In a single-LX1500 enclosure, only the power supply nearer the center of the rear panel needs a cord.

3.2.4 Apply Power

Turn on each LX1500 with its associated power switch on the front panel. You should hear the internal fans start up and see the Heartbeat indicators flashing about once per second.

3.2.5 Installation of LX1500 Base Unit

The LX1500 base unit does not come with an enclosure, power supply, or external controls. The user must install the unit in an enclosure with a power supply and connect external signals to the unit. The base unit is designed to be mountable in any disk drive bay that will hold four “half-height” 5.25-inch disk drives.

Figure 3-1 shows a drawing of the rear panel of the LX1500 base unit. The panel has the following features:

- **RS-232 Connector**: an RJ-45 jack for connecting to a terminal, modem, or computer.
- **Fail LED**: A yellow indicator that lights when the embedded controller fails its self-test.
- **Heartbeat LED**: A green indicator that flashes about once per second when the controller is operating properly.
- **External Heartbeat Connector**: A two-pin connector to which an external heartbeat LED may optionally be attached.
- **External Reset Connector**: A two-pin connector to which an external switch may optionally be attached. Connecting the two pins momentarily will reset the controller.
- **Power Cables**: Power connectors for the unit.

The third two-pin connector between the Reset and External Heartbeat connectors is an unconnected spare.

3.2.6 Install LX1500 into Enclosure

CAUTION: Exercise care regarding the static environment. An anti-static mat connected to a wristband should be used when handling or installing LX1500. Failure to do this may cause permanent damage to the components.

Follow the steps below to unpack the LX1500:

1. Remove the LX1500 from the carton.
2. Visually inspect the LX1500. If the LX1500 was damaged in shipping, notify Systran Corporation or your supplier immediately.
3. If rails are required for the enclosure being used, install the rails on the LX1500.
4. Slide the LX1500 unit into the enclosure.
5. Use eight 6-32 screws to secure the LX1500 inside the enclosure.
6. In the unlikely event that you should need to return your LX1500, please keep the original shipping materials for this purpose.

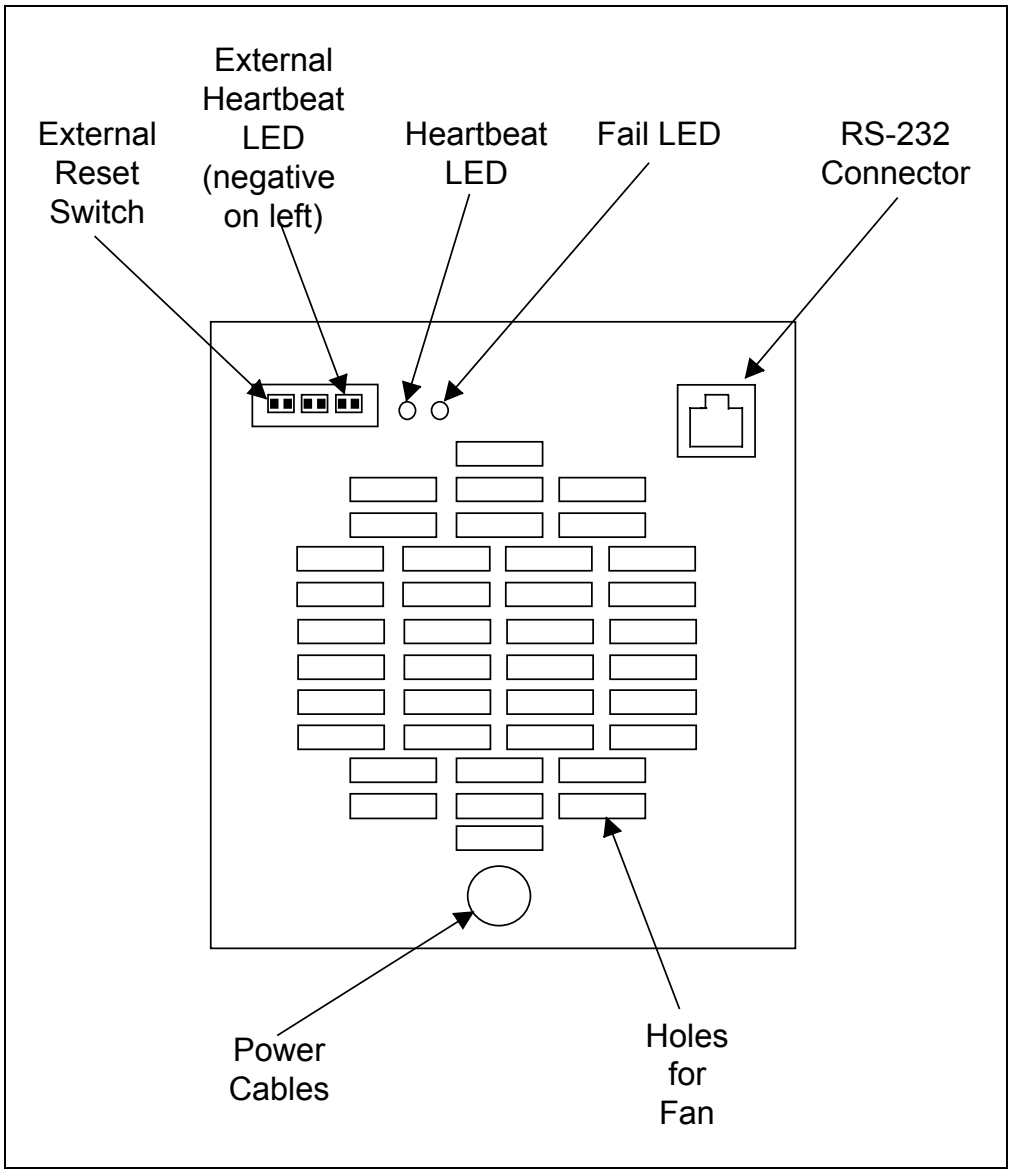

Figure 3-1 Back View of LX1500 Unit

3.2.7 Connect the RS-232 Cable

Each LX1500 unit requires a separate cable to a controlling VT-100 compatible terminal, a computer emulating such a terminal, or a modem. RS-232 cables are not provided with the LX1500. For cabling details, refer to Appendix C.

3.2.8 Connect the External Reset Line (Optional)

If desired, connect a momentary normally-open switch (not supplied) to the External Reset connector. The mate to the LX1500 connector is AMP part number 103956-1.

3.2.9 Connect the External Heartbeat LED (Optional)

If desired, connect an LED (not supplied) to the External Heartbeat connector. The mate to the LX1500 connector is AMP part number 103956-1.

The external LED must include current-limiting resistance and be connected as shown in Figure 3-2. Current through the LED should be 10 mA or less. If the two pins are swapped, the heartbeat LED will not function but the switch will not be damaged.

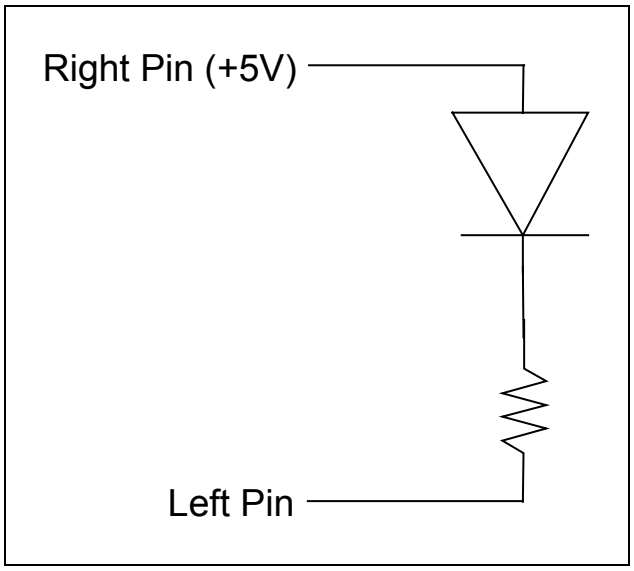

Figure 3-2 External Heartbeat LED Circuit

3.2.10 Connect Power to the LX1500

Power must be connected to the LX1500 using the power cables at the rear of the LX1500 case. A standard PC power supply or any other supply that can provide +5 volts and +12 volts at the required current may be used. (Refer to appendices A and B to calculate the required currents.) Power supply voltage must be accurate to within ±5%.

Special high-current connectors are used to bring +5 volts into the LX1500. Four matching connectors are provided loose with the LX1500 for attachment to the power supply (Methode part number 2300-202-216). +12 volts is supplied through a standard hard-disk style power connector.

These steps describe how to connect a typical PC power supply to the LX1500 base unit.

1. Disconnect all power from the power supply.
2. Locate a hard disk power connector attached to the power supply. It will be a four-pin connector with one (red) +5 volt wire, two (black) ground wires, and one (yellow or orange) +12 volt wire. Cut, but do not strip, the (red) +5 volt wire and the one adjacent (black) ground wire at the back of the connector. Do not cut the other ground wire or the (yellow or orange) +12 volt wire.
3. Connect the modified connector, with its remaining ground and +12 volt wire, to the matching connector on the LX1500 base unit.
4. Locate the four loose two-position power connectors that were packaged with the LX1500 base unit.

5. Lay the unstripped (red) +5 volt wire and (black) ground wire on the rear contacts of one of the two-position power connectors (see Figure 3-3.) Before proceeding further, verify that the colors of the wires will match up with the colors of the LX1500 power wires when the connectors are mated. Then close the cover of the connector down onto the wires with a pair of pliers.

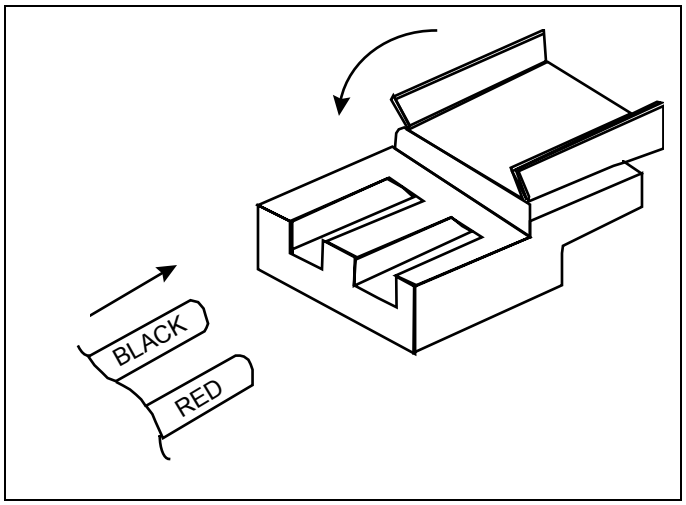

Figure 3-3 LX1500 Power Wires

6. Locate another hard-disk power connector attached to the power supply. Cut the (red) +5 volt wire and the adjacent (black) ground wire at the rear of the connector as in step 2. Attach a two-position power connector to the wires as described in step 5.
7. Repeat step 6 two more times to attach the remaining power connectors.
8. Connect the newly-installed power connectors to the matching connectors on the LX1500 base unit.
9. Double-check all five connectors to make sure that all the wires from the power supply are lined up through the connectors with matching wires from the LX1500.

CAUTION: Incorrectly wired connectors can short-circuit the power supply and may cause damage to the power supply and/or the LX1500!

10. Reconnect power to the power supply.

3.2.11 Apply Power

Turn on the power supply. You should hear the internal fan start up and see the Heartbeat indicator flashing about once per second. The yellow Fail LED should be off.

3.2.12 Installing a Port Card

If you need to install a port card, follow these instructions:

CAUTION: Exercise care regarding the static environment. An anti-static mat connected to a wristband should be used when handling or installing port card. Failure to do this may cause permanent damage to the components on the card.

Follow the steps below to unpack the card:

1. Put on the wristband attached to an anti-static mat.
2. Remove the card and anti-static bag from the carton.
3. Place the bag on the anti-static mat.
4. Open the anti-static bag and remove the card.
5. Visually inspect the board. If the card was damaged in shipping, notify Systran Corporation or your supplier immediately.
6. In the unlikely event that you should need to return your port card, please keep the original shipping materials for this purpose.
7. Power down the LX1500 unit.
8. Remove the LX1500 filler plate or port card that is to be replaced by the new port card.
9. Insert the port card into the desired slot.
10. Press the port card back until it is fully inserted into the LX1500.
11. Secure the new port card with two screws.
12. Power up the LX1500.

3.3 LX1500 Configuration

Chapter 5. describes how to configure the LX1500 using the RS-232 interface.

3.4 Troubleshooting

If the LX1500 does not boot correctly, double-check cable and power connections. If problems persist, call Technical Support at **(937) 252-5601**.

Please be prepared to supply the following information:

Power Supply Used: _____
Enclosure Used: _____
Port Card Types: _____
_____
_____
_____

3.5 Maintenance

Other than periodic cleaning, no routine maintenance is required for the LX1500.

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4. OPERATION

4.1 Structure of the LX1500

A fully-loaded LX1500 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 LX1500 full of optical port cards with the ports numbered.

SCRAMNet+ port cards have the ports rearranged somewhat for easier use with paired media, but the basic layout remains similar.

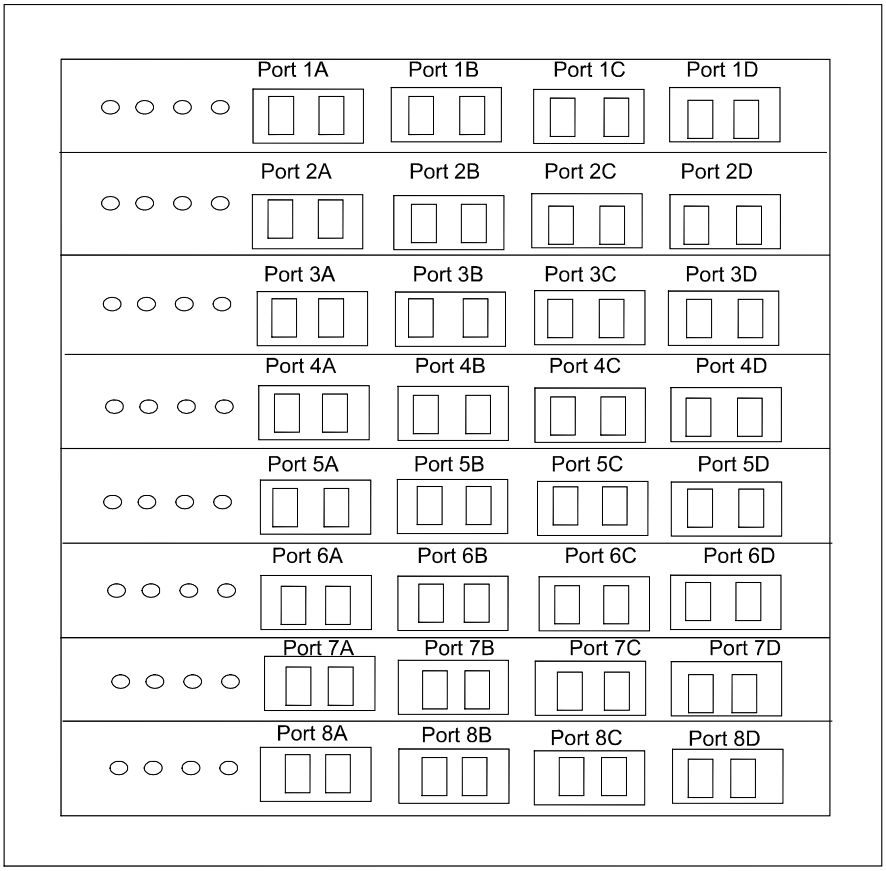

Figure 4-1 LX1500 Port Numbering

When in its rack-mountable enclosure, the LX1500 is rotated clockwise, as shown in Figure 2-1 and Figure 2-2, so the port cards are vertical and port card 1 is rightmost.

Figure 4-2 is a drawing of the LX1500 control panel on the rack-mountable enclosure. Each LX1500 has a separate control panel with RESET button, HEARTBEAT indicator, POWER switch, and SERIAL (RS-232) jack. For an enclosure with two LX1500 units, both power switches must be turned on to power both LX1500s.

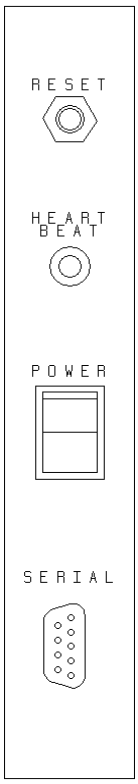

Figure 4-2 LX1500 Control Panel

4.2 Possible Connections

A port can be in one of two states, active or inactive. A port is active if its input port has a signal present. A port is inactive if its input port does not have a signal present.

An active port can be in one of six modes:

Wrap	Port's output is connect to its own input.
Loop	Port is on a loop (requires a loop ID).
Copy	Port's output is connected to a specified input port.
SCRAMNet Wrap	SCRAMNet port pair's outputs are connected to that port's own inputs.
SCRAMNet Loop	SCRAMNet port pair is on a SCRAMNet loop (requires a loop ID).
SCRAMNet Copy	SCRAMNet port pair's outputs are connected to a specified SCRAMNet input port.

An inactive port can be in one of four modes:

Wrap	Port's output is connected to its own input.
Copy	Port's output is connected to a specified input port.
SCRAMNet Wrap	SCRAMNet port pair's outputs are connected to that port's own inputs.
SCRAMNet Copy	SCRAMNet port pair's outputs are connected to a specified SCRAMNet input port.

Using the command line interface of the LX1500, the user can configure each port by specifying an active and inactive mode.

NOTE:

SCRAMNet Modes

SCRAMNet is Systran's proprietary, replicated shared-memory network. It provides a low-latency interface across many different computer busses. The LX1500 can be used to route SCRAMNet signals and provide fault isolation to a SCRAMNet network.

Each transmit and receive link of a SCRAMNet node requires a paired media cable (fiber or copper). This requirement for paired media is handled in the LX1500 by combining ports into *port pairs*, (A,B) and (C,D). This allows 16 SCRAMNet nodes to be connected using the LX1500.

LX1500 ports are configured into SCRAMNet modes using the **`S<PORT#>`** command (see section 5.3.2). When an LX1500 port is referenced with this command, it and the port paired with it are treated as a single unit. The combined port pair is considered active only if signals are present on both inputs and the pair's auxiliary connector also indicates that the port should be active.

4.2.1 Wrap Mode

A port in wrap mode has its input connected to its output. This mode is shown in Figure 4-3. In this configuration the node attached to the switch acts as it would with a loopback connector.

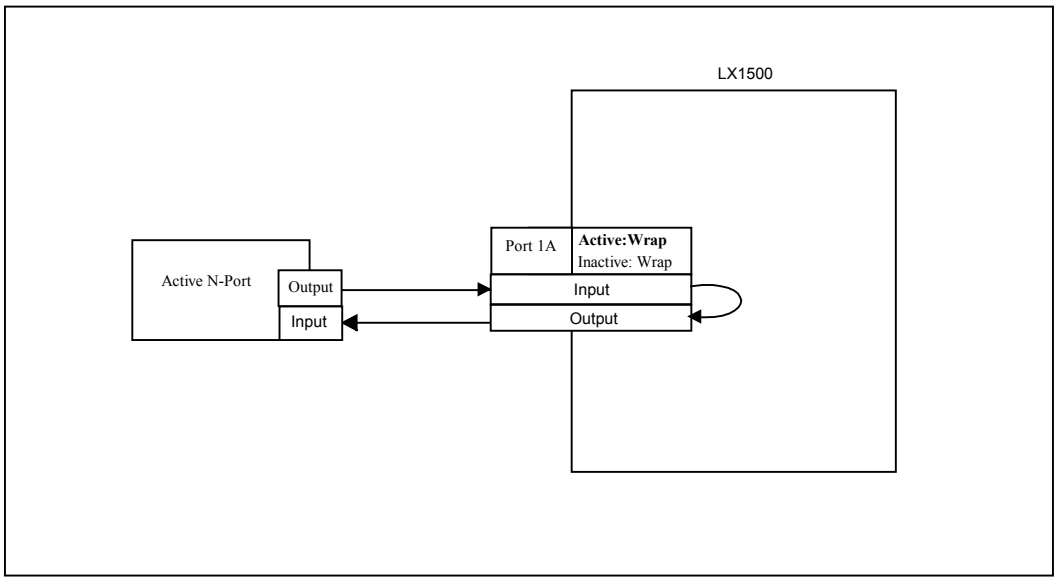

Figure 4-3 A Port in Wrap Mode

Wrap mode can be used to isolate a port from all other ports. Even though a port that is in wrap mode is considered to be isolated from the system, the input to this port can be copied to another port.

4.2.2 Loop Mode

A loop port must be assigned a loop number. The port will be configured in a loop with all other active ports of the same loop number. A loop number is any number between 0 and 31. Figure 4-4 shows a sample configuration. In this configuration, ports 1A, 2A, and 3A have loop number 1, and ports 4A and 5A have loop number 0.

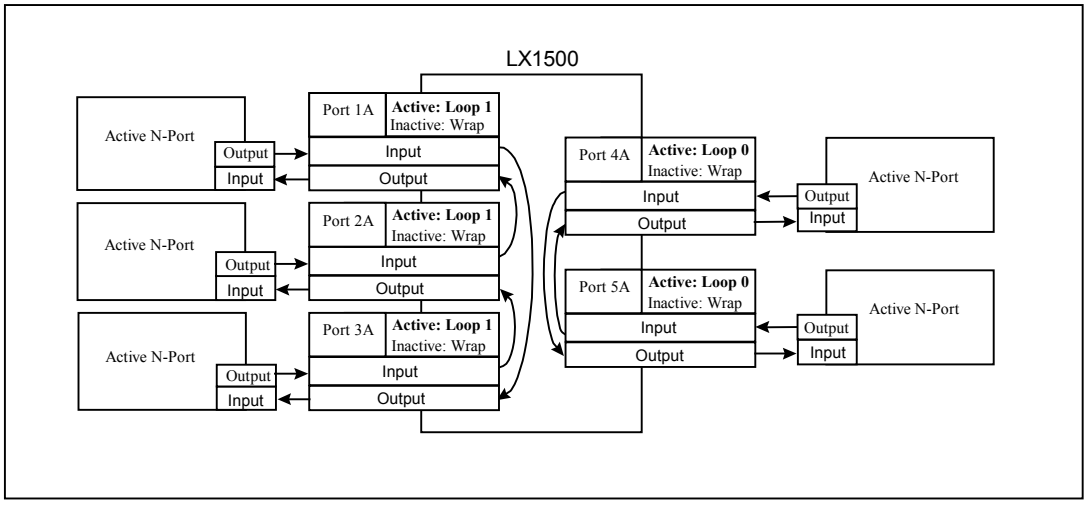

Figure 4-4 Active Loop Ports

When a loop port changes from active to inactive, the configuration of this port is changed to that specified for its inactive state. This configuration can be wrap or copy mode. This feature provides loop ports with fault isolation. Fault isolation allows all other ports on the loop to continue communicating after an error occurs. Figure 4-5 shows a port whose input signal is not being detected.

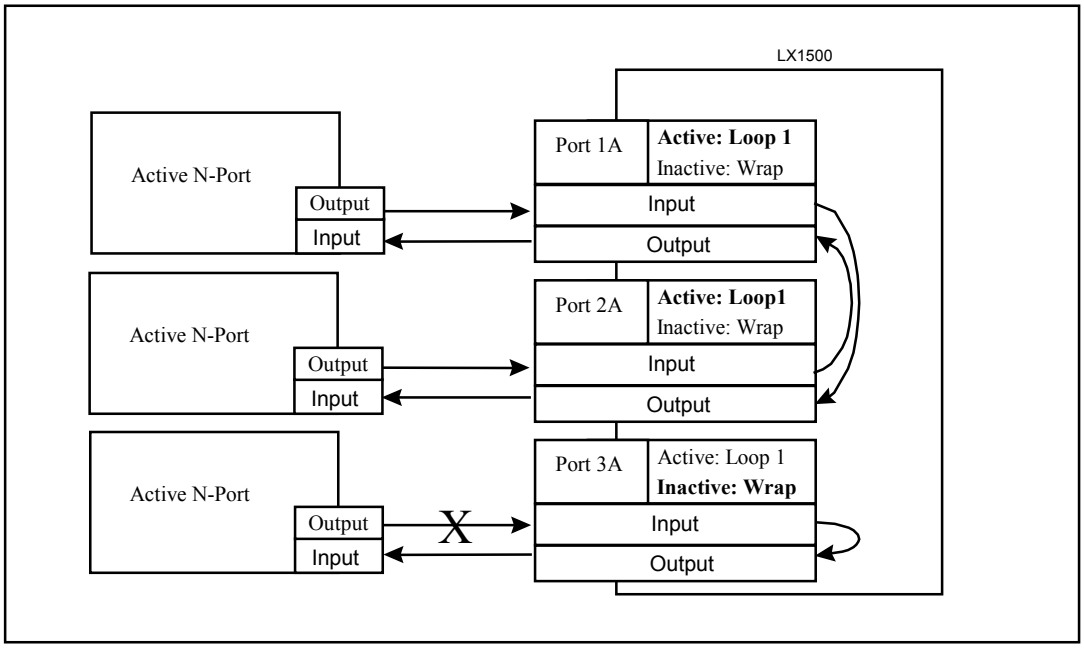

Figure 4-5 A Loop With One Inactive Member

When the port's signal returns, it will be reconnected in the loop.

4.2.3 Copy Mode

A port that is configured as a copy is assigned an input port to copy to its output port. Figure 4-6 shows port 4A configured as a copy of port 1A and port 5A configured as a copy of port 4A.

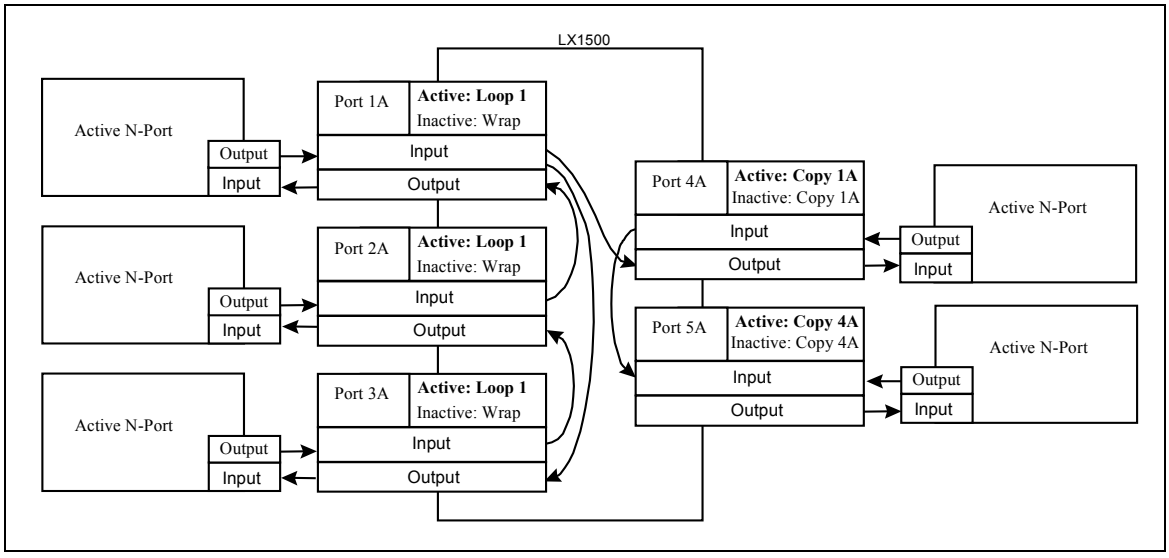

Figure 4-6 Ports Configured as Copies

4.2.4 SCRAMNet Wrap Mode

A port pair in SCRAMNet Wrap mode has the output of each port of the pair wrapped to that port's own input. This is logically identical to each of the two ports being individually put in wrap mode. Figure 4-7 shows an LX1500 port pair (1A and 1B) connected to a SCRAMNet node and configured as a SCRAMNet wrap.

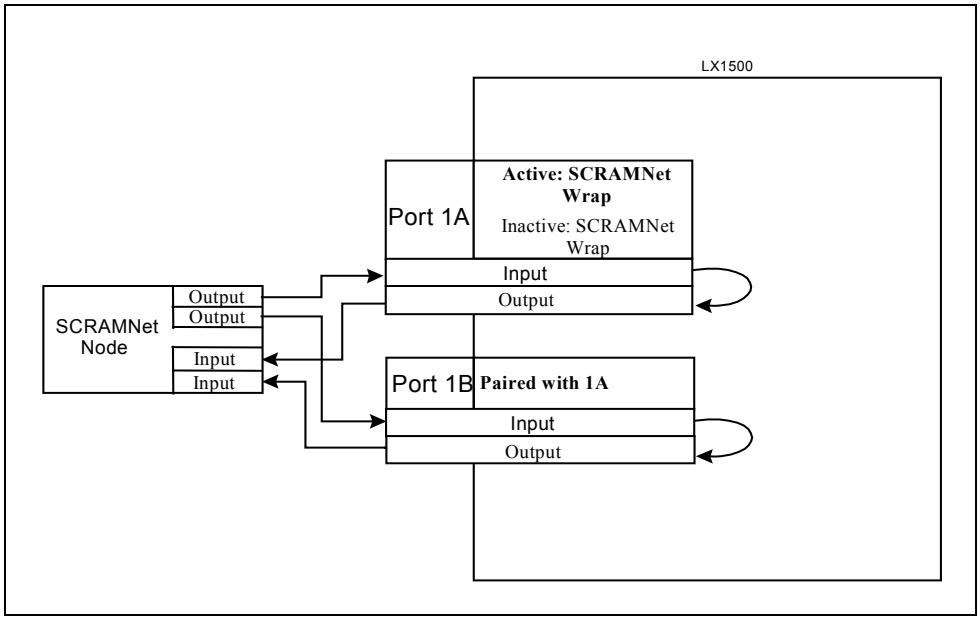

Figure 4-7 Port Pair in SCRAMNet Wrap Mode

4.2.5 SCRAMNet Loop Mode

A port pair that is configured in a SCRAMNet loop is assigned a SCRAMNet loop number in the range 0 - 31. When the pair is active, it is connected in a loop with all other active pairs of the same SCRAMNet loop number. Figure 4-8 shows ports pairs (1A, 1B), (1C, 1D), and (4A, 4B) configured in a SCRAMNet loop.

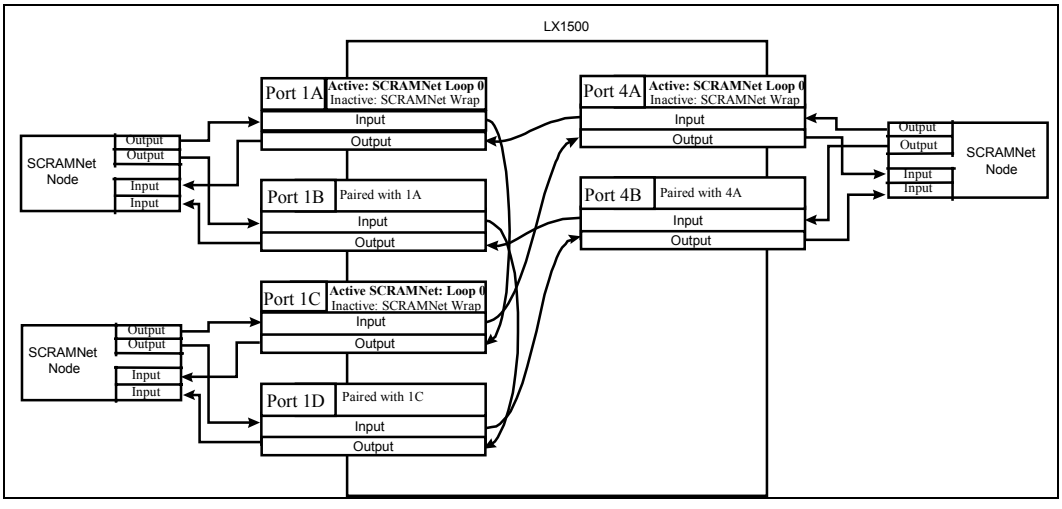

Figure 4-8 SCRAMNet Loop

4.2.6 SCRAMNet Copy Mode

A port pair that is configured in a SCRAMNet copy is assigned an input pair to copy to its outputs. In Figure 4-9 pair (4A, 4B) is configured as a copy of pair (1A, 1B).

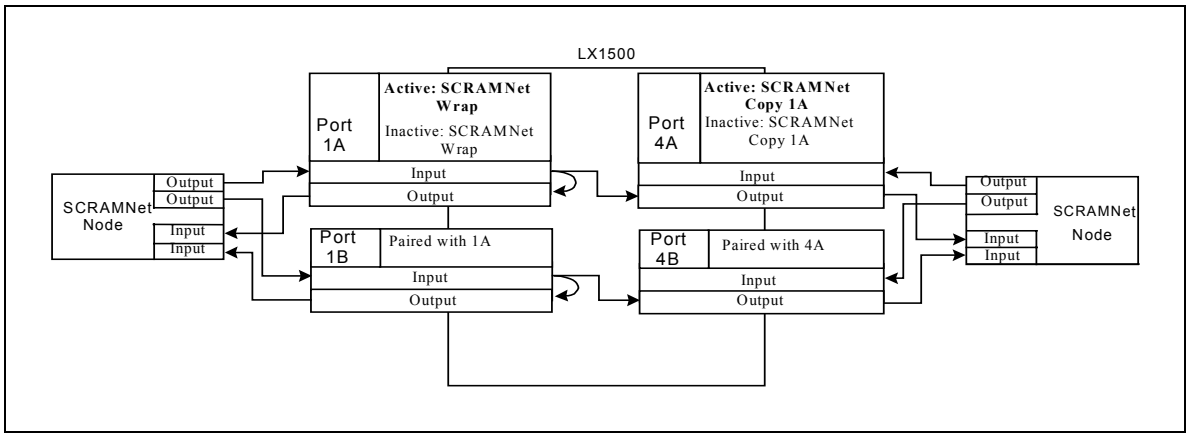

Figure 4-9 SCRAMNet Copy

4.3 Current and Saved Configurations

The LX1500 has four saved configurations and one current configuration. The current configuration is the current state of the switch. Both the saved and current configurations are stored in nonvolatile memory. On a power-up or reset, the LX1500 will start in the current configuration.

The current configuration can be saved into any of the four saved configuration slots. Saved configurations can also be directly edited using a special command subset, which is available when the LX1500 is in the Edit-Saved-Configuration Mode (see section 5.4). In this mode, the hub continues to function; fault isolation and the periodic display of port status information continue as commanded by the current configuration. While in the Edit-Saved-Configuration Mode, all configuration commands act on the saved configuration and do not affect the current configuration. A different command prompt is used to indicate that a saved configuration is being edited.

4.4 Standard Configurations

The LX1500 has four pre-programmed standard configurations available:

Wrap (W)	All ports are in wrap mode.
One Loop (OL)	All ports are configured to be active on loop number 0.
Permanent Loop (PL)	Each port is configured as a copy and all ports are connected in a permanent loop containing all ports. No fault isolation is used.
SCRAMNet Loop (SL)	All ports are configured to be in SCRAMNet loop 0.

The standard configurations are available at any time. They can be used from the normal command line interface or while editing saved configurations.

4.5 Multiple LX1500 Configuration

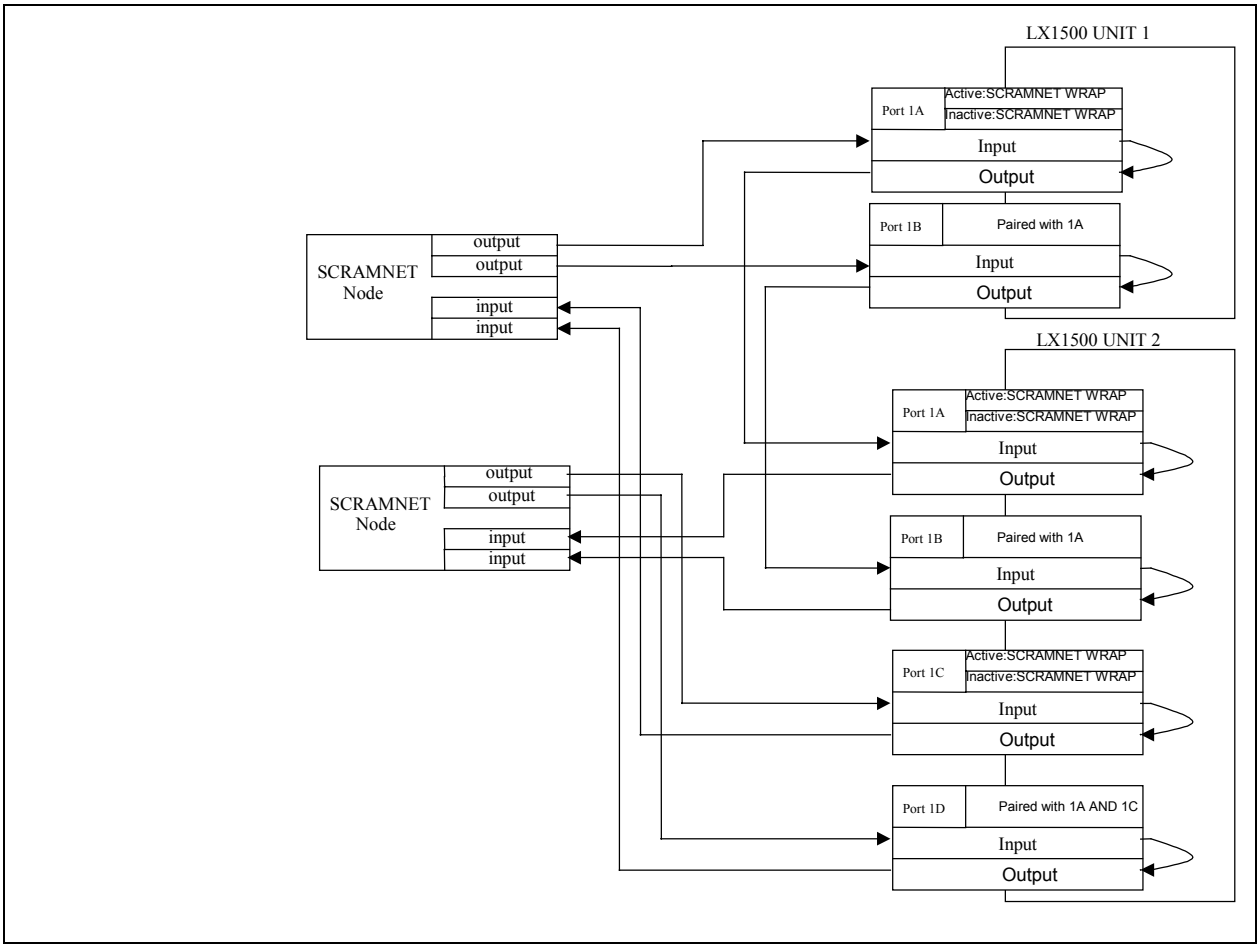

Figure 4-10 Two LX1500s in Configured in Wrap Mode

Figure 4-10 shows how to configure two LX1500 units with SCRAMNET port cards connected to SCRAMNET NIC cards. To simplify this example, we only use two SCRAMNET port cards and two SCRAMNET NIC cards. To configure the connection:

- Configure both cards in SCRAMNET wrap mode (Refer to section 4.2.4).
- Insert SCRAMNET NIC cards on the loop and ensure the transmitters and receivers are enabled.
- Verify the signals detect LEDs on both the SCRAMNET NIC and SCRAMNET port cards are lit.

Below is an example command for configuring two LX1500s in wrap mode:

```
S1A W
```

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5. USER CONTROL INTERFACE

5.1 Overview

The LX1500 can be configured by using a command line interface. To use the command line interface, a VT-100 compliant terminal (or equivalent) must be connected to the LX1500's serial port using an RS-232 cable.

5.1.1 Connecting a Terminal

A VT-100 compatible terminal (or a computer emulating one) can be connected to the LX1500 using an RS-232 cable. Bit rates of 9600, 19200, 38400, and 57600 bps are supported.

It is not necessary to set the LX1500 bit rate. The LX1500 can autobaud with the terminal. This allows the user to connect a terminal to the LX1500, press a few keys, and have LX1500 automatically detect the bit rate. Follow the steps below to connect a VT-100 terminal to the LX1500:

1. Connect the terminal to the LX1500 using an RS-232 cable. See Appendix C for connector pin definitions.
2. Power on the terminal.
3. If the LX1500 is off, power it on. If the LX1500 is on, rebooting is not required.
4. Press a character key a few times. This enables the LX1500 to detect that a new baud rate is required.
5. Press 

a few times. This enables the LX1500 to detect the new baud rate.
6. The LX1500 command line prompt should appear. This shows that the autobaud worked as expected.

5.1.2 Connecting a Modem

To control the LX1500 remotely, connect a modem to the RS-232 port. The modem should be configured to use neither hardware nor software flow control on the RS-232 link.

At power up or reset, the LX1500 sends the sequence, "ATQ1V0E0S0=1". For modems compatible with the Hayes AT command set, this sets the modem to answer the phone line after one ring.

Systran has tested this configuration with a Hayes compatible modem operating at 14.4 and 28.8 kbps.

5.2 Notation

To simplify the learning curve for the command line interface commands, a consistent notation is used for all help messages and LX1500 documentation.

[]	Indicates optional parameters.
<Port#>	Indicates that a port number is required. Valid port numbers are those shown in Figure 4-1.
<Loop#>	Indicates that a loop id number is required. Valid loop id numbers are the numbers 0 to 31.
<CFG#>	Indicates a configuration number is required. Valid configuration numbers are 0 to 3.

5.3 Normal Command Line Interface

All of the available LX1500 commands described in subsequent sections have three common characteristics. The commands are:

- composed of ASCII characters.
- no more than 60 characters in length.
- terminated by a carriage return.

5.3.1 System Commands

5.3.1.1 H (Help)

COMMAND PROTOTYPE:

H [command name]

DESCRIPTION:

Display help for the specified command or a general help message if a valid command does not appear as a parameter.

PARAMETERS:

command name	Specifies the name of a command to display a help message for.

5.3.1.2 T (Time)

COMMAND PROTOTYPE:

T [MM/DD/YY] [HH:MM:SS]

DESCRIPTION:

Set the current date and time.

PARAMETERS:

MM/DD/YY	The current The "A" may be dropped from AL, AC, or AW date. Fields are separated by the backslash " / " character. Three fields must be present and in the order of month, day, year.
HH:MM:SS	The current time. Fields are separated by the colon " : " character. The time is in 24 hour format. The fields must be in hours, minutes, and seconds.

NOTE: Seconds are optional for time.

To set both the time and date, use the following command:

```
T 12/31/99 23:59
```

To set just the time, use the following command:

```
T 12:00:00
```

To set just the date, use the following command:

```
T 4/1/2001
```

5.3.1.3 V (Version)

COMMAND PROTOTYPE:

V

DESCRIPTION:

Displays the version of the LX1500's Controller Software.

PARAMETERS:

None.

5.3.2 Configuration Commands

5.3.2.1 P (Port)

COMMAND PROTOTYPE:

P<Port#> [AL<Loop#>] [AC<Port#>] [AW] [IC<Port#>] [IW]

DESCRIPTION:

Modify the configuration of a port.

PARAMETERS:

Port#	Indicates that a port number is required. Valid port numbers are those shown in Figure 4-1.
AL	Active Loop: Add the port to the specified loop when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
Loop#	Indicates that a loop id number is required. Valid loop id numbers are the numbers 0 to 31.
AC	Active Copy: Copy the specified port when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AC, Inactive Copy of the same port number is assumed.
AW	Active Wrap: Wrap the port when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
IC	Inactive Copy: Copy the specified port when inactive.
IW	Inactive Wrap: Wrap the port when inactive.

NOTE: No more than one active (AL, AC, or AW) and one inactive (IC or IW) parameter may be supplied.

To configure port 5A into loop 4 when active and wrap when inactive, use the following command:

```
P5A AL4
```

5.3.2.2 S (SCRAMNet Port)

COMMAND PROTOTYPE:

S<Port#> [AL<Loop#>] [AC<Port#>] [AW] [IC<Port#>] [IW]

DESCRIPTION:

Modify the configuration of a SCRAMNet port pair.

PARAMETERS:

Port#	Indicates that a port number is required. Valid port numbers are those shown in Figure 4-1.
AL	Active Loop: Add the pair to the specified loop when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
Loop#	Indicates that a loop id number is required. Valid loop id numbers are the numbers 0 to 31.
AC	Active Copy: Copy the specified port pair when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AC, Inactive Copy of the same port number is assumed.
AW	Active Wrap: Wrap the port pair when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
IC	Inactive Copy: Copy the specified port pair when inactive.
IW	Inactive Wrap: Wrap the port pair when inactive.

NOTE: This command acts on pairs of ports. Ports are grouped into pairs (AB) and (CD). Referring to either port of a pair affects both ports.

NOTE: No more than one active (AL, AC, or AW) and one inactive (IC or IW) parameter may be supplied.

To configure port 5A and 5B into SCRAMNet loop 4 when active, use the following command:

```
S5A AL4
```

5.3.2.3 L (Loop)

COMMAND PROTOTYPE:

L <Loop#>

DESCRIPTION:

Display all ports on the specified loop. This works for both SCRAMNet loops and normal loops.

PARAMETERS:

Loop#	A loop id number is required. Valid loop id numbers are 0 to 31.

To show the members of loop, use the following command:

```
L 4
```

5.3.2.4 MS (Modify Saved Configuration)

COMMAND PROTOTYPE:

MS <CFG#>

DESCRIPTION:

Modify a saved configuration.
(See section 5.4, Edit-Saved-Configuration Mode.)

PARAMETERS:

CFG#	A configuration number is required. Valid configuration numbers are 0 to 3.

NOTE: The configuration can be recalled using the **R** command. See section 4.3 and section 5.4 for a description of editing a saved configuration.

5.3.2.5 R (Restore Saved Configuration)

COMMAND PROTOTYPE:

R <CFG#>

DESCRIPTION:

Restore a saved configuration.

PARAMETERS:

CFG#	A configuration number is required. Valid configuration numbers are 0 to 3.

NOTE: The saved configurations can be changed using the **MS** and **SA** commands.

To restore saved configuration number three, use the following command:

```
R 3
```

5.3.2.6 SA (Save Current Configuration)

COMMAND PROTOTYPE:

SA <CFG#>

DESCRIPTION:

Save the current configuration as a saved configuration.

PARAMETERS:

CFG#	A configuration number is required. Valid configuration numbers are 0 to 3.

To save the current configuration as configuration number two, use the following command:

```
SA 3
```

5.3.2.7 SC (Standard Configuration)

COMMAND PROTOTYPE:

SC [OL] [W] [PL] [SL]

DESCRIPTION:

Use a standard configuration.

PARAMETERS:

OL	One Loop: Configure all ports on the switch to be AL 0 and IW.
W	Wrap: Configure all ports in the wrap mode.
PL	Permanent Loop: Configure all ports in a permanent loop. Each port will be set up as a copy of the port next port.
SL	SCRAMNet Loop: Configure all ports to be in SCRAMNet loop 0.

NOTE: At least one parameter is required.

To set the LX1500 to use the standard configuration "wrap mode," use the following command:

```
SC W
```

5.3.3 Display Options

The LX1500's display is intended for a terminal of 80 columns and 24 rows. The screen can be divided into two sections. If the periodic display of status information is enabled, the bottom 10 rows are reserved for the status. The portion of the screen that is not used by the status display, called the scrollable region, is used by the command line interface.

5.3.3.1 BE (Beep)

COMMAND PROTOTYPE:

BE [OFF] [ON]

DESCRIPTION:

Set up the beep to notify the user of a port state change.

PARAMETERS:

OFF	Disables the notification beep.
ON	Enables the notification beep.

NOTE: For the notification beep to be given, the status window must be on. If no parameter is specified, the notification beep is toggled.

To set the LX1500 to beep to notify the user of a port state change, use the following command:

```
BE ON
```

5.3.3.2 DS (Display Status)

COMMAND PROTOTYPE:

DS [OFF] [ON]

DESCRIPTION:

Set up the display of port status changes.

PARAMETERS:

OFF	Disables the display of port status change.
ON	Enables the display of port status change.

NOTE: If no parameter is specified and the messages are on, messages will be disabled. Messages will be enabled if no parameter is specified and the message display is off.

To set the LX1500 to display the status of a port state change, use the following command:

```
DS ON
```

5.3.3.3 DW (Display Window)

COMMAND PROTOTYPE:

DW [OFF] [ON] [1] [2] [3] [4] [P<Period#>]

DESCRIPTION:

Set up the display window for port status information

PARAMETERS:

OFF	Disables the use of the display window.
ON	Enables the use of the display window.
1	Displays only the most important information.
2	Displays an intermediate amount of information.
3	Displays an intermediate amount of information.
4	Displays all status information (very detailed).
P	Sets up the periodic display of port status information.
Period#	The number of seconds to wait then redisplay the status. Possible values are in the range of 10 to 300. The default value is 60.

NOTE: If no parameter is specified and the display window is on, the display window will be disabled. The display window will be enabled if no parameter is specified and the display window is off. The status window uses the bottom 10 lines of the terminal display.

To set the LX1500 to use the display window to display only the most important port information and redisplay that information every 30 seconds, use the following command:

```
DW ON 1 P30
```

5.3.3.4 ST (Status)

COMMAND PROTOTYPE:

ST

DESCRIPTION:

Display port status information.

PARAMETERS:

None.

NOTE: If the status window is on, the window will be updated. Otherwise, the port status information will be displayed in the scrollable section of the screen.

5.4 Edit-Saved-Configuration Mode Commands

The edit saved configuration mode commands are available when the LX1500 is in edit-saved-configuration mode. This state is entered by issuing the **MS** command. While in this state, port commands operate on the selected saved-configuration and not the current configuration. If the status display window is on, it will show the status of the current configuration. To exit the edit-saved-configuration mode, use the **EX** command.

The following commands work the same way in this mode as in the Normal Command mode and the saved configuration is not affected:

- **H** (Help) (see section 5.3.1.1)
- **T** (Time set) (see section 5.3.1.2)
- **V** (Version) (see section 5.3.1.3)
- **BE** (configure BEep) (see section 5.3.3.1)
- **DS** (Display port Status) (see section 5.3.3.2)
- **DW** (set up Display Window) (see section 5.3.3.3)

5.4.1 System Commands

5.4.1.1 EX (Exit)

COMMAND PROTOTYPE:

EX

DESCRIPTION:

Exit the editing of a saved configuration.

PARAMETERS:

None.

5.4.2 Configuration Commands

5.4.2.1 P (Port)

COMMAND PROTOTYPE:

P<Port#> [AL<Loop#>] [AC<Port#>] [AW] [IC<Port#>] [IW]

DESCRIPTION:

Modify the configuration of a port.

PARAMETERS:

Port#	Indicates that a port number is required. Valid port numbers are those shown in Figure 4-1.
AL	Active Loop: Add the port to the specified loop when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
Loop#	Indicates that a loop id number is required. Valid loop id numbers are the numbers 0 to 31.
AC	Active Copy: Copy the specified port when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AC, Inactive Copy of the same port number is assumed.
AW	Active Wrap: Wrap the port when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
IC	Inactive Copy: Copy the specified port when inactive.
IW	Inactive Wrap: Wrap the port when inactive.

NOTE: No more than one active (AL, AC, or AW) and one inactive (IC or IW) parameter may be supplied.

To configure port 5A into loop 4 when active and wrap when inactive, use the following command:

```
P5A AL4
```

5.4.2.2 S (SCRAMNet Port)

COMMAND PROTOTYPE:

S<Port#> [AL<Loop#>] [AC<Port#>] [AW] [IC<Port#>] [IW]

DESCRIPTION:

Modify the configuration of a SCRAMNet port pair.

PARAMETERS:

Port#	Indicates that a port number is required. Valid port numbers are those shown in Figure 4-1.
AL	Active Loop: Add the pair to the specified loop when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
Loop#	Indicates that a loop id number is required. Valid loop id numbers are the numbers 0 to 31.
AC	Active Copy: Copy the specified port pair when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AC, Inactive Copy of the same port number is assumed.
AW	Active Wrap: Wrap the port pair when active. The "A" may be dropped from AL, AC, or AW. If no inactive parameter is supplied with AL or AW, Inactive Wrap is assumed.
IC	Inactive Copy: Copy the specified port pair when inactive.
IW	Inactive Wrap: Wrap the port pair when inactive.

NOTE: This command acts on pairs of ports. Ports are grouped into pairs (AB) and (CD). Referring to either port of a pair affects both ports.

NOTE: No more than one active (AL, AC, or AW) and one inactive (IC or IW) parameter may be supplied.

To configure port 5A and 5B into SCRAMNet loop 4 when active, use the following command:

```
S5A AL4
```

5.4.2.3 SC (Standard Configuration)

COMMAND PROTOTYPE:

SC [OL] [W] [PL] [SL]

DESCRIPTION:

Use a standard configuration for the saved configuration.

PARAMETERS:

OL	One Loop: Configure all ports on the switch to be AL 0 and IW.
W	Wrap: Configure all ports in the wrap mode.
PL	Permanent Loop: Configure all ports in a permanent loop. Each port will be set up as a copy of the port next port.
SL	SCRAMNet Loop: Configure all ports to be in SCRAMNet loop 0.

NOTE: At least one parameter is required.

To set the LX1500 to use the standard configuration "wrap mode," use the following command:

```
SC W
```

5.4.3 Display Options

5.4.3.1 ST (Status)

COMMAND PROTOTYPE:

ST

DESCRIPTION:

Display the status of the saved configuration that is being edited.

PARAMETERS:

None.

5.5 Examples of Commands

When the LX1500 is first booted, the user must perform the following steps:

1. Set the date and time
2. Configure the current configuration to the desired setup
3. Configure the display and alarms to the desired setup
4. Enter up to four saved configurations

The following sections contain examples of performing each task.

5.5.1 Setting the Date and Time

The LX1500 contains a real-time clock that the user must set to the current time and date. This can be done with the **T** command. The following command sets the date to December 31, 1999 and the time to 11:59 P.M.

```
T 12/31/1999 23:59
```

Notice that the date fields are separated by the backslash " / " character and the time fields are separated by the colon " : " character. In the time entry, seconds are optional, but the time must be in 24 hour format.

Only the last two digits of the year are used. Issuing the following command also sets the date to December 31, 1999.

```
T 12/31/99
```

5.5.2 Changing Port Configurations

Figure 5-1 shows a sample hub configuration. In this configuration, the ports have the following configuration settings:

- Ports 1A, 1B, 1C, and 1D are configured as active on loop 1.
- Port 2A is a copy of port 1A.
- Port 2B is active wrap and inactive copy of port 2D.
- Port 2C copies port 2D when active and port 2B when inactive.
- Port 2D is in wrap mode.

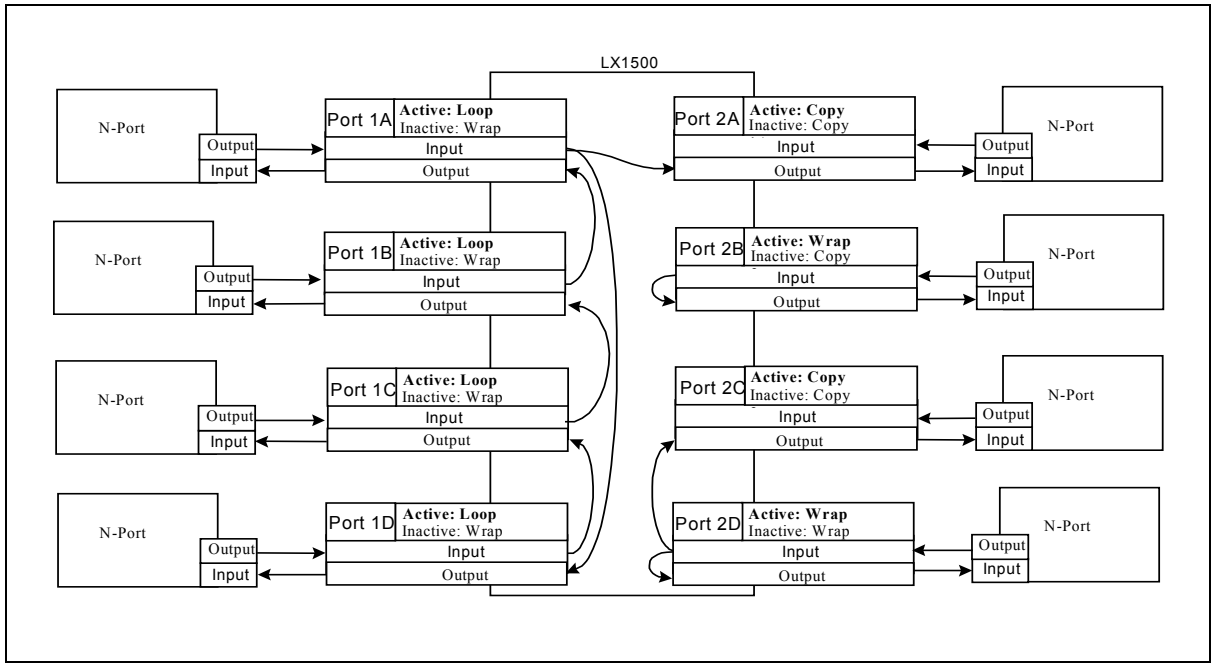

Figure 5-1 Sample Switch Configuration

To achieve this configuration the following commands must be issued:

```
P1A AL1          {setup port 1A as active on loop 1}
P1B AL1          {setup port 1B as active on loop 1}
P1C AL1
P1D AL1
P2A C1A          {setup port 2A as a copy of port 1A}
P2B AW IC2D
P2C AC2D IC2B
P2D W            {setup port 2D in wrap mode}
```

The hub's configuration contained four ports in active loop mode and two with copy inactive fields defined. This means that the hub may rearrange connections if a signal is lost. Figure 5-2 shows the configuration of the hub if ports 1A, 1D, 2B and 2C lose their signals.

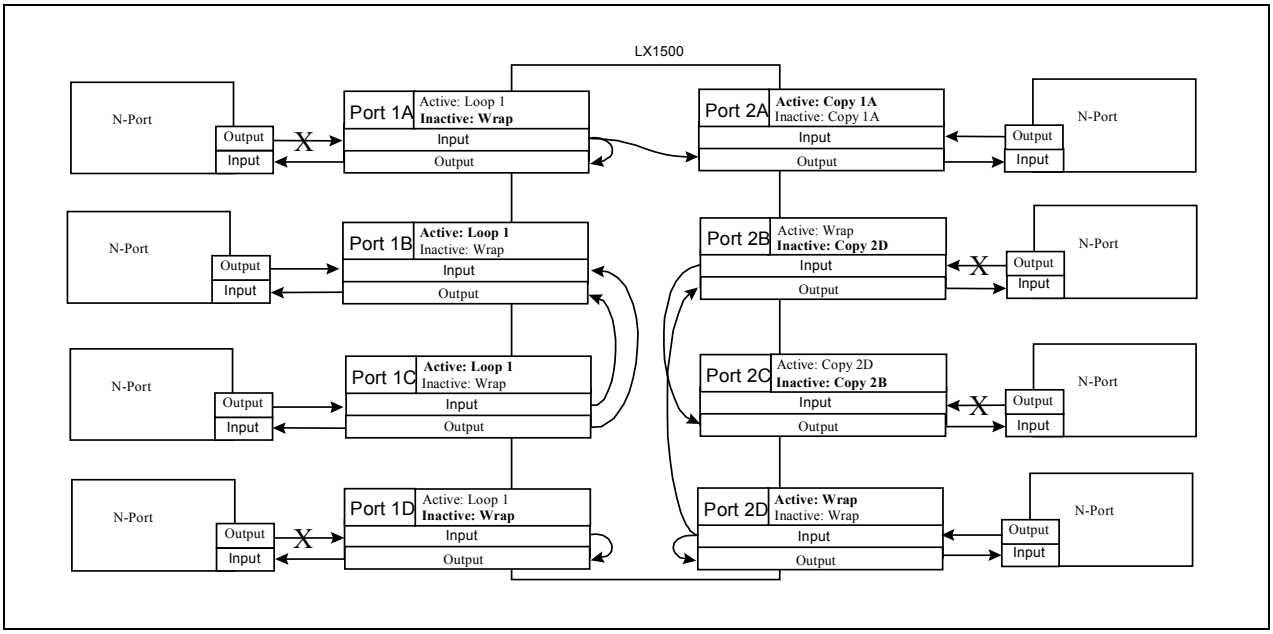

Figure 5-2 Switch After Faults

The LX1500 recognizes the signal loss on ports 1A, 1D, 2B, and 2C. Ports 1A and 1D are removed from loop number 1 and connected to the input ports specified by their inactive field, port 2B is changed to a copy of port 2D, and port 2C is changed to a copy of port 2B. Also notice that the copy of the input to port 1A that is sent to port 2A remains in effect. When the signals return on ports 1A and 1D, they will reenter loop 1. When a signal returns to port 2B or 2C, the port will return to its specified active state.

A port can be removed from a connection by placing the port in a new configuration. Since it is possible to configure a port in wrap mode, a port can be isolated from all other ports. The following commands remove the connections of ports 1A and 2A and attach port 2B into loop 1.

```
P1A W       {remove port 1A from loop 1}
P2A W       {remove port 2A from being a copy of port 1A}
P2B AL1     {reconfigure port 2B as a component of loop 1}
```

Figure 5-3 shows how the LX1500 will be configured after these commands are executed. Note that ports 1A and 2A are in wrap mode and port 2B is connected to loop 1.

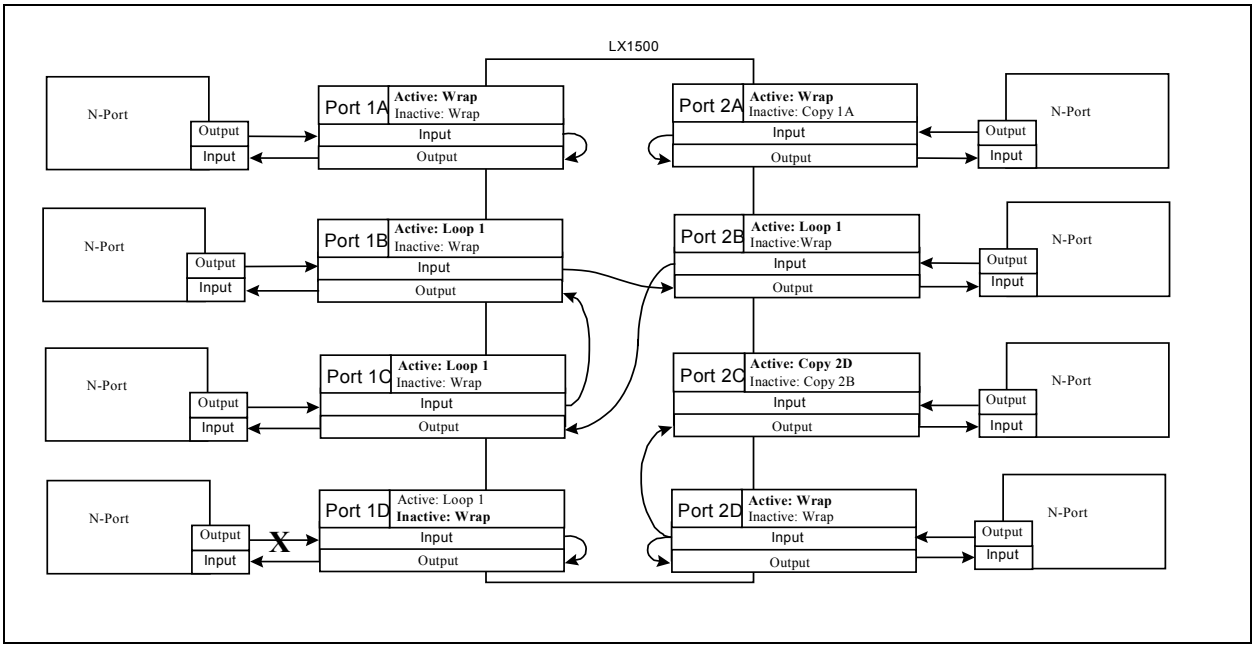

Figure 5-3 Reconfiguration of the Switch

Using the **ST** command, it is possible to list the current switch configuration. By issuing the **ST** command as shown below:

```
nts>>st
```

The configuration shown in Figure 5-3 would produce:

```
1A<1A    Wrap   00 1B<1C AL01IW   00 1C<2B AL01IW   00 1D<1D AL01IW   00
2A<2A    Wrap   00 2B<1B AL01IW   00 2C<2D AC2DIC2B 00 2D<2D   Wrap   00
3A<3A    Wrap   01 3B<3B   Wrap   01 3C<3C   Wrap   01 3D<3D   Wrap   01
4A<4A    Wrap   01 4B<4B   Wrap   01 4C<4C   Wrap   01 4D<4D   Wrap   01
5A<5A    Wrap   01 5B<5B   Wrap   01 5C<5C   Wrap   01 5D<5D   Wrap   01
6A<6A    Wrap   01 6B<6B   Wrap   01 6C<6C   Wrap   01 6D<6D   Wrap   01
7A<7A    Wrap   01 7B<7B   Wrap   01 7C<7C   Wrap   01 7D<7D   Wrap   01
8A<8A    Wrap   01 8B<8B   Wrap   01 8C<8C   Wrap   01 8D<8D   Wrap   01
nts>>
```

The **ST** command's output consists of eight lines. Each line lists the state of four ports. The output for each port is separated by four spaces. The columns displayed correspond to the Output port number, Input port number that is connected to the output port, State of the Port, and Number of detected signal losses (in Hex) and are identified as shown in Figure 5-4.

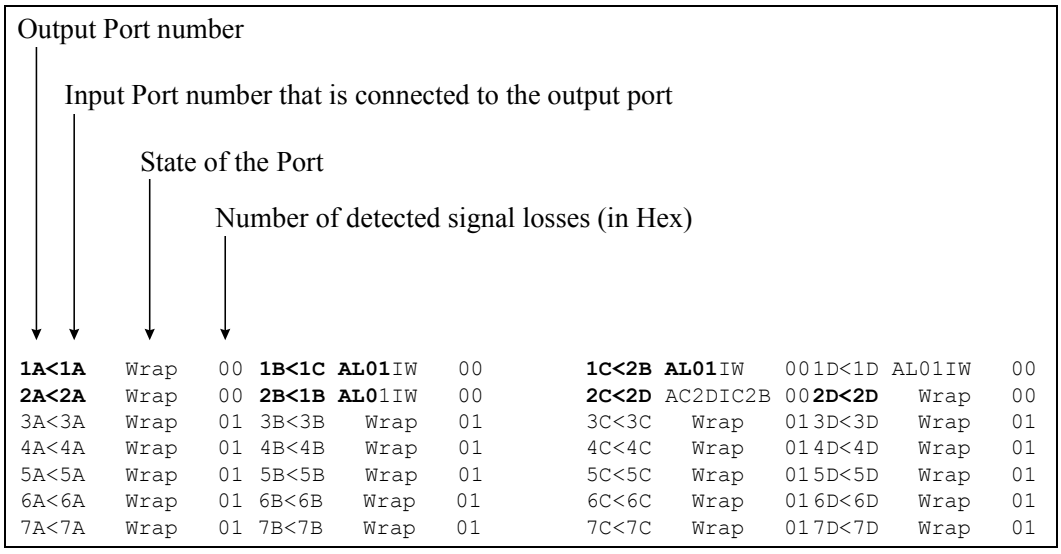

Figure 5-4 Switch Configuration List

The bold characters in Figure 5-4, denote characters that appear in reverse color on the computer screen. Reversed color is used to denote ports with signals present and to show the port is active on a loop.

If port 1A is in the wrap mode, its status record will look like the one below.

```
1A<1A   WRAP  00
```

If port 1A is active on loop 1 (and at least one other port is active on loop id 1), its status record will look like the one below.

```
1A<2B   AL01IW      00
```

If the port above lost its signal and entered the inactive state, its status record would change to the following.

```
1A<1A   AL01IW      01
```

If port 1A is configured as a copy of port 8D, its status record would be the following.

```
1A<8D   C 8D      00
```

If port 1A is configured as a copy of port 8D when active and port 8C when inactive, its status record would be the following (if port 8D has a signal detected).

```
1A<8D  AC8DIC8C  00
```

If the port 1A above lost its signal and entered the inactive copy state, its status record would change to the following.

```
1A<8C  AC8DIC8C  01
```

5.5.3 Using the Status Window

Using the **DW** command, it is possible to allocate the bottom 10 lines of the terminal's display as a status window. The status window shows the current configuration of each port. To start the status window, execute the following command.

```
DW ON
```

This command turns the display on. Once the status window is on, the screen will look like the one below. Notice, the status window's display has the same format as the **ST** command that is described above.

```
nts>









===========================================================================
1A<1A   Wrap   00     1B<1C AL01IW   00 1C<2B AL01IW   00 1D<1D AL01IW   00
2A<2A   Wrap   00     2B<1B AL01IW   00 2C<2D AC2DIC2B 00 2D<2D   Wrap   00
3A<3A   Wrap   01     3B<3B   Wrap   01 3C<3C   Wrap   01 3D<3D   Wrap   01
4A<4A   Wrap   01     4B<4B   Wrap   01 4C<4C   Wrap   01 4D<4D   Wrap   01
5A<5A   Wrap   01     5B<5B   Wrap   01 5C<5C   Wrap   01 5D<5D   Wrap   01
6A<6A   Wrap   01     6B<6B   Wrap   01 6C<6C   Wrap   01 6D<6D   Wrap   01
7A<7A   Wrap   01     7B<7B   Wrap   01 7C<7C   Wrap   01 7D<7D   Wrap   01
8A<8A   Wrap   01     8B<8B   Wrap   01 8C<8C   Wrap   01 8D<8D   Wrap   01
01/01/96  13:46:20    update period:  10 secs use DS to disable messages
```

The bottom line of the status display contains three types of information. On the left side, the date and time are displayed. In the middle, the update period for the status window is displayed. On the right, the user is told how to enable or disable signal loss/detect messages.

With the status window on, the user can continue to execute commands as before. The LX1500 still tracks the ports with signals present and adjusts connections accordingly. The status window is updated when the configuration of a port changes, when the **ST** command is issued, or when the update period has elapsed. The update period is the maximum number of seconds between status window updates. This can be set by the **DW** command to range between 10 and 300 (5 minutes). To set the update period to 30 seconds, issue the following command.

```
DW P30
```

To turn off the status window issue the following command.

```
DW OFF
```

5.5.4 Modifying and Restoring Saved Configurations

The LX1500 contains four saved configurations. To use a saved configuration, the **R** command must be used. This command configures the LX1500 so that each port is configured as noted in the selected saved-configuration. To use saved-configuration number 3, execute the following command.

```
R 3
```

The **MS** command allows the user to modify a saved-configuration. The command prompt that is displayed while editing saved-configurations is illustrated below.

```
modify#>>
```

The # is replaced by the number of the saved-configuration being edited.

Editing of saved-configurations is very similar to using the normal command line interface to operate the switch. The **H**, **T**, **V**, **P**, **SC**, **BE**, **DS**, **DW**, and **ST** commands are available while editing saved-configurations as well as in normal command line operation. While editing saved-configurations, one additional command is available. The **EX** command is used to exit the editing of a saved-configuration and return to normal command line operation.

While editing a saved-configuration, some commands act differently than in the normal mode. The **P** command changes the specified port's configuration for the saved-configuration being edited. The **P** command will not change the current configuration in any way. The **SC** command, like the **P** command, will act on the saved-configuration and not the current configuration. The **DW** command can be used to change the status window display. The status window display still displays the current configuration of each port. The status information that appears in the status window has nothing to do with the saved configuration. The **ST** command will not update the status window; it will display the state of the saved-configuration being edited.

The following is example of changing a saved-configuration. To start, the LX1500 is in the normal command mode.

```
nts>>st
nts>>ms 0









================================================================================
1A<1A   Wrap   00   1B<1C AL01IW   00   1C<2B AL01IW   00   1D<1D AL01IW   00
2A<2A   Wrap   00   2B<1B AL01IW   00   2C<2D AC2DIC2B 00   2D<2D   Wrap   00
3A<3A   Wrap   01   3B<3B   Wrap   01   3C<3C   Wrap   01   3D<3D   Wrap   01
4A<4A   Wrap   01   4B<4B   Wrap   01   4C<4C   Wrap   01   4D<4D   Wrap   01
5A<5A   Wrap   01   5B<5B   Wrap   01   5C<5C   Wrap   01   5D<5D   Wrap   01
6A<6A   Wrap   01   6B<6B   Wrap   01   6C<6C   Wrap   01   6D<6D   Wrap   01
7A<7A   Wrap   01   7B<7B   Wrap   01   7C<7C   Wrap   01   7D<7D   Wrap   01
8A<8A   Wrap   01   8B<8B   Wrap   01   8C<8C   Wrap   01   8D<8D   Wrap   01
01/01/96  13:46:20     update period: 10 secs     use DS to disable messages
```

Once the **MS 0** command is executed, the command prompt will change.

```
nts>>st
nts>>ms 0
modify0>>sc OL
modify0>>st
Port   State     Port   State     Port   State     Port   State
=================================================================
 1A  AL00 IW      1B  AL00 IW      1C  AL00 IW      1D  AL00 IW
 2A  AL00 IW      2B  AL00 IW      2C  AL00 IW      2D  AL00 IW
 3A  AL00 IW      3B  AL00 IW      3C  AL00 IW      3D  AL00 IW
 4A  AL00 IW      4B  AL00 IW      4C  AL00 IW      4D  AL00 IW
 5A  AL00 IW      5B  AL00 IW      5C  AL00 IW      5D  AL00 IW
 6A  AL00 IW      6B  AL00 IW      6C  AL00 IW      6D  AL00 IW
 7A  AL00 IW      7B  AL00 IW      7C  AL00 IW      7D  AL00 IW
 8A  AL00 IW      8B  AL00 IW      8C  AL00 IW      8D  AL00 IW
modify0>>ex
nts>>
=================================================================
1A<1A   Wrap   00 1B<1C AL01IW   00 1C<2B AL01IW   00 1D<1D AL01IW   00
2A<2A   Wrap   00 2B<1B AL01IW   00 2C<2D AC2DIC2B 00 2D<2D   Wrap   00
3A<3A   Wrap   01 3B<3B   Wrap   01 3C<3C   Wrap   01 3D<3D   Wrap   01
4A<4A   Wrap   01 4B<4B   Wrap   01 4C<4C   Wrap   01 4D<4D   Wrap   01
5A<5A   Wrap   01 5B<5B   Wrap   01 5C<5C   Wrap   01 5D<5D   Wrap   01
6A<6A   Wrap   01 6B<6B   Wrap   01 6C<6C   Wrap   01 6D<6D   Wrap   01
7A<7A   Wrap   01 7B<7B   Wrap   01 7C<7C   Wrap   01 7D<7D   Wrap   01
8A<8A   Wrap   01 8B<8B   Wrap   01 8C<8C   Wrap   01 8D<8D   Wrap   01
01/01/96  13:46:20     update period: 10 secs     use DS to disable messages
```

The example above shows how the **SC** command can set up all the ports in a saved-configuration to the same loop id. Then the state of the saved-configuration is displayed and the exit command is used to stop editing the saved-configuration. To use the modified saved-configuration, execute the **R 0** command.

APPENDIX A

SPECIFICATIONS

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FIGURES

A.1 Rack-Mountable Enclosure Specifications

Physical Dimensions:	17.0” wide by 7.0” tall by 16.85” deep (432 mm by 178 mm by 428 mm)
With handles and mounting ears:	19.0” wide by 7.0” tall by 18.5” deep (485 mm by 178 mm by 470 mm)
Power Requirements:	
Input voltage:	90-135 or 180-270 VAC
Input current per supply:	4.2A max at 115 V, 60 Hz 2.0A max at 230 V, 50 Hz
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)

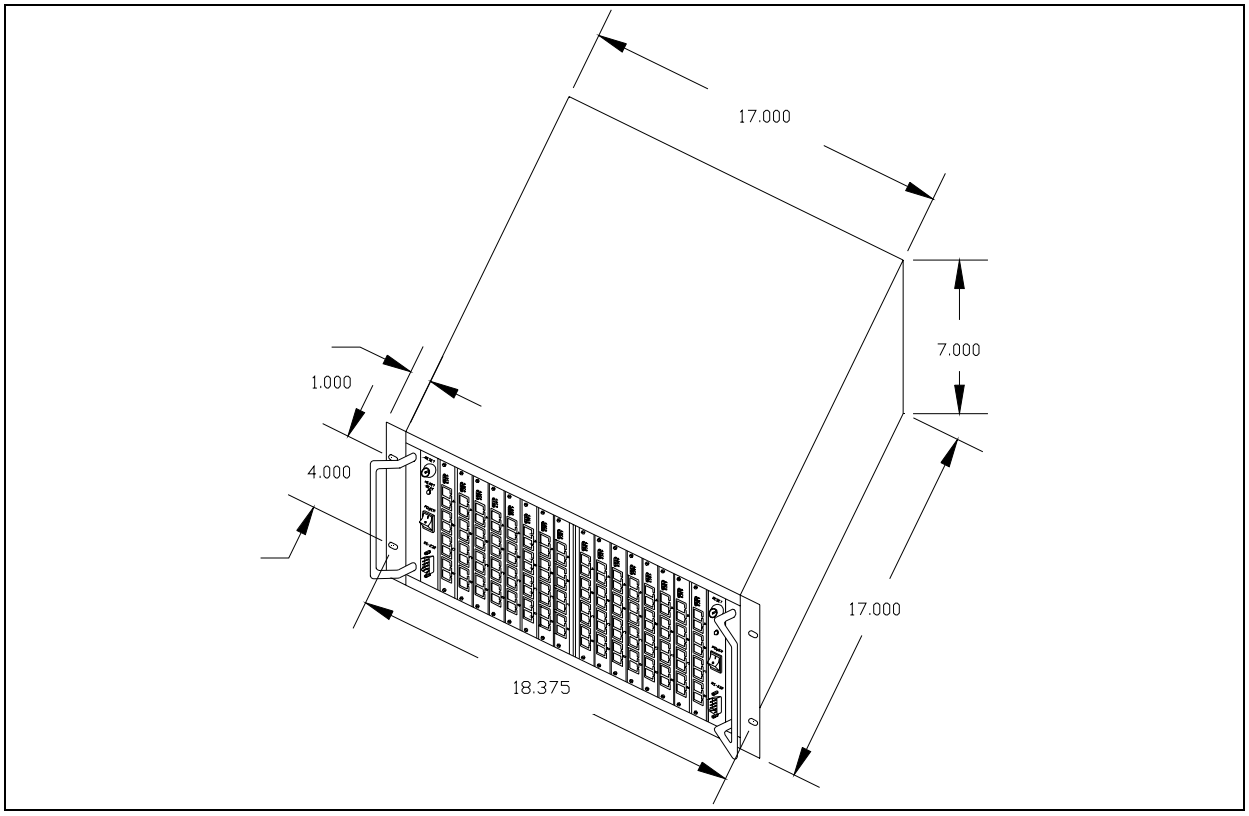

Figure A–1 Rackmount Enclosure Dimensions

A.2 LX1500 Base Unit Hardware Specifications

Physical Dimensions:	5.850” wide by 6.750” tall by 7.180” deep (149 mm by 171 mm by 182 mm) (See Figure A–2)
Power Requirements:	+5VDC±5%, 5 Amps +12 VDC ±5%, 1 Amp (base unit only, port cards not included)
Storage Temperature Range:	-65° to +85° C on LX1500 (port cards may be more restrictive)
Operating Temperature Range:	0° to +60° C on LX1500 (port cards may be more restrictive)
Storage Humidity Range:	5% to 95% (noncondensing)
Operating Humidity Range:	10% to 90% (noncondensing)
Data Rates:	Up to 1.5 Gbps (port card dependent)
Total Bandwidth:	48 Gbps with 32 ports

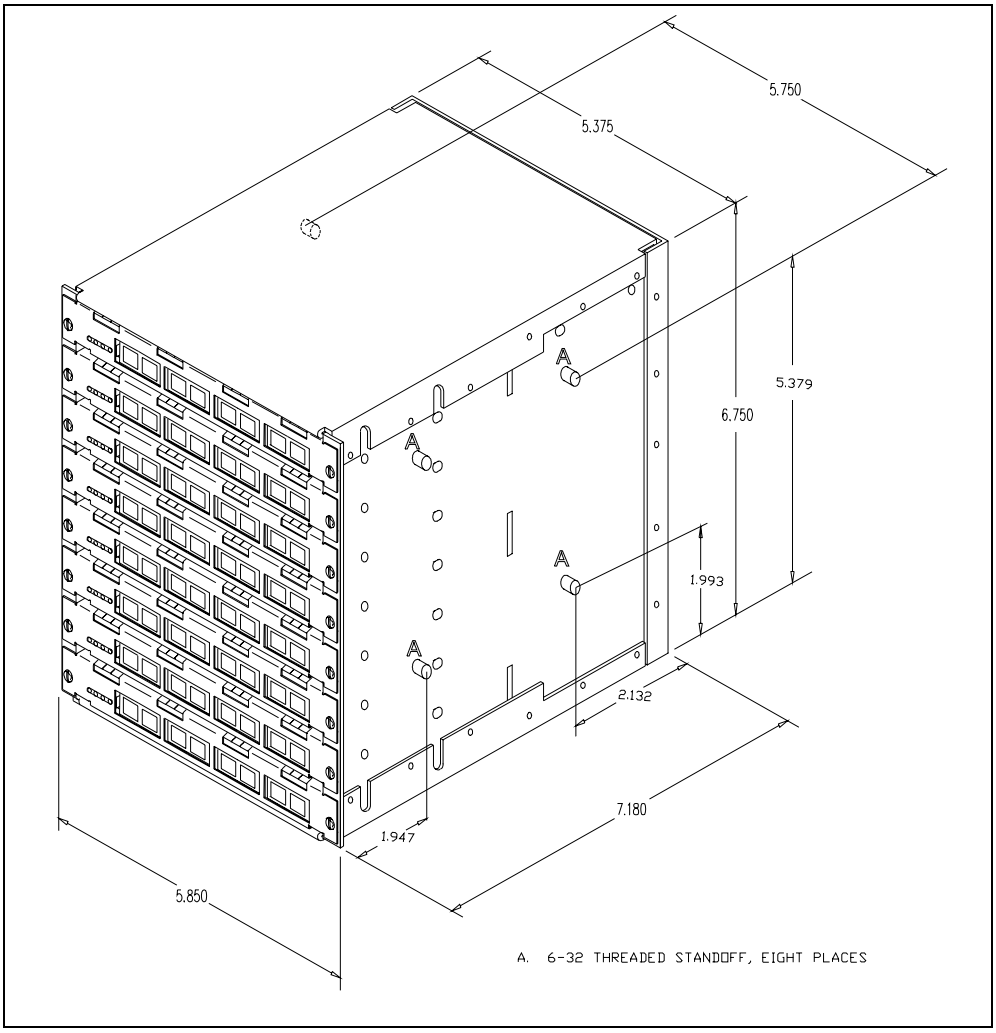

Figure A–2 Physical Dimensions of the LX1500

APPENDIX B

AVAILABLE PORT CARDS

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FIGURES

TABLES

B.1 Overview

Systran offers Fibre Channel and SCRAMNet port cards for the LX1500. This appendix contains descriptions of all available LX1500 port cards.

B.2 Fibre Channel Compatible Port Cards

Retimed port cards are optimized for use in 1.0625 Gbps Fibre Channel networks and with Systran's FibreXtreme Simplex Link products. They can also be used in other 1.0625 Gbps systems that use Fibre Channel compatible signaling.

Non-retimed port cards are for data rates other than 1.0625 Gbps, including half-speed and quarter-speed Fibre Channel. They can also be used in other systems over a wide range of data rates if signaling levels compatible.

B.2.1 Non-Retimed Short Wavelength Optical Port Card

The Non-Retimed Short Wavelength Optical Port Card interfaces short wavelength optical signals to the LX1500 at Fibre Channel-compatible power levels and speeds of up to 1.0625 Gbps.

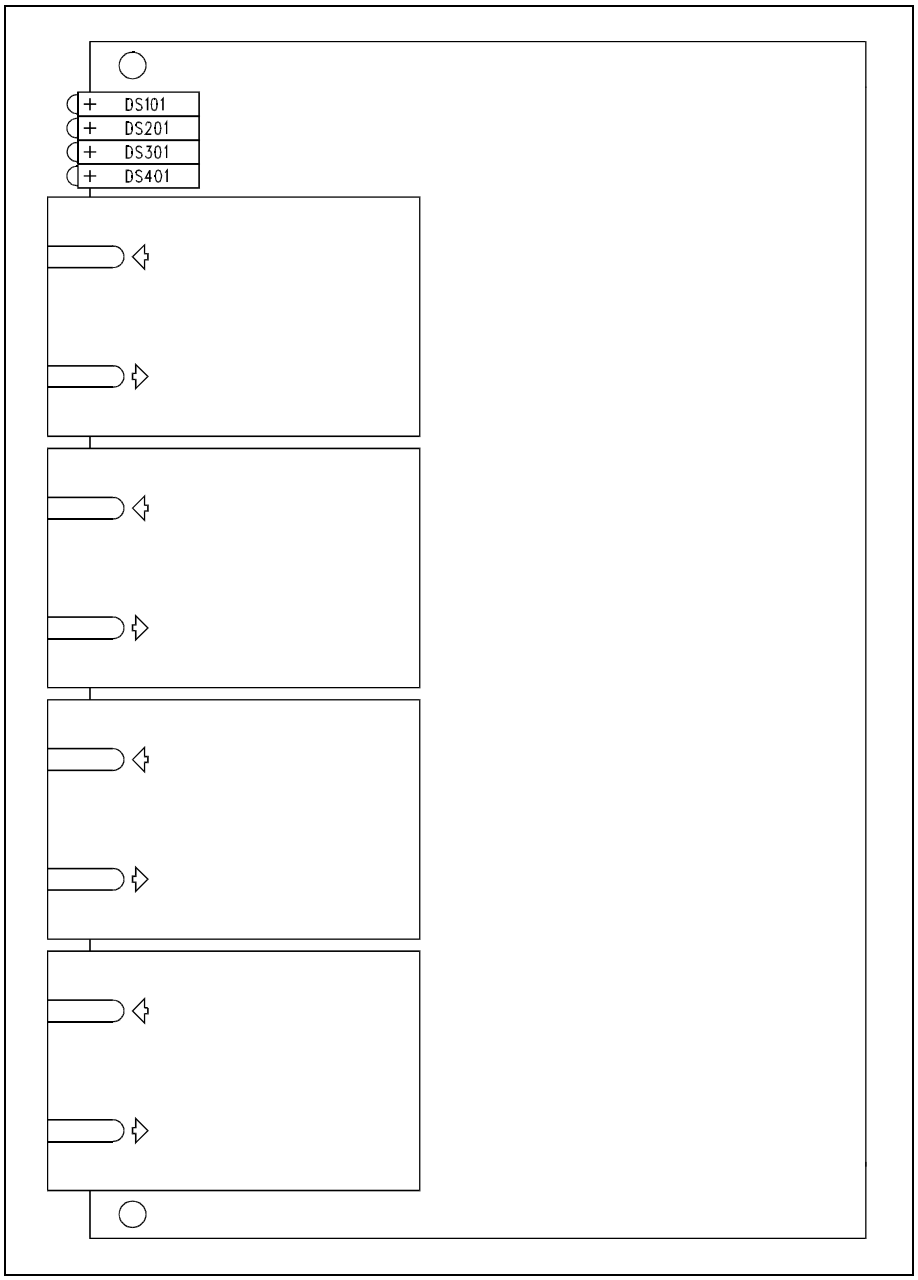

Figure B-1 Non-Retimed Short Wavelength Optical Port Card

FEATURES:

- 10 Mbps to 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-M5-SN-I (1 Gbps, 50 µm multimode fiber, no Open Fiber Control)
  100-M6-SN-I (1 Gbps, 62.5 µm multimode fiber, no Open Fiber Control)
- Compatible with the following Fibre Channel technology options except for having no Open Fiber Control:
  50-M5-SL-I (531 Mbps, 50 µm multimode fiber)
  50-M6-SL-I (531 Mbps, 62.5 µm multimode fiber)
  25-M5-SL-I (266 Mbps, 50 µm multimode fiber)
  25-M6-SL-I (266 Mbps, 62.5 µm multimode fiber)

OPERATING CONSTRAINTS:

Maximum Switch Passes:	Data rate dependent
Power Consumption:	3.55 Watts (0.710 Amps at 5 Volts)
Operating Temperatures:	0° to 50° C
Storage Temperatures:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	Dual SC
Media:	50 µm or 62.5 µm multimode fiber
Maximum Fiber Length:	Data rate dependent: 300 m to 2 km in 50 µm fiber 300 m to 700 m in 62.5 µm fiber
Transmit Wavelength:	830 to 860 nm
Transmit Power:	-10 to -4 dbm
Receive Wavelength:	770 to 860 nm
Receive Power:	-16 to 0 dbm
Maximum Data Run Length:	500 ns

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port's receiver).

TESTED APPLICATIONS:

The Non-Retimed Short Wavelength Optical Port Card has been tested and found to work in the following applications:

- Full one-gigabit Fibre Channel using a short wavelength optical interface
- Quarter speed (266 Mbps) Fibre Channel using a short wavelength optical interface

NOTE: For 1.0625 Gbps Fibre Channel and FibreXtreme applications, the retimed version of this card will give better performance.

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 **(937) 252-5601**.

B.2.2 Retimed Short Wavelength Optical Port Card

The Retimed Short Wavelength Optical Port Card interfaces 1.0625 Gbps short wavelength optical Fibre Channel signals to the LX1500. Outgoing data passes through retiming circuits to reduce pulse jitter and signal distortion. Because of the retiming circuits, this card is intended for 1.0625 Gbps data only.

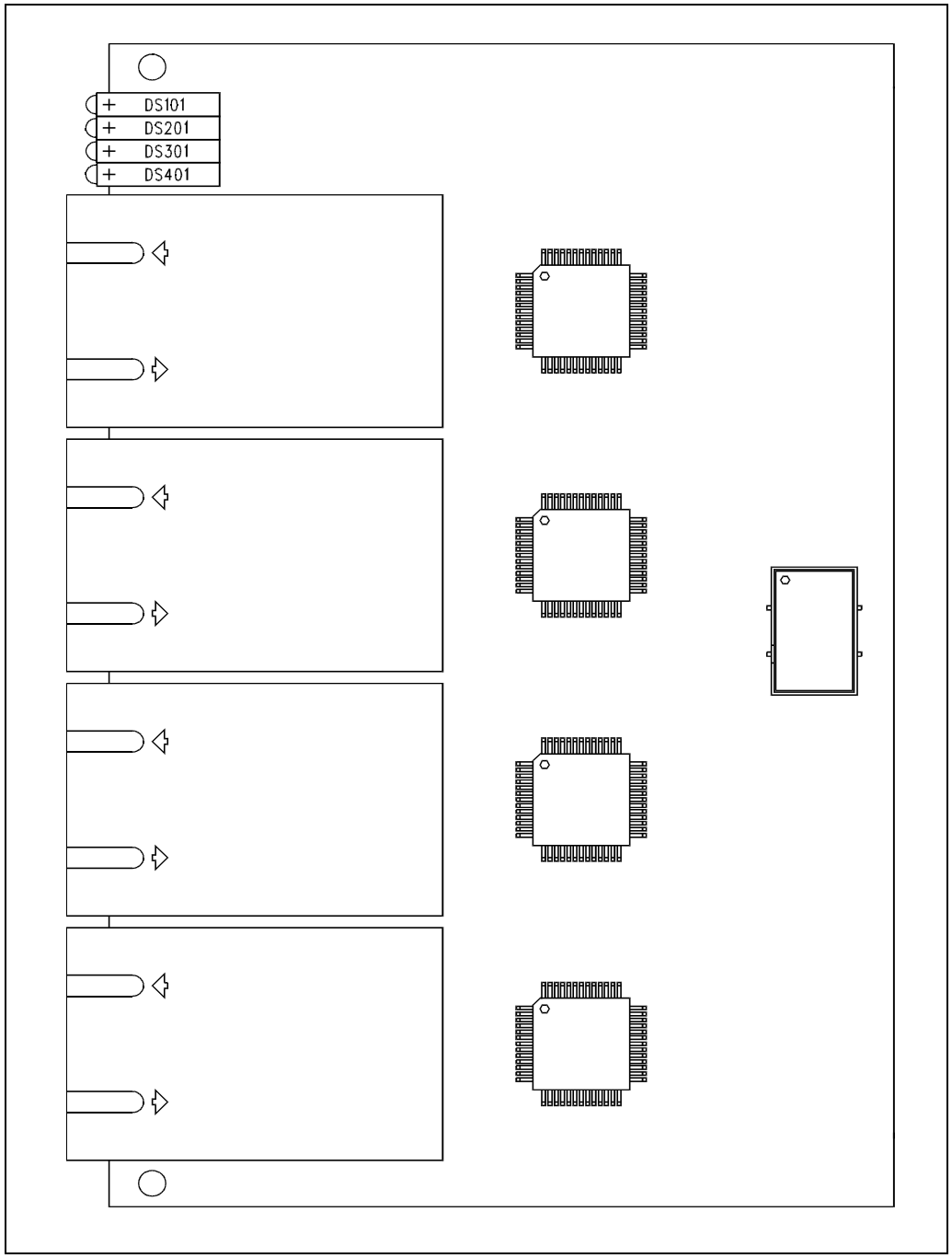

Figure B-2 Retimed Short Wavelength Optical Port Card

FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one standard Systran LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-M5-SN-I (1 Gbps, 50 µm multimode fiber, no Open Fiber Control)
  100-M6-SN-I (1 Gbps, 62.5 µm multimode fiber, no Open Fiber Control)

OPERATING CONSTRAINTS:

Maximum Switch Passes:	5
Power Consumption:	10.5 Watts (2.1 Amps at 5 Volts)
Operating Temperatures:	0° to 50° C
Storage Temperatures:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	Duplex SC
Media:	50 µm or 62.5 µm multimode fiber
Maximum Fiber Length:	300 meters
Transmit Wavelength:	830 to 860 nm
Transmit Power:	-10 to -4 dbm
Receive Wavelength:	770 to 860 nm
Receive Power:	-16 to 0 dbm
Maximum Data Run Length:	10 bits

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port's receiver).

TESTED APPLICATIONS:

The Retimed Short Wavelength Optical Port Card has been tested and found to work in the following applications:

- One Gbps Fibre Channel using a short wavelength optical interface.
- Systran FibreXtreme Simplex Link using a short wavelength 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 **(937) 252-5601**.

B.2.3 Retimed Long Wavelength Optical Port Card

The Retimed Long Wavelength Optical Port Card interfaces 1.0625 Gbps long wavelength optical Fibre Channel signals to the LX1500. Outgoing data passes through retiming circuits to reduce pulse jitter and signal distortion. Because of the retiming circuits, this card is intended for 1.0625 Gbps data only.

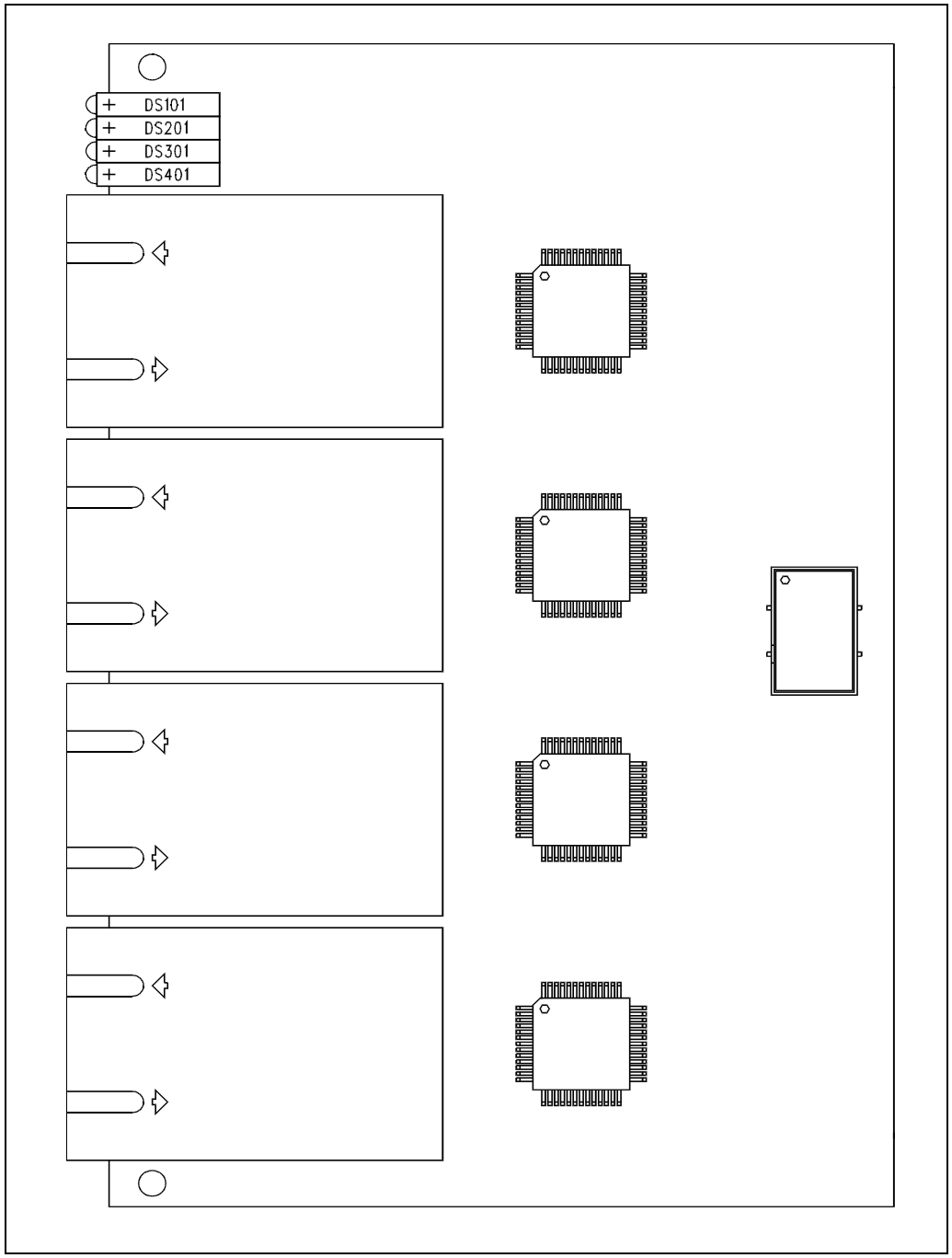

Figure B-3 Retimed Long Wavelength Optical Port Card

FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-SM-LL-I (1 Gbps, 9 µm single-mode fiber, intermediate distance)
  100-SM-LC-L (1 Gbps, 9 µm single-mode fiber, low cost long distance)

OPERATING CONSTRAINTS:

Maximum switch passes:	5
Power Consumption:	10.5 watts (2.1 amps at 5 volts)
Operating Temperature:	0° to 50° C
Storage Humidity:	0% to 95% (noncondensing)
Storage Temperature:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	Duplex SC
Media:	9 µm single-mode fiber
Maximum fiber length:	10 km
Transmit wavelength:	1285 to 1330 nm
Transmit Power:	-9 to –3 dBm
Receive Wavelength:	1100 to 1600 nm
Receive Power:	-20 to –3 dBm
Maximum Data Run Length:	10 bits

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port's receiver).

TESTED APPLICATIONS:

The Retimed Long Wavelength Optical Port Card has been tested and found to work in the following applications:

- One Gbps Fibre Channel using a long wavelength single-mode optical interface.
- Systran FibreXtreme Simplex Link using a long wavelength single-mode 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 **(937) 252-5601**.

B.2.4 Retimed HSSDC Copper Port Card

The Retimed HSSDC Copper Port Card is designed to interface 1.0625 Gbps copper Fibre Channel signals with the LX1500 using Fibre Channel "Style-2" copper connectors. Outgoing data passes through retiming circuits to reduce pulse jitter and signal distortion. Because of the retiming circuits, this card is intended for 1.0625 Gbps data only.

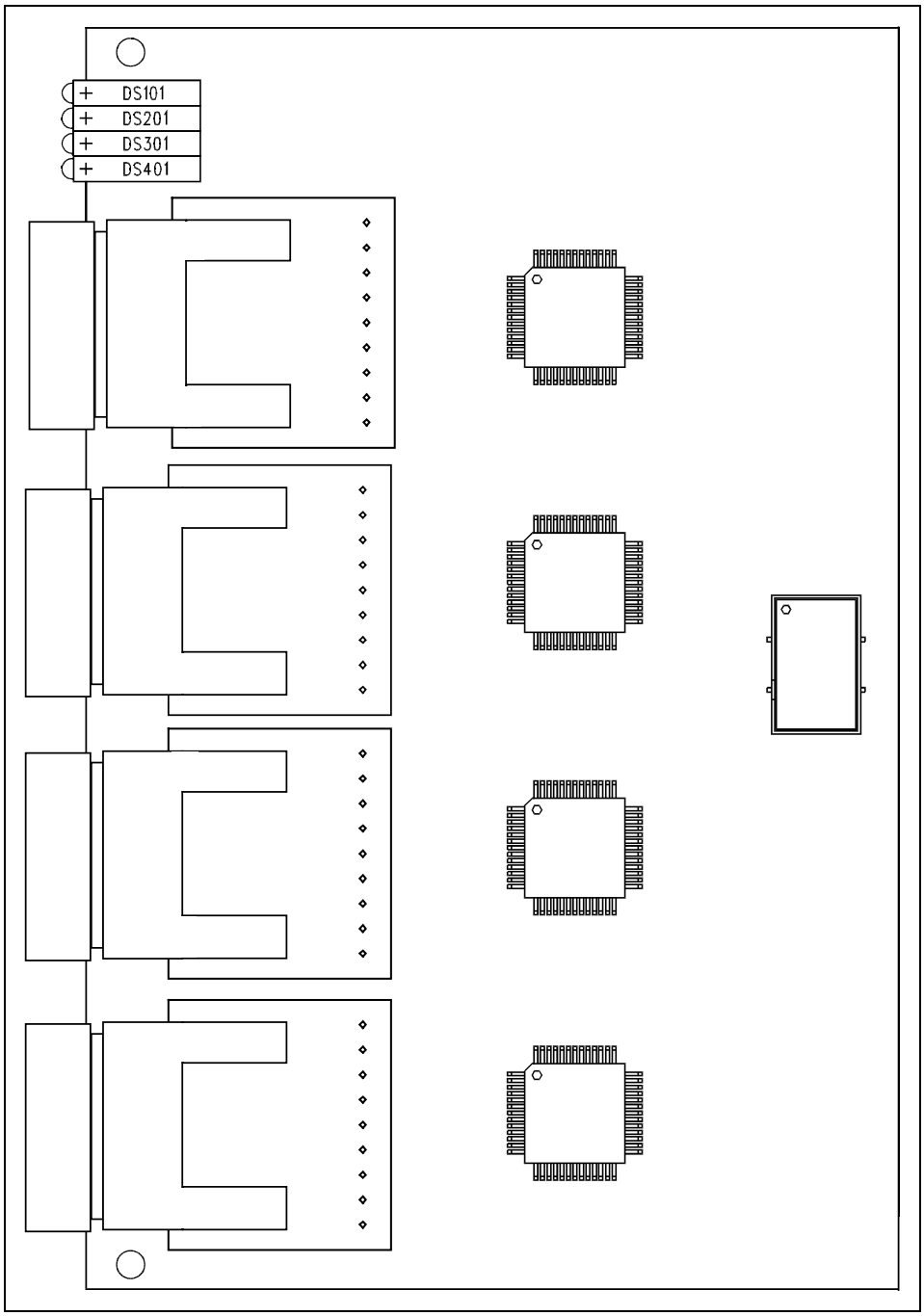

Figure B-4 Retimed HSSDC Copper Port Card

FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-TW-EL-S (1 Gbps, Shielded Balanced cable)

OPERATING CONSTRAINTS:

Maximum Switch Passes:	6
Power Consumption:	10.0 Watts (2.0 Amps at 5 Volts)
Operating Temperatures:	0° to 70° C
Storage Temperatures:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	HSSDC (“Style-2”)
Media:	150 Ω Shielded Quad
Maximum Cable Length:	Up to 25m unequalized; Up to 30m equalized
Maximum Data Run Length:	6 bits

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port’s receiver).

TESTED APPLICATIONS:

The Retimed HSSDC Copper Port Card has been tested and found to work in the following applications:

- One Gbps Fibre Channel using an HSSDC differential copper interface.
- Systran FibreXtreme Simplex Link using an HSSDC differential copper 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 **(937) 252-5601**.

B.2.5 Non-Retimed 1x3 Copper Port Card

The Non-Retimed 1x3 Copper Port Card interfaces differential copper signals to the LX1500 at Fibre Channel-compatible signal levels and speeds of up to 1.0625 Gbps.

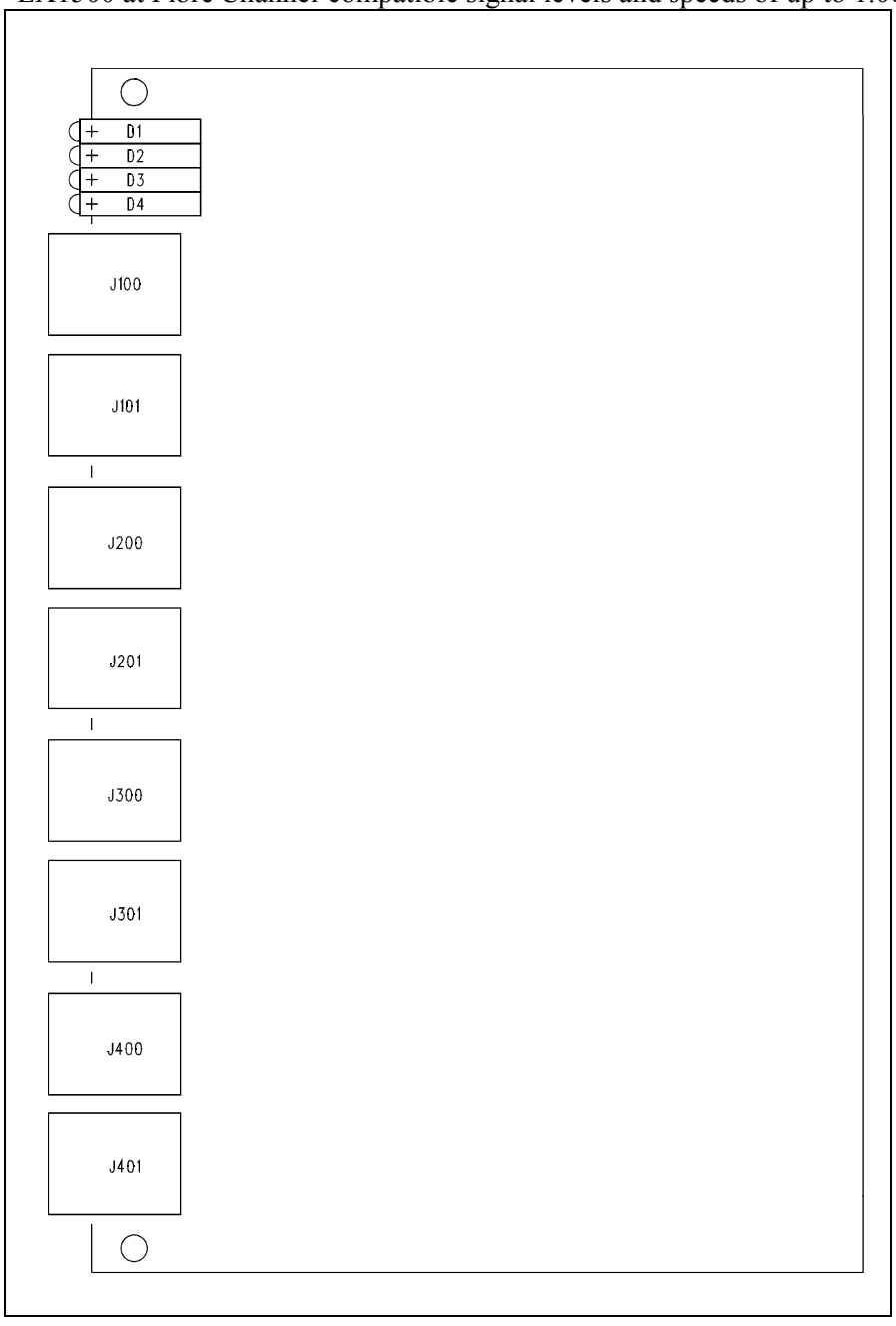

Figure B-5 Non-Retimed 1x3 Copper Port Card

FEATURES

- 10 Mbps to 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-TW-EL-S (1 Gbps, Shielded Balanced Cable)
  50-TW-EL-S (533 Mbps, Shielded Balanced Cable)
  25-TW-EL-S (266 Mbps, Shielded Balanced Cable)
  12-TW-EL-S (133 Mbps, Shielded Balanced Cable)

OPERATING CONSTRAINTS:

Maximum Switch Passes:	Data rate dependent
Power Consumption:	2.8 Watts (0.56 Amps at 5 Volts)
Operating Temperatures:	0° to 70° C
Storage Temperatures:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	3-pin header, .025 in. square posts
Media:	150 Ω Twinaxial cable (Gore QuietZone or equivalent)
Maximum Cable Length:	Data rate dependent
Maximum Data Run Length:	500 ns

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port's receiver).

TESTED APPLICATIONS:

The Non-Retimed 1x3 Copper Port Card has been tested and found to work in the following applications:

- One Gbps Fibre Channel using an HSSDC differential copper interface.
- Systran FibreXtreme Simplex Link using an HSSDC differential copper interface.
- Quarter speed (266 Mbps) Fibre Channel using a differential copper interface.

NOTE: For 1.0625 Gbps Fibre Channel and FibreXtreme applications, the retimed version of this card will give better performance.

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 **(937) 252-5601**.

B.2.6 Retimed 1x3 Copper Port Card

The Retimed Copper Port Card is designed to interface 1.0625 Gbps copper Fibre Channel signals with the LX1500. Outgoing data passes through retiming circuits to reduce pulse jitter and signal distortion. Because of the retiming circuits, this card is intended for 1.0625 Gbps data only.

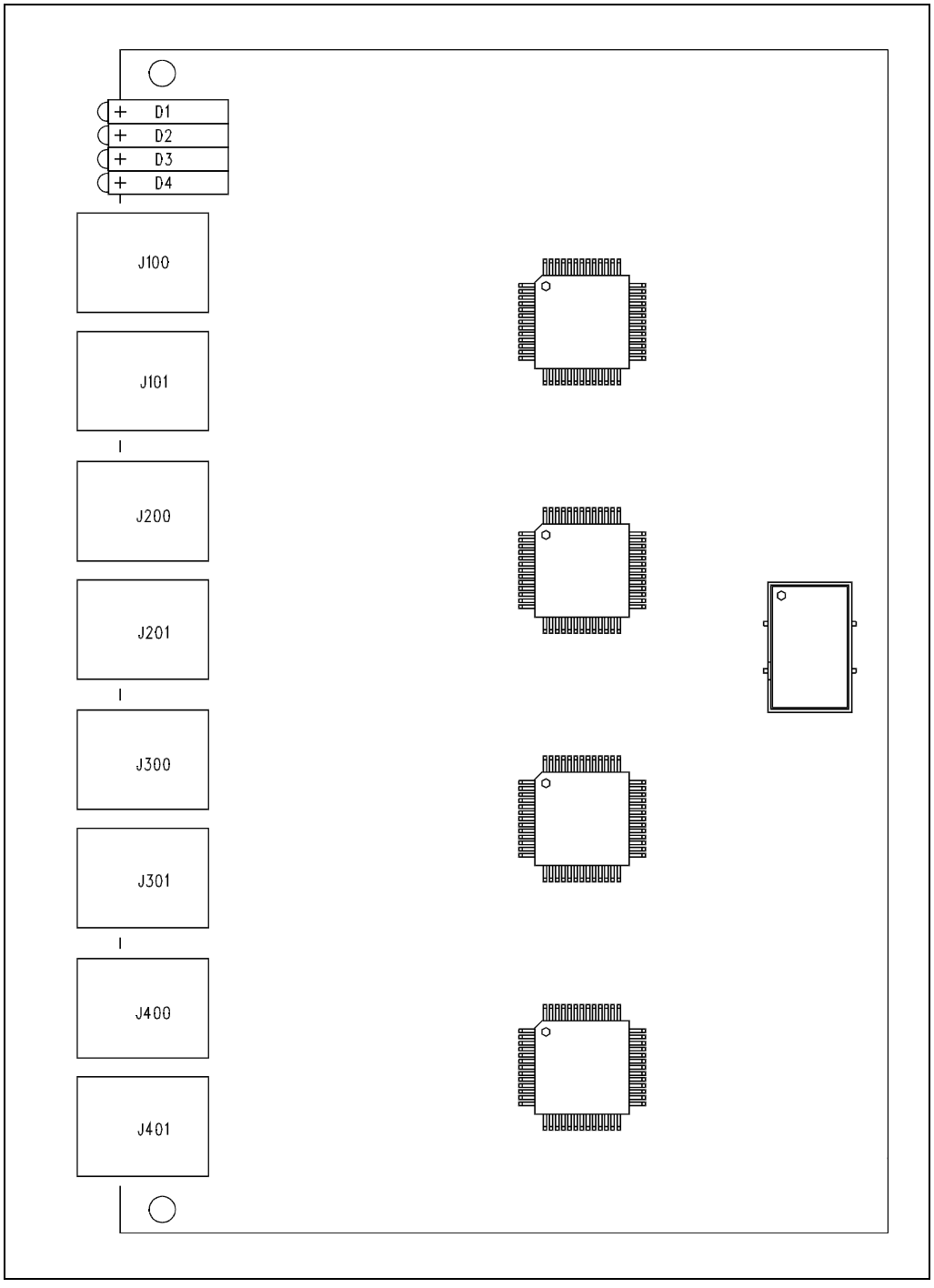

Figure B-6 Retimed 1x3 Copper Port Card

FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with the following Fibre Channel technology options:
  100-TW-EL-S (1 Gbps, Shielded Balanced Cable)

OPERATING CONSTRAINTS:

Maximum Switch Passes:	6
Power Consumption:	10.0 Watts (2.0 Amps at 5 Volts)
Operating Temperatures:	0° to 70° C
Storage Temperatures:	-40° to 85° C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Connector:	3-pin header, .025 in. square posts
Media:	150 Ω Twinaxial cable (Gore QuietZone or equivalent)
Maximum Cable Length:	13 meters
Maximum Data Run Length:	6 bits

LEDS:

One indicator per port lights when the port is active (a signal is detected at that port's receiver).

TESTED APPLICATIONS:

The Retimed 1x3 Copper Port Card has been tested and found to work in the following applications:

- One Gbps Fibre Channel using a 1x3 differential copper interface.
- Systran FibreXtreme Simplex Link using a 1x3 differential copper 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 **(937) 252-5601**.

B.3 SCRAMNet Port Cards

SCRAMNet port cards are designed to be used with Systran's SCRAMNet+ and SCRAMNet Classic products.

B.3.1 SCRAMNet Standard-Link Optical Port Card

The SCRAMNet Standard Link Optical Port Card interfaces two SCRAMNet ports to the LX1500. Each SCRAMNet port uses two LX1500 channels, so the 32x32 channel LX1500 can route up to 16 SCRAMNet ports.

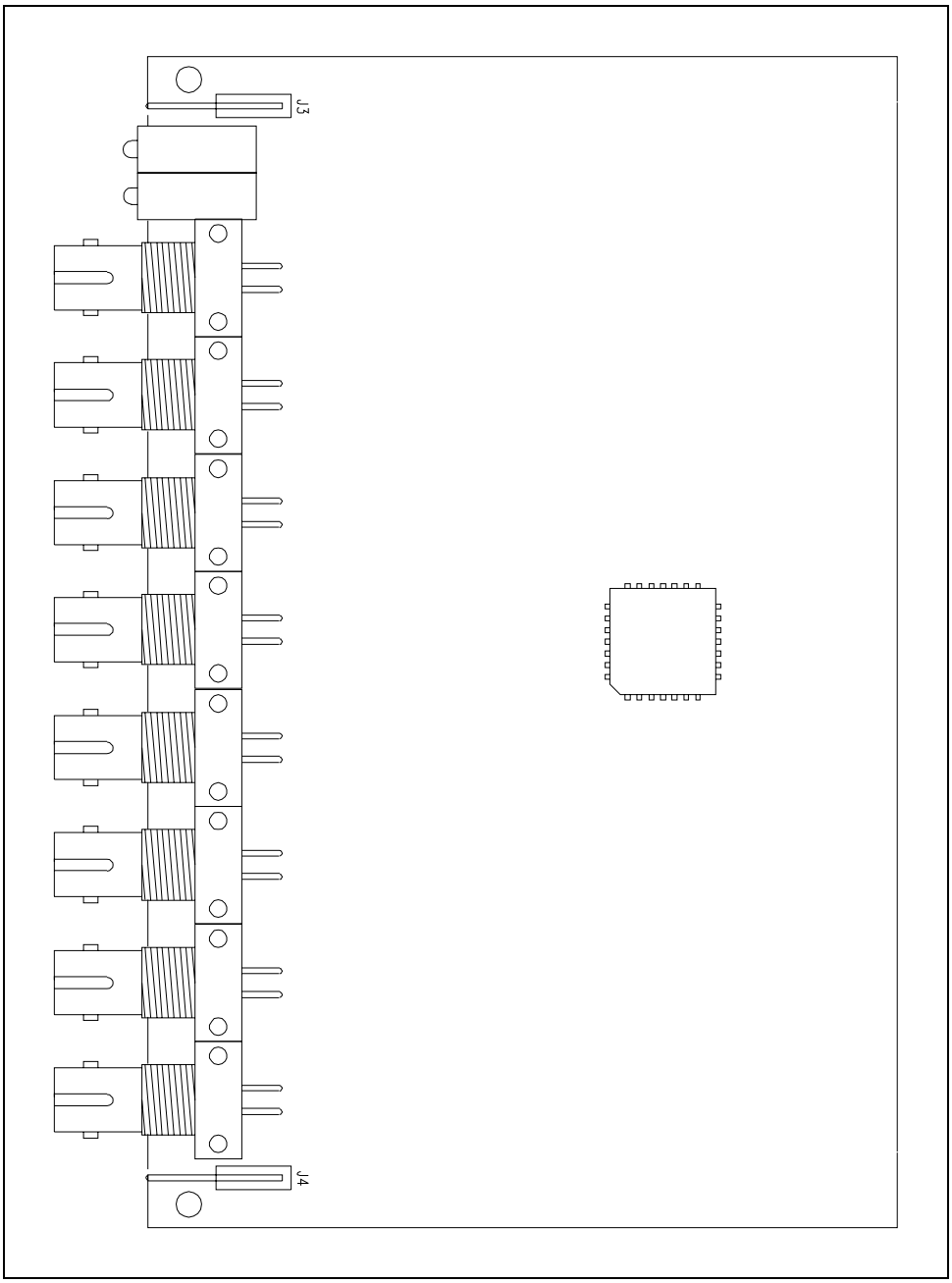

Figure B-7 SCRAMNet Standard Link Optical Port Card

FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with SCRAMNet+ or SCRAMNet Classic nodes

AUXILIARY CONNECTORS

In addition to the high-speed data lines, a SCRAMNet node may be connected to an LX1500 port by the associated Auxiliary Connector. If the node is connected but not powered up or it is in loopback mode, the Auxiliary connector forces the LX1500 port into the *inactive* state. If the port is not forced inactive by the Auxiliary connector and both of that port's receivers are detecting a signal, the LX1500 considers that port to be *active*. The LX1500 can be programmed to automatically switch a port (for example, into or out of a ring) depending on its active or inactive status.

If nothing is attached to the Auxiliary Connector, the associated port is not forced inactive, and its active/inactive status depends on the presence of signals at its two receivers.

FRONT PANEL:

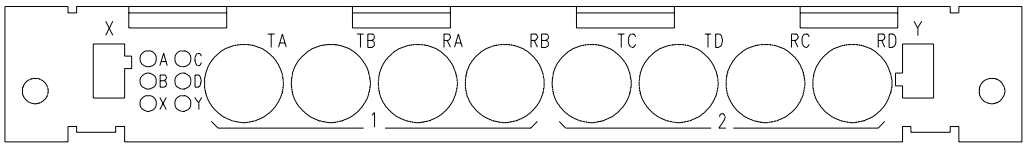

Figure B-8 SCRAMNet Fiber-optic Faceplate

CONNECTORS

TA, TB	Transmitter pair for port 1
RA, RB	Receiver pair for port 1
TC, TD	Transmitter pair for port 2
RC, RD	Receiver pair for port 2
X	Auxiliary connector for port 1
Y	Auxiliary connector for port 2

LEDS

A	Indicates presence of signal at RA
B	Indicates presence of signal at RB
C	Indicates presence of signal at RC
D	Indicates presence of signal at RD
X	Indicates that Auxiliary connector X allows port 1 to be active
Y	Indicates that Auxiliary connector Y allows port 2 to be active

The LX1500 considers a port "active" when LEDs A, B, and X (for port 1) or C, D, and Y (for port 2) are lit.

OPERATING CONSTRAINTS:

Maximum Switch Passes:	5
Maximum Cable Length:	See section B.3.4 Link Length Constraints for LX1500 SCRAMNet Port Cards, page B-24.
Power Consumption:	5.5 Watts (1.1 Amps at 5 Volts)
Operating Temperatures:	0 to 70 C
Storage Temperatures:	-40 to 85 C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Optical Connector:	ST (bayonet)
Auxiliary Connector:	3-pin header, .025 in. square posts
Media:	62.5/125µm multimode fiber (two pairs per port)

B.3.2 SCRAMNet Long-Link Optical Port Card

The SCRAMNet Long-Link Optical Port Card interfaces two SCRAMNet fiber ports to the LX1500. Each SCRAMNet port uses two LX1500 channels, so the 32x32-channel LX1500 can route up to 16 SCRAMNet ports.

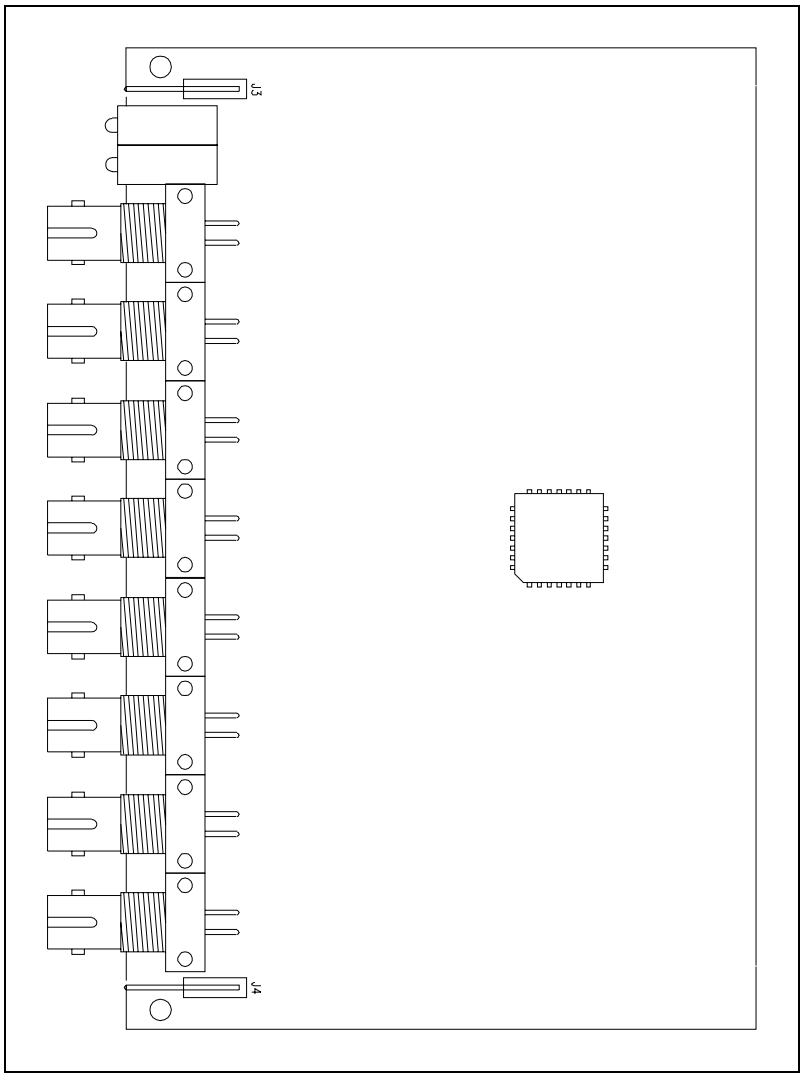

Figure B-9 SCRAMNet Long-Link Optical Port Card

FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with SCRAMNet+ or SCRAMNet Classic nodes

AUXILIARY CONNECTORS

In addition to the high-speed data lines, a SCRAMNet node may be connected to an LX1500 port by the associated Auxiliary Connector. If the node is connected but it is not powered up or it is in loopback mode, the Auxiliary connector forces the LX1500 port into the *inactive* state. If the port is not forced inactive by the Auxiliary connector and both of that port's receivers are detecting a signal, the LX1500 considers that port to be *active*. The LX1500 can be programmed to automatically switch a port (for example, into or out of a ring) depending on its active or inactive status.

If nothing is attached to the Auxiliary Connector, the associated port is not forced inactive, and its active/inactive status depends on the presence of signals at its two receivers.

FRONT PANEL:

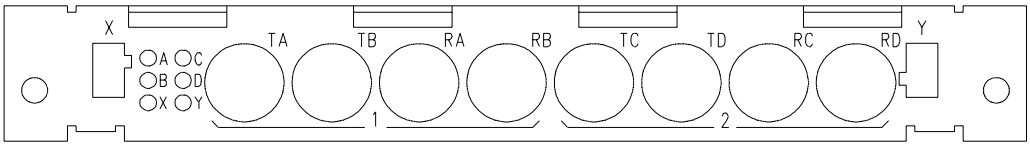

Figure B-10 SCRAMNet Fiber-optic Faceplate

CONNECTORS

TA, TB	Transmitter pair for port 1
RA, RB	Receiver pair for port 1
TC, TD	Transmitter pair for port 2
RC, RD	Receiver pair for port 2
X	Auxiliary connector for port 1
Y	Auxiliary connector for port 2

LEDS

A	Indicates presence of signal at RA
B	Indicates presence of signal at RB
C	Indicates presence of signal at RC
D	Indicates presence of signal at RD
X	Indicates that Auxiliary connector X allows port 1 to be active
Y	Indicates that Auxiliary connector Y allows port 2 to be active

The LX1500 considers a port "active" when LEDs A, B, and X (for port 1) or C, D, and Y (for port 2) are lit.

OPERATING CONSTRAINTS:

Maximum Switch Passes:	5
Maximum Cable Length:	See section B.3.4 Link Length Constraints for LX1500 SCRAMNet Port Cards, page B-24.
Power Consumption:	5.5 Watts (1.1 Amps at 5 Volts)
Operating Temperatures:	0 to 70 C
Storage Temperatures:	-40 to 85 C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Optical Connector:	ST (bayonet)
Auxiliary Connector:	3-pin header, .025 in. square posts
Media:	62.5/125µm multimode fiber (two pairs per port)

B.3.3 SCRAMNet Coax Port Card

The SCRAMNet Coax Port Card interfaces two SCRAMNet ports to the LX1500. Each SCRAMNet port uses two LX1500 channels, so the 32x32-channel LX1500 can route up to 16 SCRAMNet ports.

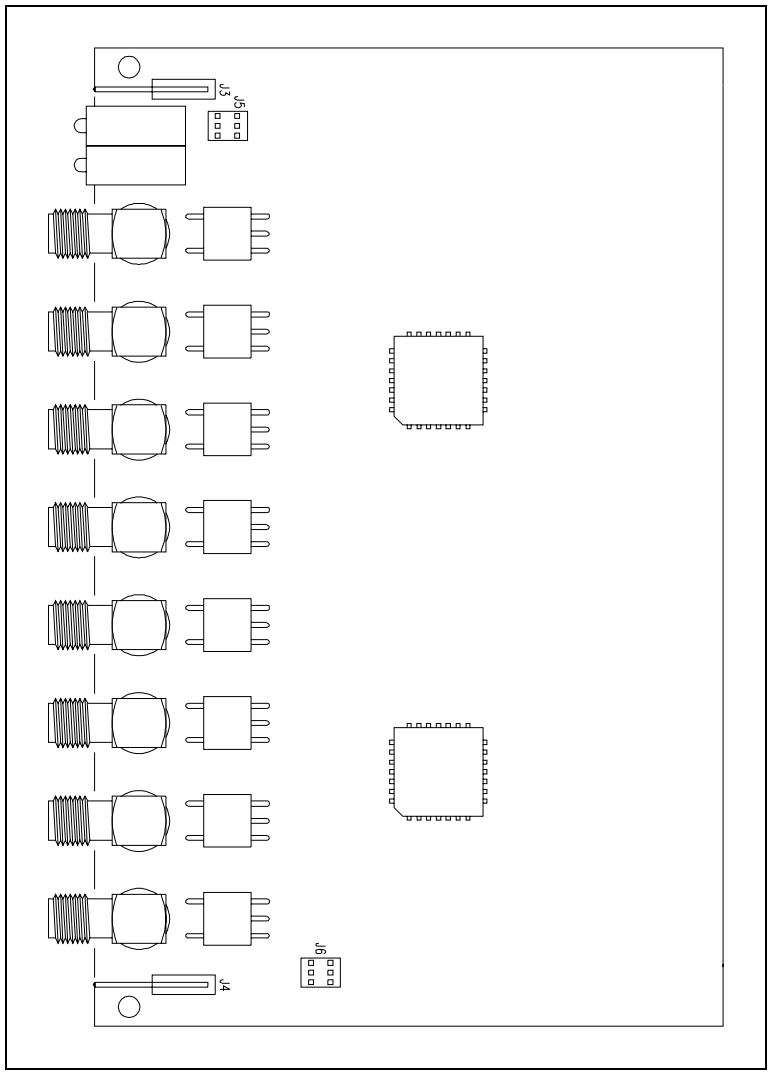

Figure B-11 SCRAMNet Coax Port Card

FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500 port card slot
- Compatible with SCRAMNet+ or SCRAMNet Classic nodes

AUXILIARY CONNECTORS

In addition to the high-speed data lines, a SCRAMNet node may be connected to an LX1500 port by the associated Auxiliary Connector. If the node is connected but it is not powered up or it is in loopback mode, the Auxiliary connector forces the LX1500 port

into the *inactive* state. If the port is not forced inactive by the Auxiliary connector and both of that port's receivers are detecting a signal, the LX1500 considers that port to be *active*. The LX1500 can be programmed to automatically switch a port (for example, into or out of a ring) depending on its active or inactive status.

If nothing is attached to the Auxiliary Connector, the associated port is not forced inactive, and its active/inactive status depends on the presence of signals at its two receivers.

FRONT PANEL:

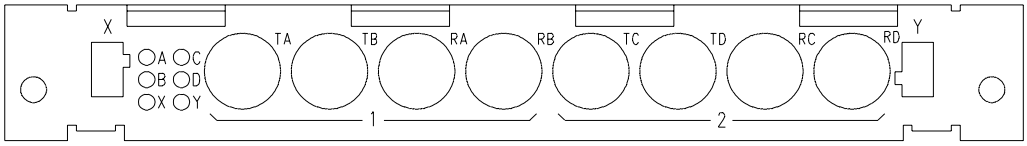

Figure B-12 SCRAMNet Coax Faceplate

CONNECTORS

TA, TB	Transmitter pair for port 1
RA, RB	Receiver pair for port 1
TC, TD	Transmitter pair for port 2
RC, RD	Receiver pair for port 2
X	Auxiliary connector for port 1
Y	Auxiliary connector for port 2

LEDS

A	Indicates presence of signal at RA
B	Indicates presence of signal at RB
C	Indicates presence of signal at RC
D	Indicates presence of signal at RD
X	Indicates that Auxiliary connector X allows port 1 to be active
Y	Indicates that Auxiliary connector Y allows port 2 to be active

The LX1500 considers a port "active" when LEDs A, B, and X (for port 1) or C, D, and Y (for port 2) are lit.

ISOLATION JUMPERS:

The coax cable connectors are transformer-coupled to the card. By default this is the only connection between the LX1500 and cables. This results in a very high common-mode rejection and no ground loops between systems.

A jumper header is provided to independently modify the grounding for each port (J5 for port 1; J6 for port 2). A jumper in each header may be set as shown in Table B-1:

Table B-1 Isolation Jumper Modes

Position	Mode
1	Isolate (default)
2	Connect to LX1500 common
3	Connect to LX1500 chassis

PHANTOM POWER:

SCRAMNet coax node cards are capable of providing phantom power to each other through the coax cables. The SCRAMNet Coax Port Card neither uses nor sources this power. However, each port will allow power to pass between the nodes connected to it. Phantom power is not shared between the two ports on a card or with any other card in the LX1500.

OPERATING CONSTRAINTS:

Maximum Switch Passes:	5
Maximum Cable Length:	See section B.3.4 Link Length Constraints for LX1500 SCRAMNet Port Cards, page B-24.
Power Consumption:	1.5 Watts (0.3 Amps at 5 Volts)
Operating Temperatures:	0 to 70 C
Storage Temperatures:	-40 to 85 C
Operating Humidity:	5% to 95% (noncondensing)
Storage Humidity:	0% to 95% (noncondensing)

INTERFACE DESCRIPTION:

Optical Connector:	SMA
Auxiliary Connector:	3-pin header, .025 in. square posts
Media:	50Ω coax cable (two pairs per port)

B.3.4 Link Length Constraints for LX1500 SCRAMNet Port Cards

SCRAMNet networks built using the LX1500 and its SCRAMNet Port Cards are subject to the following three constraints:

1. *LX1500 Switch Passes:* The path from one SCRAMNet node to another must pass through an LX1500 no more than five times.
2. *Maximum link length:* The length of any single link, from node to LX1500 port or from LX1500 port to LX1500 port, must be no more than the normal SCRAMNet link limits:

Table B-2 Maximum Cable Length

Medium	Maximum link length
Coax	30 meters
Standard link fiber	300 meters
Long-link fiber	3500 meters

3. *Maximum total path length:* For each link the signal passes through in its path from one node to another, multiply the length of that link in meters by the appropriate constant:

Table B-3 Maximum total path length

Medium	Multiplier
Coax	1.0
Standard link fiber	0.1
Long-link fiber	0.012

The sum of these products over the path of the node must not exceed 60.

EXAMPLES

Figure B-13 shows a signal path from SCRAMNet node 1 through three LX1500 boxes to SCRAMNet node 2. Each link of this path is an equal-length pair of fiber or coax cables. The signal passes through an LX1500 three times, so the first constraint is met. The other constraints may or may not be met, depending upon the type and length of the links.

Example 1: L1 = 280 m standard-link fiber
L2 = 1 m coax
L3 = 1 m coax
L4 = 280 m standard-link fiber
All links are below their individual limits and the total-path-length sum is 58. This path is legal.

Example 2: L1 = 320 m standard-link fiber
L2 = 1 m coax
L3 = 1 m coax
L4 = 240 m standard-link fiber
Same sum as Example 1, but Link 1 is too long.

Example 3: L1 = 300 m standard-link fiber

L2 = 1 m coax
L3 = 1 m coax
L4 = 300 m standard-link fiber

All links are below their individual limits, but the total-path-length sum is too large at 62.

Example 4: L1 = 20 m coax

L2 = 20 m coax
L3 = 20 m coax
L4 = 20 m coax

All links are below their individual limits, but the total-path-length sum is too large at 80.

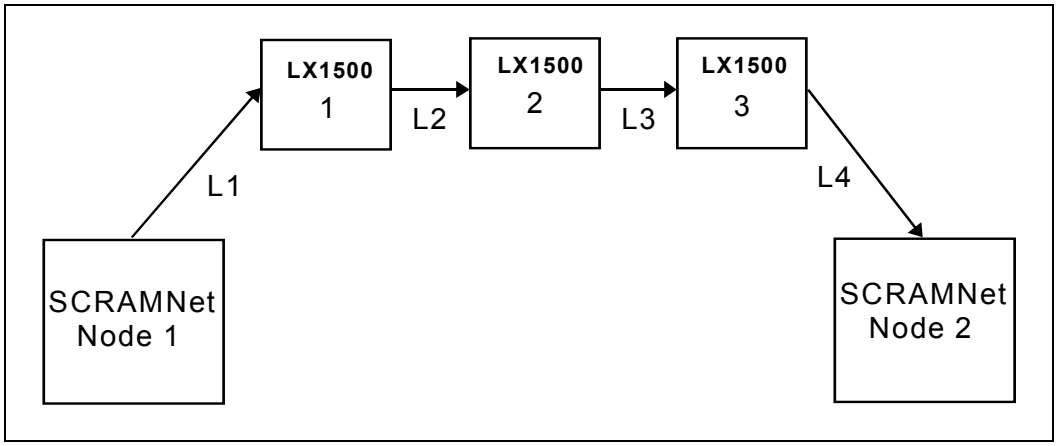

Figure B-13 SCRAMNet/LX1500 Signal Path

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APPENDIX C

RS-232 CABLES

TABLE OF CONTENTS

FIGURES

TABLES

C.1 Introduction

The LX1500 receives commands and issues status messages through its RS-232 serial port. The port can be connected to a VT-100 compatible terminal, a computer emulating such a terminal, or a modem. Where multiple LX1500s are to be controlled, each LX1500 serial port must be cabled to a separate controlling port.

C.2 Connector Pinouts

Figure C-1 shows the pin numbering of several connectors that are often used with RS-232. The LX1500 Base Unit uses an RJ-45 connector. (For the RJ-45 connector shown in Figure C-1, the pins are numbered as they would be seen looking at the end of a cable.) The LX1500 rack-mountable enclosure uses male DB-9 connectors, as do the serial ports on many personal computers. Most modems with serial ports use female DB-25 connectors. Terminals traditionally use male DB-25 connectors, but not all terminals observe the tradition.

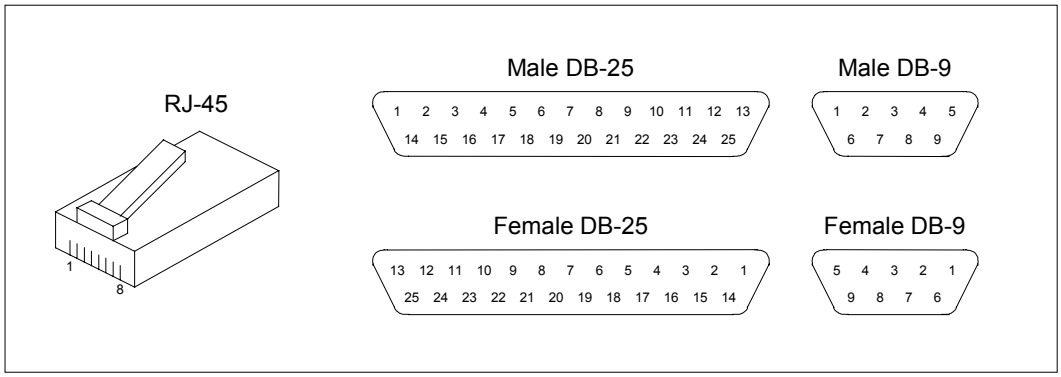

Figure C-1 RS-232 Connector Pinouts

C.3 LX1500 Pin Assignments

Table C-1 shows the signals assigned to each pin for the two RS-232 connectors used by the LX1500. The "Direction" column indicates the signal direction at the LX1500. The LX1500 DB-9 pinout is the same as on the DB-9 serial connectors commonly found on personal computers, with the exception that the LX1500 doesn't use the DSR (Data Set Ready) or RI (Ring Indicator) input signals.

Table C-1 LX1500 Pin Assignments

Signal	Direction	RJ-45 Pin	DB-9 Pin
TxD	out	5	3
RxD	in	4	2
RTS	out	7	7
CTS	in	2	8
GND		3, 6	5
DCD	in	8	1
DTR	out	1	4

The current version of the controller software embedded in the LX1500 just pays attention to TxD and RxD, so it is only really necessary to wire TxD, RxD, and GND for a bare-bones serial connection. Inputs CTS and DCD are ignored by the LX1500. The

LX1500 drives outputs RTS and DTR high ("ON") in case those logic levels are required by the serial ports they are connected to.

C.4 Cable Connections

C.4.1 Computers and Terminals

The null modem cable shown in Figure C-2 can be used to connect the LX1500 DB-9 connector to a personal computer's DB-9 serial port.

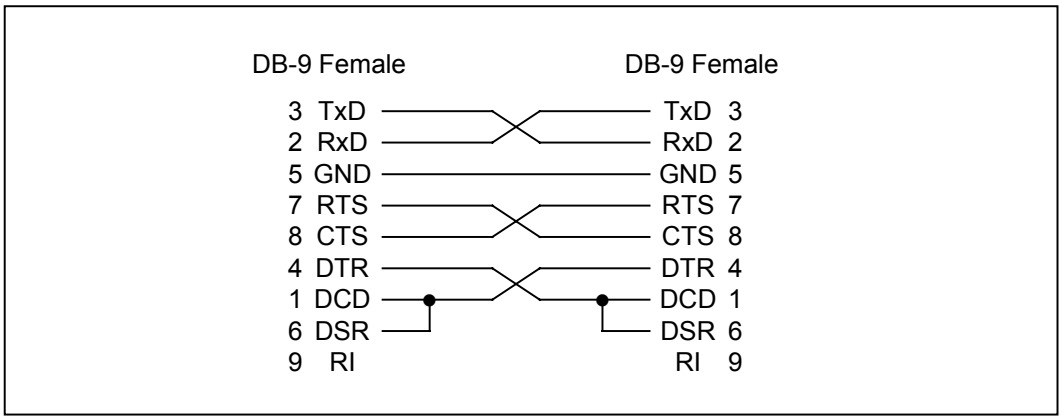

Figure C-2: DB-9 to DB-9 Null Modem Cable

The similar cable shown in Figure C-3 can be used to connect the LX1500 to a terminal that uses the traditional Male DB-25 connector and pin assignments.

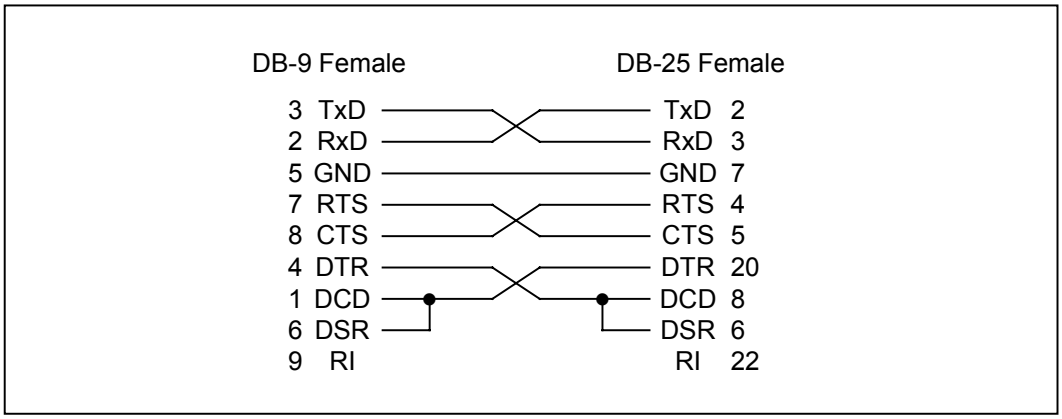

Figure C-3: DB-9 to DB-25 Null Modem Cable

Both of these cables are widely available off the shelf.

C.4.2 Modems

For connection to a modem, an off-the-shelf "straight through" (non-null modem) DB-9 to DB-25 cable, as shown in Figure C-4, may be used. This is also available off the shelf – it's the same cable that would be used to connect a personal computer's DB-9 serial port to an external modem.

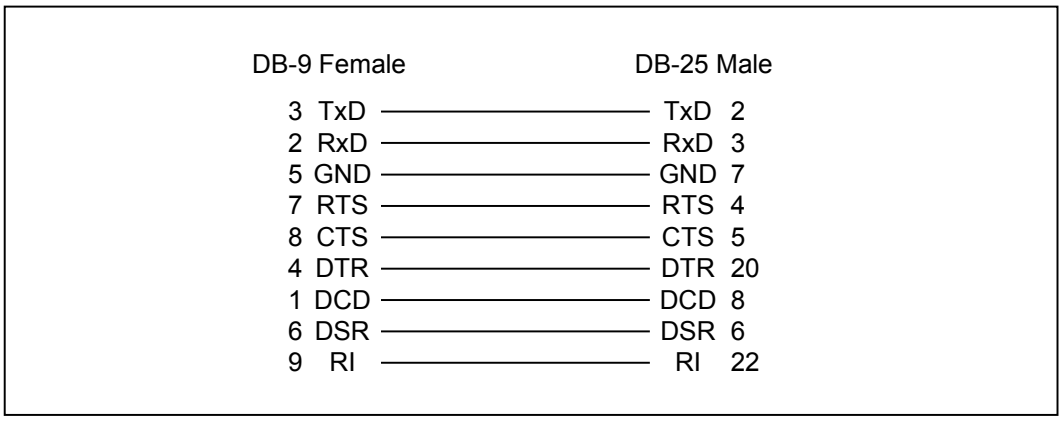

Figure C-4: DB-9 to DB-25 "Straight Through" Cable

C.4.3 Connecting to the Base Unit

Wiring to the RJ-45 jack on the LX1500 Base Unit requires a custom-built cable. A cable wired as shown in Figure C-5 produces the same pinout at the DB-9 connector as is used on the rack-mountable enclosure. From there, standard cables can be used as above.

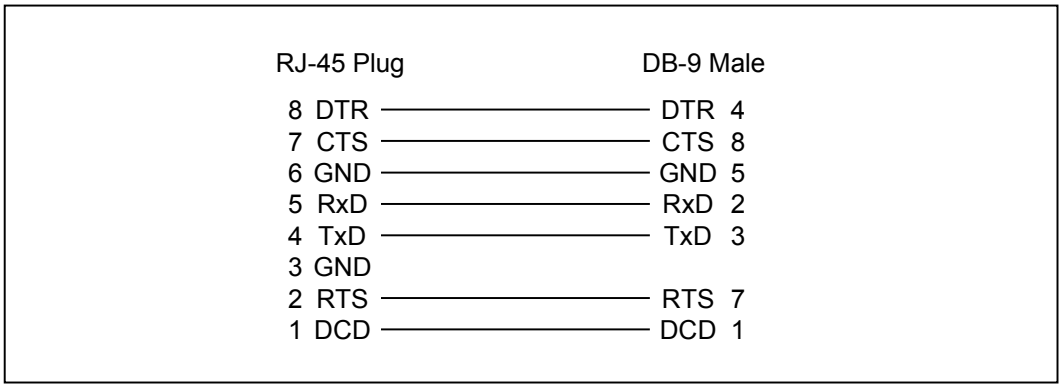

Figure C-5: RJ-45 Plug to DB-9 Male Cable

A cable wired as shown in Figure C-6 would allow the LX1500 Base Unit to be cabled directly to the DB-9 male serial port of a personal computer.

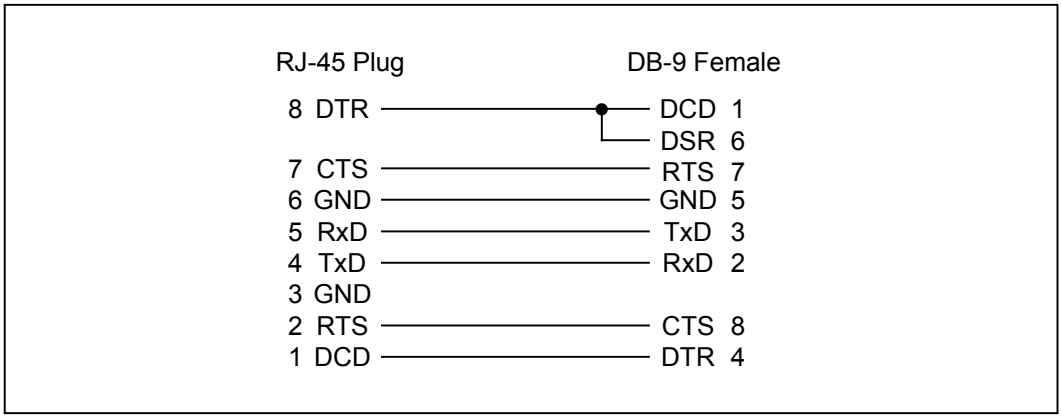

Figure C-6: RJ-45 Plug to DB-9 Female Cable

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APPENDIX D

ORDERING INFORMATION

TABLE OF CONTENTS

D.1 Order Numbers

Systran offers the LX1500 products listed below.

D.1.1 LX1500 Units

The LX1500 is available as the bare Base Unit, or as one or two units installed in a rack-mountable enclosure. For each LX1500 part number, the "xxxxxxxx" field specifies the port cards that are to be installed in the LX1500'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 table below.

Order Number	Description
FHS1-xxxxxxxx-00	LX1500 Base Unit
FHS1-xxxxxxxx-10	One base unit in rack-mountable enclosure
FHS1-xxxxxxxx-11	Second base unit in rack-mountable enclosure (must be ordered with FHS1-xxxxxxxx-10)

D.1.2 LX1500 Port Cards

Port cards can be ordered separately or as part of the LX1500 unit (see above).

Order Number	x	Description
FHSA-S14MW000-00	A	Retimed Short Wavelength Optical Port Card
FHSB-S14C3000-00	B	Retimed 1x3 Copper Port Card
FHSC-S14MW000-00	C	Non-Retimed Short Wavelength Optical Port Card
FHSD-S14C3000-00	D	Non-Retimed 1x3 Copper Port Card
FHSE-S11SL000-00	E	SCRAMNet+ Standard Link Optical Port Card
FHSF-S11LL000-00	F	SCRAMNet+ Long-Link Optical Port Card
FHSG-S11CL000-00	G	SCRAMNet+ Coax Port Card
FHSH-S14SW000-00	H	Retimed Long Wavelength Optical Port Card
FHSK-S14HS000-00	K	Retimed HSSDC Copper Port Card

D.2 Cables

Systran offers the following cables for use with its LX1500 port cards:

D.2.1 Short Wavelength: Multimode Optical Fiber

Duplex, 50/125µm multimode fiber optic cables with dual SC connectors, for use with the short wavelength laser media interface.

Order Number	Description
FHAC-M2SC3000-00	3m duplex cable
FHAC-M2SC5000-00	5m duplex cable
FHAC-M2SC1001-00	10m duplex cable
FHAC-M2SC2001-00	20m duplex cable
FHAC-M2SC3001-00	30m duplex cable
FHAC-M2SCxxxx-00	Custom duplex cable (call your sales representative for details)

D.2.2 Long Wavelength: Singlemode Optical Fiber

Duplex, 9/125µm single-mode fiber optic cables with dual SC connectors, for use with the long wavelength laser media interface.

Order Number	Description
FHAC-S2SC3000-00	3m duplex cable
FHAC-S2SC5000-00	5m duplex cable
FHAC-S2SC1001-00	10m duplex cable
FHAC-S2SC2001-00	20m duplex cable
FHAC-S2SC3001-00	30m duplex cable
FHAC-S2SCxxxx-00	Custom duplex cable (call your sales representative for details)

D.2.3 HSSDC Copper: 150 Ω Shielded Quad Cable

Duplex, shielded quad cable with HSSDC connectors, for use with the HSSDC copper media interface.

Order Number	Description
FHAC-Q2HS1000-00	1m duplex cable, equalized
FHAC-Q2HS3000-00	3m duplex cable, equalized
FHAC-Q2HS5000-00	5m duplex cable, equalized
FHAC-Q2HS1001-00	10m duplex cable, equalized
FHAC-Q2HS2001-00	20m duplex cable, equalized
FHAC-Q2HS2501-00	25m duplex cable, equalized
FHAC-Q2HS3001-00	30m duplex cable, equalized
FHAC-Q2H95000-00	5m duplex cable, HSSDC to 9-pin D-sub
FHAC-Q2H35000-00	5m duplex cable, HSSDC to two 1x3 connectors

D.2.4 1x3 Copper: 150 Ω Twinaxial Cable

Simplex, shielded twinaxial cable with 1x3 connectors, for use with the 1x3 copper media interface.

Order Number	Description
FHAC-G13D4000-00	4m simplex cable
FHAC-G13D1001-00	10m simplex cable
FHAC-G93T4000-00	4m duplex cable, two 1x3 connectors to 9-pin D-sub

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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 ---------- Application Programming 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 which transfers data in small 53-byte packets and permits transmission over long distances. Proposed speeds range from 25 Mbps to 622 Mbps.

autobaud ---------- The process used by the LX1500 to determine the baud rate being used by the connected terminal.

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 which provide 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.

CDB ---------- Command Descriptor Block.

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---------- One of most widely used shared networking technologies (40% of LAN market, provides 10 Mbps of bandwidth).

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.

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

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

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

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

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

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

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

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

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

JBOD ---------- Just a Bunch Of Disks.

kB---------- KiloBytes.

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.

Loop ID---------- A unique 8 bit address assigned to each node in the loop table.

Loop table---------- A table containing information on all nodes the adapter can currently communicate with.

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

LUN ---------- Logical Unit Number.

LX1500---------- LinkXchange LX1500 Managed Hub (formerly LinkXchange Network Transparent Switch).

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

MB/s---------- 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, so have high overhead. Networks also operate in an environment of unanticipated connections. One problem with using a network is its inability 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, work station 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 NTS, a method of issuing switch commands that does not use any bandwidth of the 32 switch ports. On the LX1500, this is done using an RS-232 connection.

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.

Port ID---------- A unique 24 bit address assigned to each Fibre Channel node connected using an arbitrated loop or switched topology.

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.

RAID---------- Redundant Array of Independent Disks.

RISC ---------- Reduced Instruction Set Computer. A type of microprocessor that executes a limited number of instructions which 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.

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.

station management---------- Each node must be able to recognize error conditions on the network and provide error management needed to recover from them.

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 w/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.

WWN ---------- Short for World Wide Name. Unique 64 bit number assigned to a Fibre Channel host bus adapter.

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