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# LX1500e Crossbar Switch Hardware Reference Manual

Document No. F-T-MR-LX1500E#-A-0-A3

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Revised: June 3, 2002

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# 1. INTRODUCTION

## 1.1 How to Use This Manual

### 1.1.1 Purpose

This manual introduces the LinkXchange LX1500e Crossbar Switch, referred to in this manual as the LX1500e, and describes how to unpack, setup, and operate the product.

### 1.1.2 Scope

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

### 1.1.3 Style Conventions

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

```
ls
file1           file2               file3
```

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

## 1.2 Related Information

- *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.
- *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.

- Fibre Channel Association - http://www.fibrechannel.com/
- Systran Corp. - http://www.systran.com/.

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Our Quality System addresses the following basic objectives:

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

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

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## 1.4 Technical Support

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.

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

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- E-mail: info@systran.com
- World Wide Web address: www.systran.com

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# 2. PRODUCT OVERVIEW

## 2.1 Overview

Systran's LX1500e is a multipurpose, non-blocking 32-port crosspoint switch for digital signals at speeds up to 1.5 gigabits per second (Gbps). Any of the 32 outputs can be connected to any one of the 32 inputs. The protocol or structure of data routed through the hub is ignored by the LX1500e and is unaltered by its passage through the hub. As a result, the LX1500e can be used with many different types of networks and signals to perform the following functions:

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

A single LX1500e 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 they will pass.

This manual only covers the LX1500e Crossbar Switch. See the *LinkXchange LX1500 Crossbar Switch Hardware Reference Manual* for information on the LX1500.

## 2.2 Features

The LX1500e has the following features:

- Up to 32 non-blocking 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.
- Laser on/off control.

## 2.3 Product Family

The LX1500e 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 LX1500e or ordered separately.

### 2.3.1 Rack-mountable LX1500e

The rack-mountable enclosure comes with one or two LX1500e units, as shown in Figure 2-1 and Figure 2-2. Each LX1500e unit has a control panel, power switch, and power supply. When two LX1500e units share an enclosure, they are independent—there is no interconnection between them.

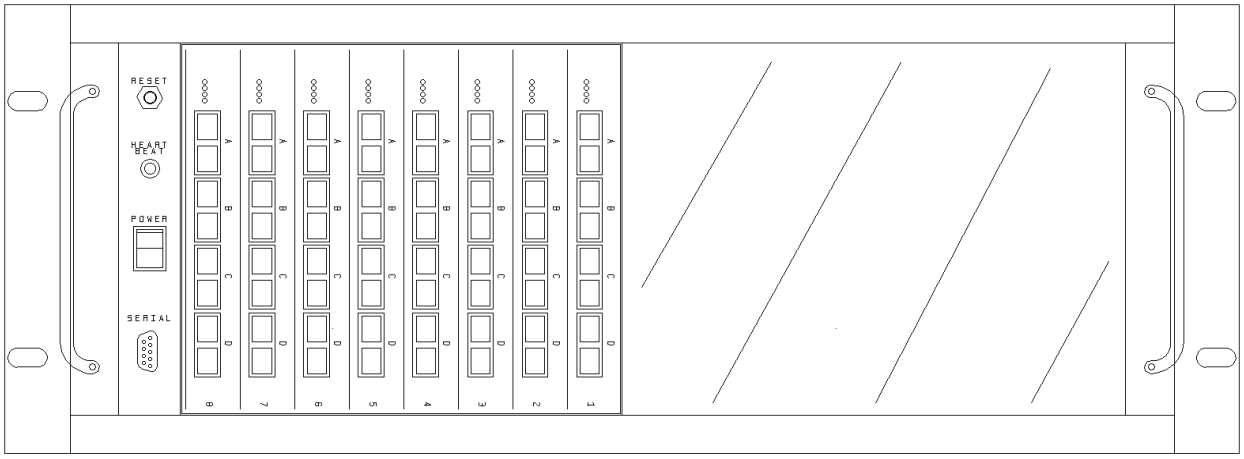



**Figure 2-1 Single LX1500e Unit in Rack-Mountable Enclosure**

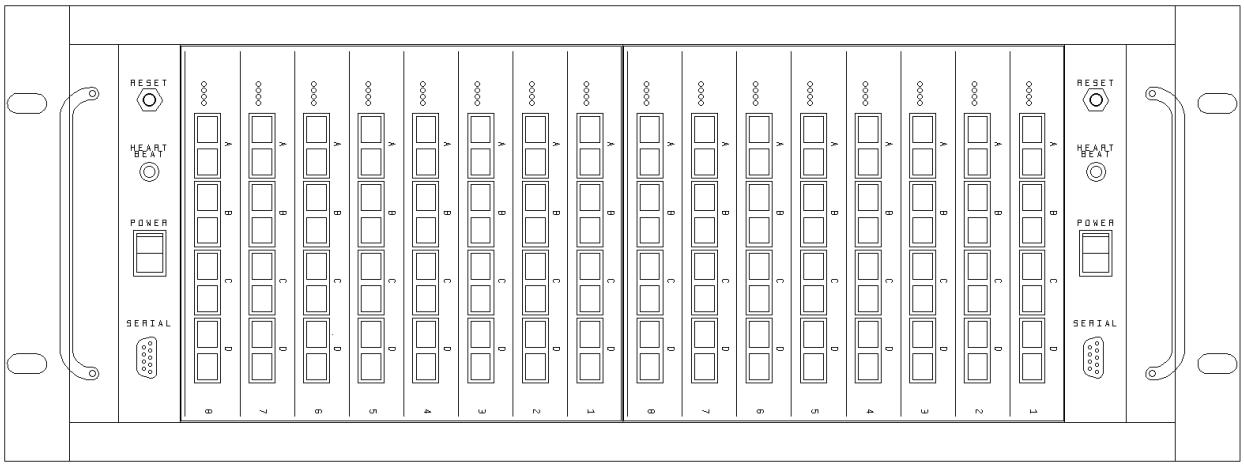



**Figure 2-2 Two LX1500e Units in Rack-Mountable Enclosure**

### 2.3.2 LX1500e Base Unit

The LX1500e base unit is mountable in any disk drive bay that will hold four “half-height” 5.25-inch disk drives.

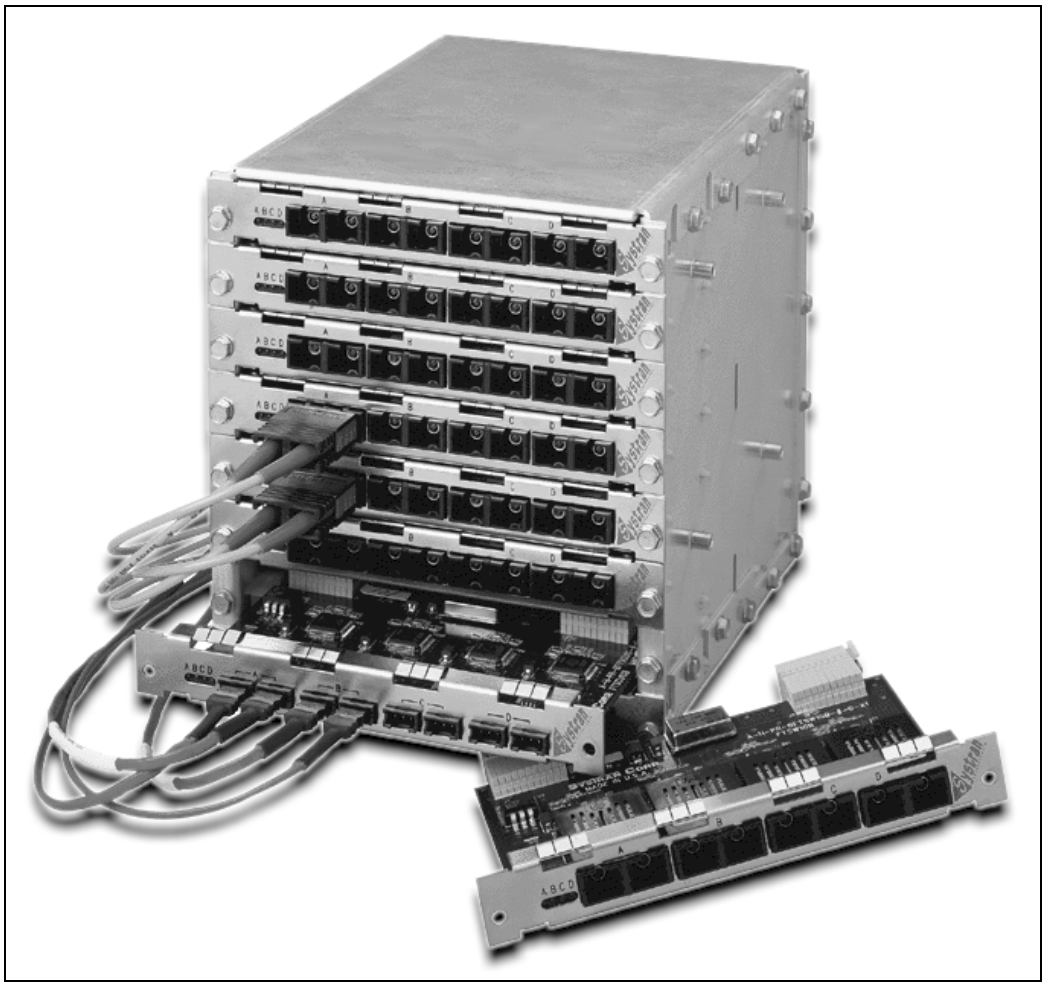


**Figure 2-3 LX1500e Base Unit with Eight Optical Port Cards**

### 2.3.3 Port Cards

The port cards currently available for use with the LX1500e are described in Appendix B.

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 Serial FPDP data 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 LX1500e is controlled through an RS-232 port separate from the 32 data ports. It provides a command line interface that allows you to configure and receive status information from the LX1500e. 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).
- Automatic restoration of the last configuration at power up.
- No user intervention required at startup.
- Two saved configurations.
- Laser on/off control for each port on Fibre-Channel-compatible optical type port cards.

See chapter 5 for a detailed description of this user interface.

In addition to the RS-232 interface, the LX1500e has a “Heartbeat” indicator, which flashes periodically to indicate that the LX1500e’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 LX1500e is by a local VT-100 compliant terminal (or a computer emulating such a terminal) connected to the LX1500e with an RS-232 cable. Connecting a terminal to the LX1500e allows a network administrator to quickly configure or check the status of the LX1500e.

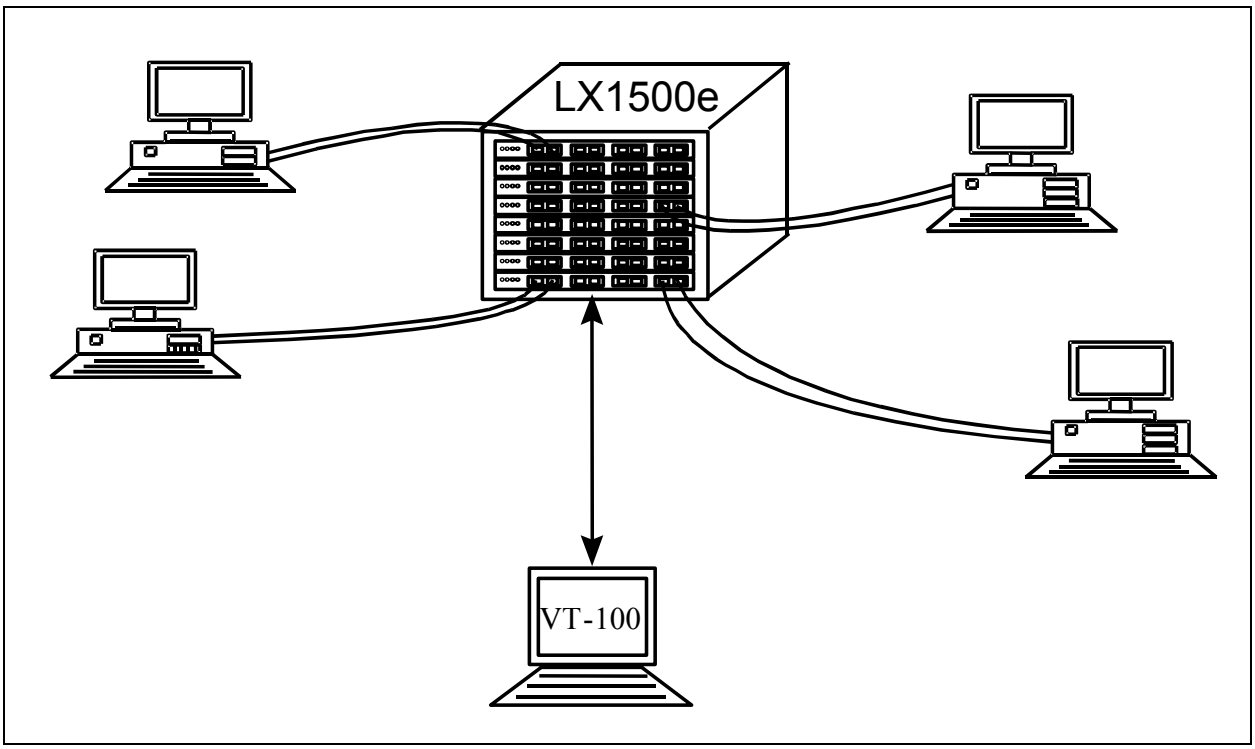



**Figure 2-4 Network Hub With Local Control**

## 2.5.2 Remotely Controlled Network Hub

To allow for multiple remote access points, a modem can be connected to the LX1500e RS-232 port. This allows control of the LX1500e from multiple locations and with no distance limitation. An example of an LX1500e network configuration with multiple control access points is presented in Figure 2-5.

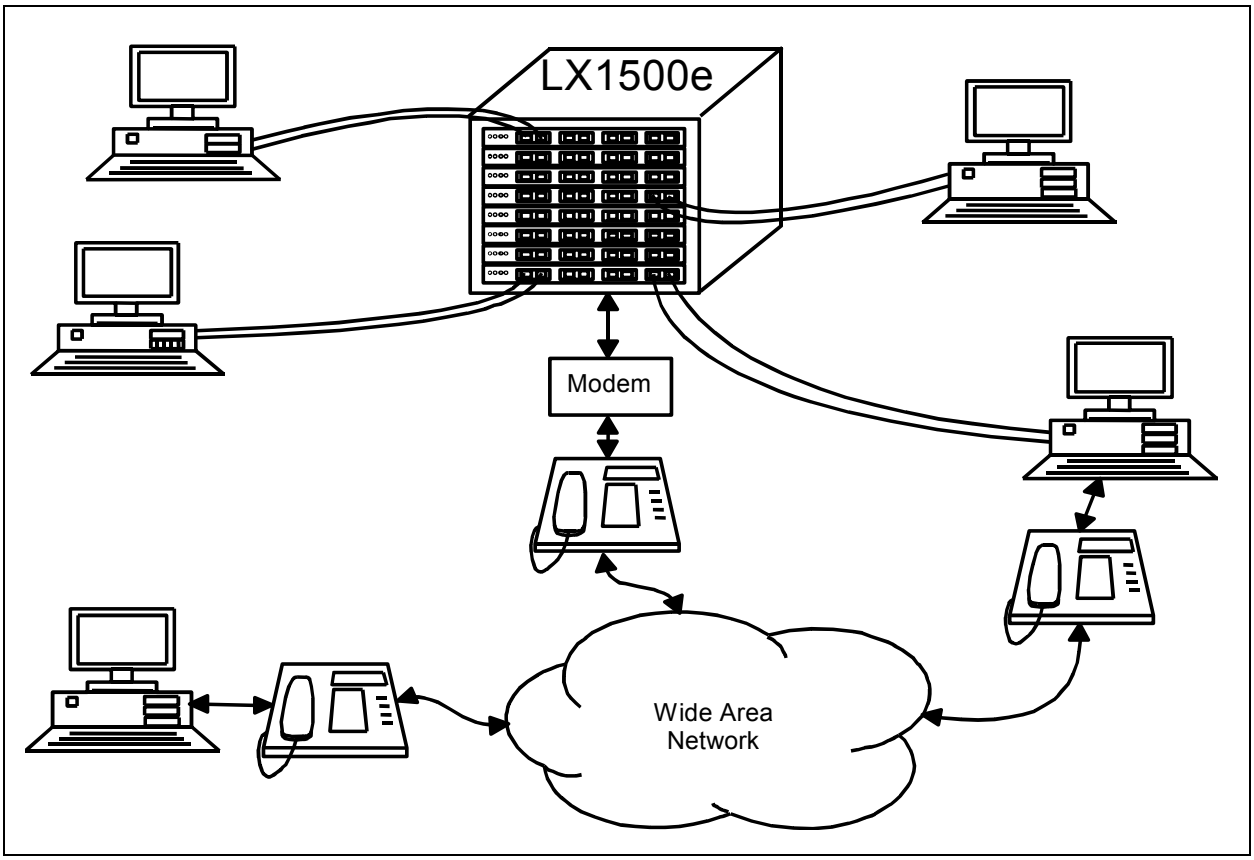



**Figure 2-5 Remotely Controlled LX1500**

## 2.5.3 Unattended Network Hub

The LX1500e 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 LX1500e 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 LX1500e as a Fibre Channel arbitrated loop hub provides a system with more stability and improves your ability to troubleshoot problems and make topological changes. Once the initial cabling is in place, the LX1500e 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 Configuring For More Than 32 Ports

Multiple LX1500e units can be cascaded together for applications requiring more than 32 ports. Figure 2-6 shows six 32-port LX1500e units combined to form a non-blocking 64-port crosspoint switch. This setup requires a maximum of three passes to perform point-to-point and loop configurations, and five passes to achieve multicast configurations.

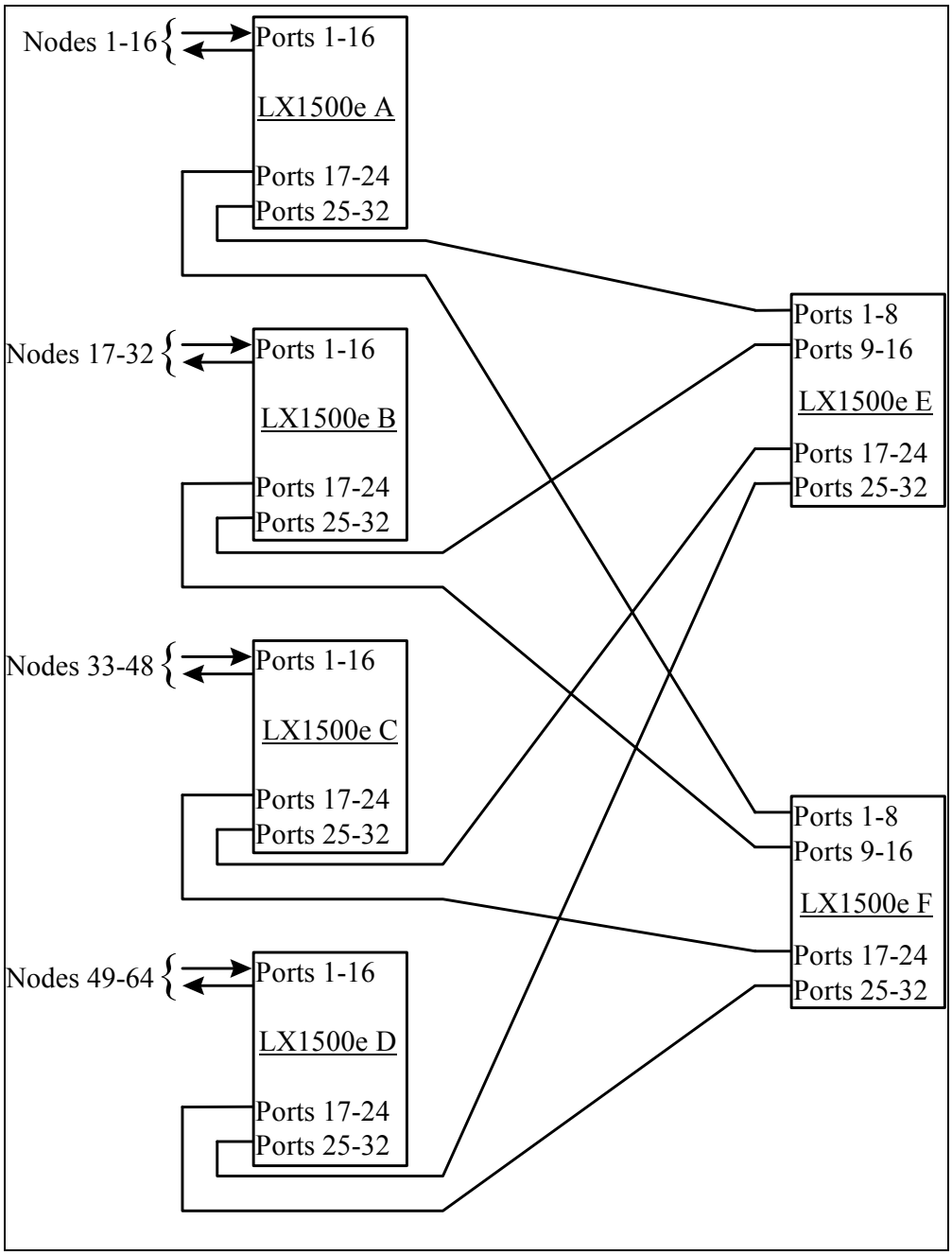



**Figure 2-6 A 64-Port Crosspoint Switch Using Multiple LX1500e Units**

A topology consisting of one large loop of more than 32 ports can be constructed very efficiently using the LX1500e.

Figure 2-7 shows four LX1500e units cascaded to form a 124-port switch. This topology is useful for forming very large arbitrated loop topologies.

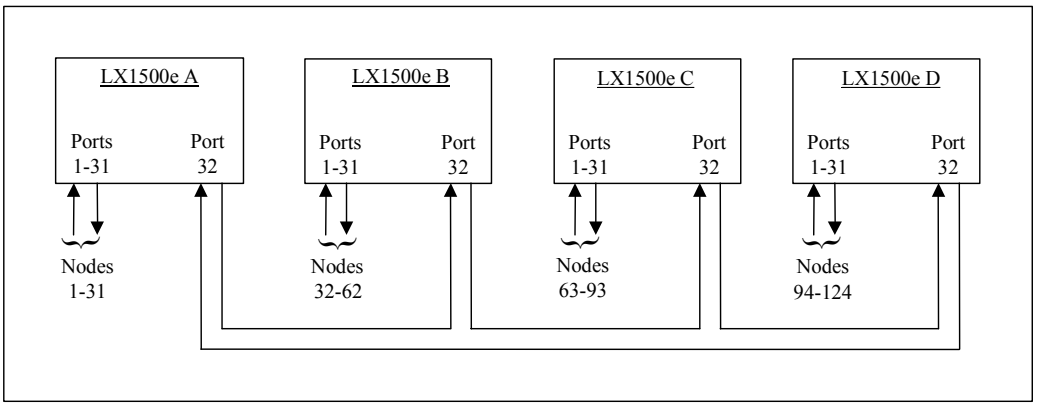



**Figure 2-7 Loop Architecture with 124 Nodes Using Multiple LX1500e Units**

# 3. INSTALLATION

## 3.1 Overview

The LX1500e and components can be shipped in a variety of configurations, including:

- Single LX1500e in rack-mountable enclosure.
- Dual LX1500e in rack-mountable enclosure.
- LX1500e base unit.
- Port cards shipped separately from the LX1500e.

## 3.2 Installation of the Rack-Mountable LX1500e

### 3.2.1 Mount the LX1500e

The rack-mountable LX1500e 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 airflow is not blocked.

Follow the steps below to unpack the single or dual rack-mountable LX1500e:

1. Remove the LX1500e from the carton.
2. Visually inspect the LX1500e. If the LX1500e was damaged in shipping, notify Systran or your supplier immediately.
3. Slide the LX1500e into the 19-inch equipment rack and secure it with screws (not included) or place it on a tabletop.
4. Connect the RS-232 cables and power to the LX1500e as described in the following sections.
5. In the unlikely event that you should need to return your LX1500e, please save the original shipping materials for this purpose.

### 3.2.2 Connect the RS-232 Cable(s) and Power Cord(s)

Each LX1500e 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 LX1500e. For cabling details, refer to Appendix C.

Each LX1500e unit requires its own power source. In a single rack-mountable LX1500e enclosure only the power supply nearer the center of the rear panel needs to be configured. A dual rack-mountable LX1500e enclosure needs both power supplies configured. Set the voltage selection switch(es) to 115 or 230 volts as appropriate for your local power. Attach the supplied cord(s) to the power supply(ies) and plug the cord(s) into an electrical outlet.

### 3.2.3 Apply Power

Turn on each LX1500e 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.

# 3.3 Installation of the LX1500e Base Unit

## 3.3.1 Install the LX1500e Base Unit into Enclosure



**CAUTION**: Exercise care regarding the static environment. An anti-static mat connected to a wristband should be used when handling or installing the LX1500e base unit. Failure to do this may cause permanent damage to the components.

Follow the steps below to unpack the LX1500e base unit:

1. Remove the LX1500e from the carton.
2. Visually inspect the LX1500e. If the LX1500e 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 LX1500e.
4. Connect the RS-232 cable, power, and any external connectors to the LX1500e as described in the following sections.
5. Slide the LX1500e unit into the enclosure.
6. Use eight 6-32 screws to secure the LX1500e inside the enclosure.
7. In the unlikely event that you should need to return your LX1500e, please keep the original shipping materials for this purpose.

The LX1500e base unit does not come with an enclosure, power supply, or external controls. You 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 LX1500e base unit. The panel has the following features:

**RS-232 Connector** ..... An RJ-45 jack for connection 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.

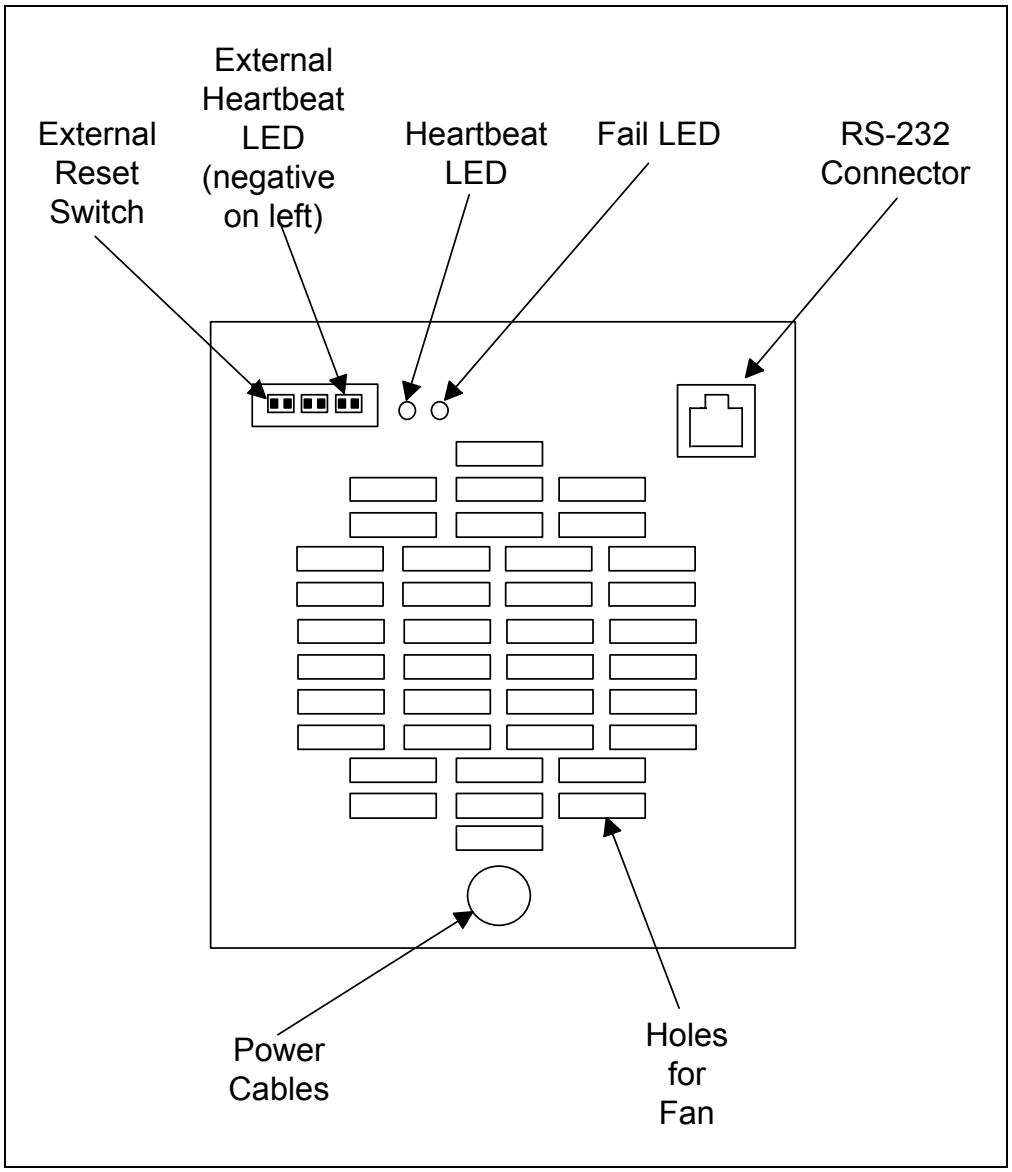



**Figure 3-1 Back View of LX1500e Unit**

### 3.3.2 Connect the RS-232 Cable

Each LX1500e 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 LX1500e. For cabling details, refer to Appendix C.

### 3.3.3 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 LX1500e connector is AMP part number 103956-1.

### 3.3.4 Connect the External Heartbeat LED (Optional)

If desired, connect an LED (not supplied) to the External Heartbeat connector. The mate to the LX1500e 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.

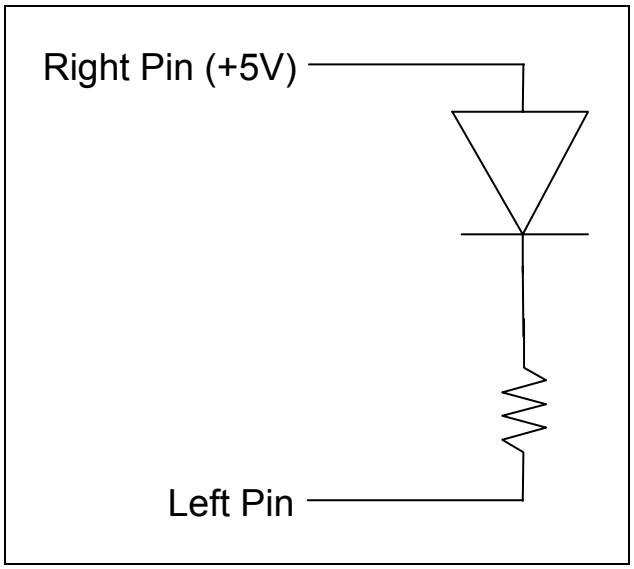



**Figure 3-2 External Heartbeat LED Circuit**

## 3.3.5 Connect Power to the LX1500e

Power must be connected to the LX1500e using the power cables at the rear of the LX1500e 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 through D 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 LX1500e. Four matching connectors are provided loose with the LX1500e for attachment to the power supply (Methode part number 2300-202-216). A standard hard-disk style power connector supplies +12 volts.

These steps describe how to connect a typical PC power supply to the LX1500e 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 LX1500e base unit.
4. Locate the four loose two-position power connectors that were packaged with the LX1500e 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 LX1500e power wires when the connectors are mated. Then close the cover of the connector down onto the wires with a pair of pliers.

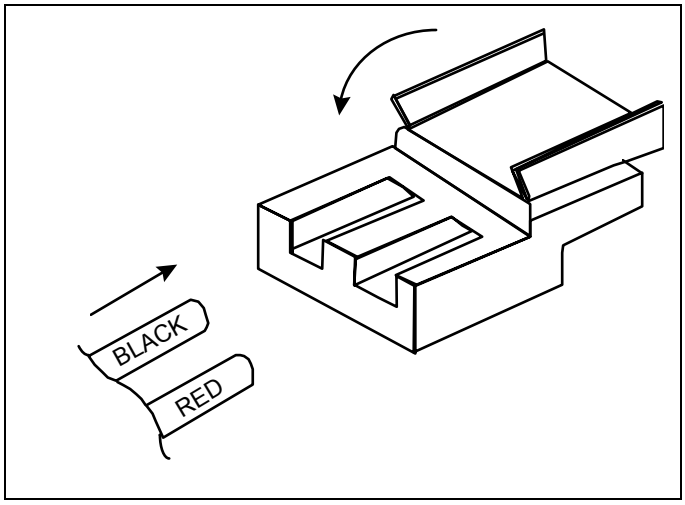



**Figure 3-3 LX1500e Power Wires**

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 LX1500e 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 LX1500e.



**CAUTION**: Incorrectly wired connectors can short-circuit the power supply and may cause damage to the power supply and/or the LX1500e!

10. Reconnect power to the power supply.

## 3.3.6 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.

## 3.4 Installing a Port Card

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 LX1500e unit.
8. Remove the LX1500e 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 LX1500e.
11. Secure the new port card with two screws.
12. Power up the LX1500e.

## 3.5 LX1500e Configuration

Chapter 5 describes how to configure the LX1500e using the RS-232 interface.

## 3.6 Troubleshooting

If the LX1500e does not boot correctly, double-check cable and power connections. If problems persist, contact Systran Technical Support at **(800) 252-5601** or **support@systran.com**.

Please be prepared to supply the following information:

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

## 3.7 Maintenance

No routine maintenance is required for the LX1500e Crossbar Switch.

# 4. OPERATION

## 4.1 Overview

This chapter describes the LX1500e structure, port connections and operational modes.

## 4.2 Structure of the LX1500e

A fully loaded LX1500e 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 LX1500e 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.

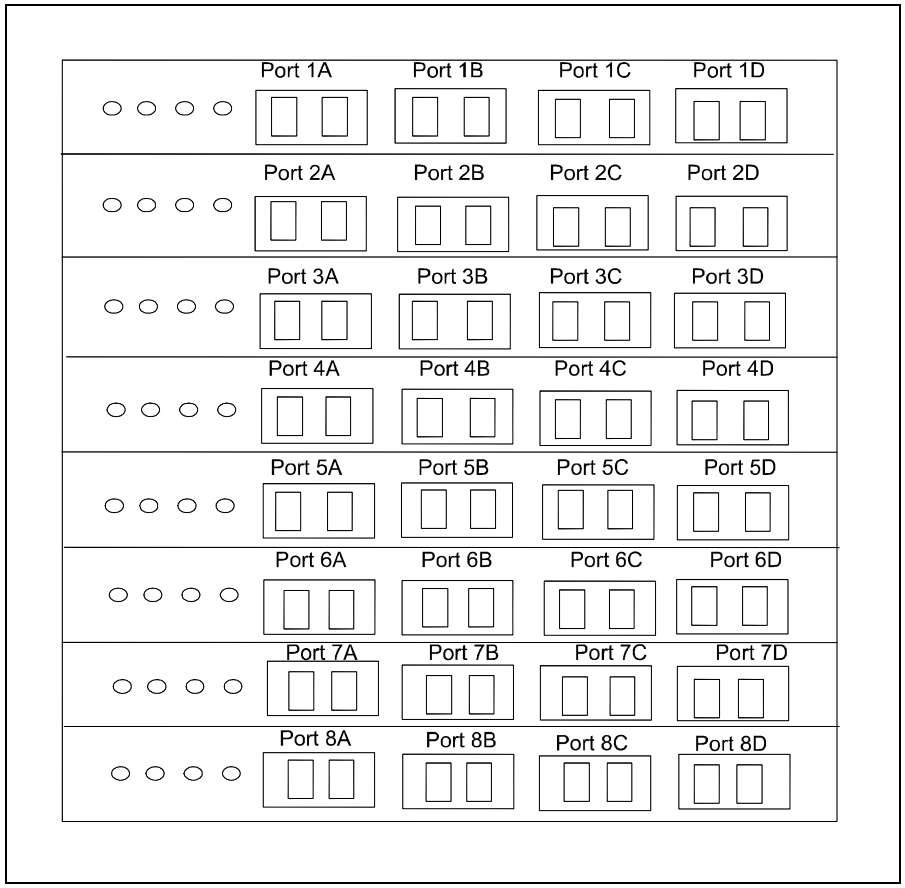



**Figure 4-1 LX1500e Port Numbering**

When in its rack-mountable enclosure, the LX1500e 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 LX1500e control panel on the rack-mountable enclosure. Each LX1500e has a separate control panel with RESET button, HEARTBEAT indicator, POWER switch, and SERIAL (RS-232) jack. For an enclosure with two LX1500e units, both power switches must be turned on to power both LX1500e's.

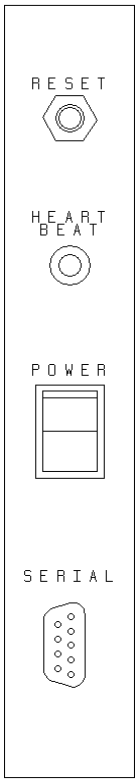



**Figure 4-2 LX1500e Control Panel**

## 4.3 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.

A port can be in one of four modes:

| | |
|---|---|
| Loop | Port is on a loop (requires a loop ID). |
| Copy | Port's output is connected to a specified input port. |
| 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. |



**NOTE:**

**SCRAMNet Modes**

SCRAMNet is Systran's proprietary, replicated shared-memory network. It provides a low-latency interface across many different computer busses. The LX1500e 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 LX1500e by combining ports into *port pairs*, (A,B) and (C,D). This allows 16 SCRAMNet nodes to be connected using the LX1500e.

LX1500e ports are configured into SCRAMNet modes using the `s` and `sl` commands. When an LX1500e 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.

The port mode does not change when the port state changes. Signal routing, however, may change. A special case is when the input signal is routed to the port's output. This is sometimes referred to as "wrap mode." This pseudo-mode might be the result of intentional configuration through Copy Mode or the auto-bypass (port-isolation) feature.

### 4.3.1 Wrap Pseudo-mode

A port in wrap pseudo-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.

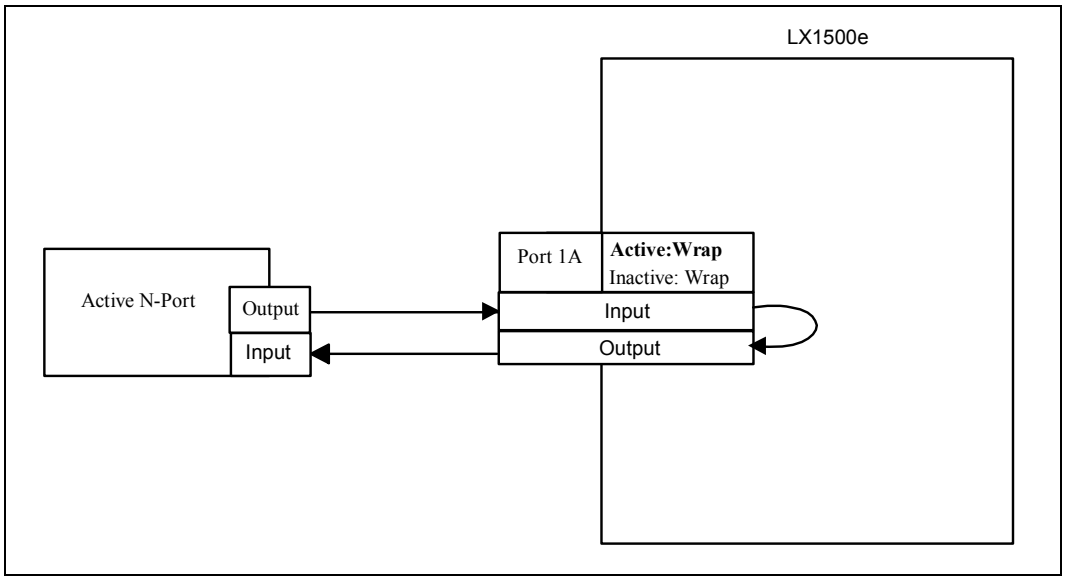



**Figure 4-3 A Port in Wrap Pseudo-Mode**

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

## 4.3.2 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.

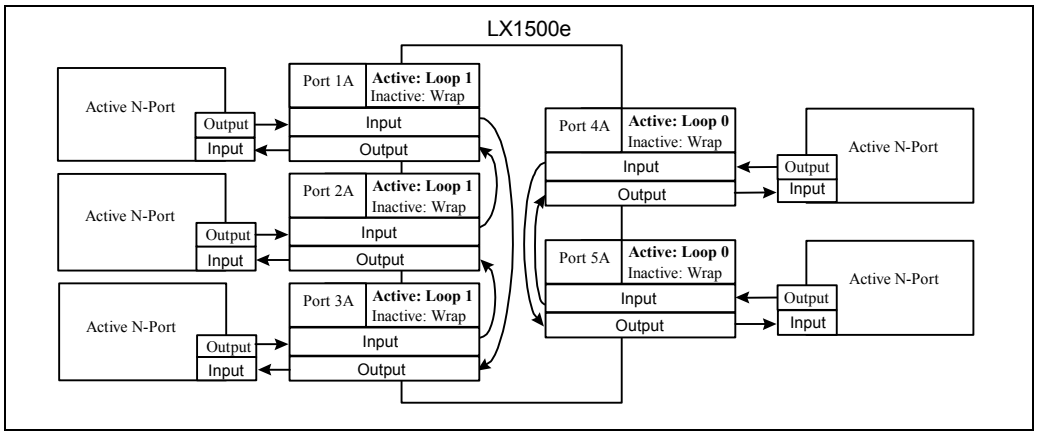



**Figure 4-4 Active Loop Ports**

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 by default is a wrap pseudo-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.

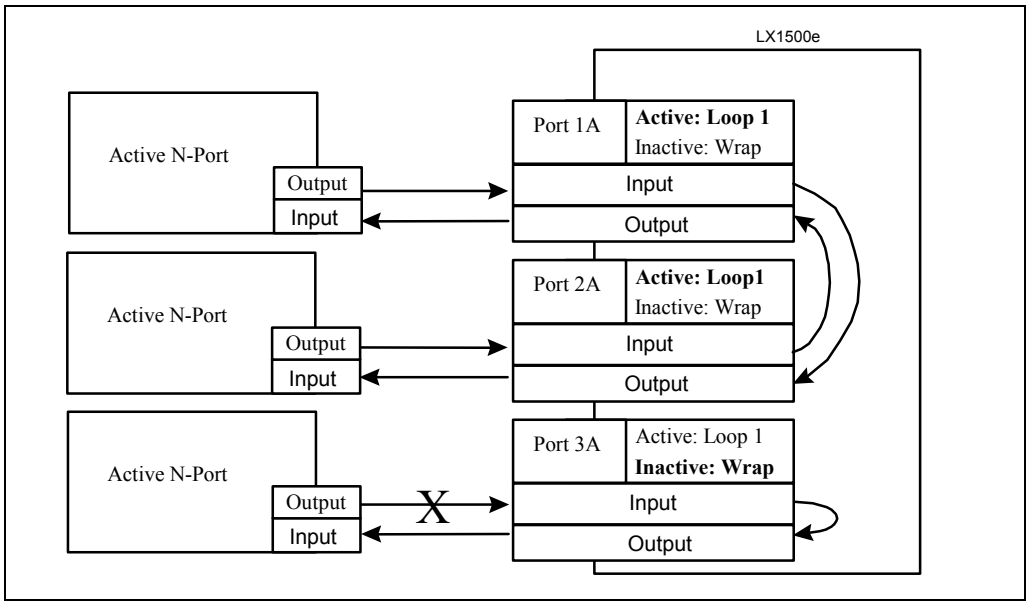



**Figure 4-5 A Loop With One Inactive Member**

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

## 4.3.3 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.

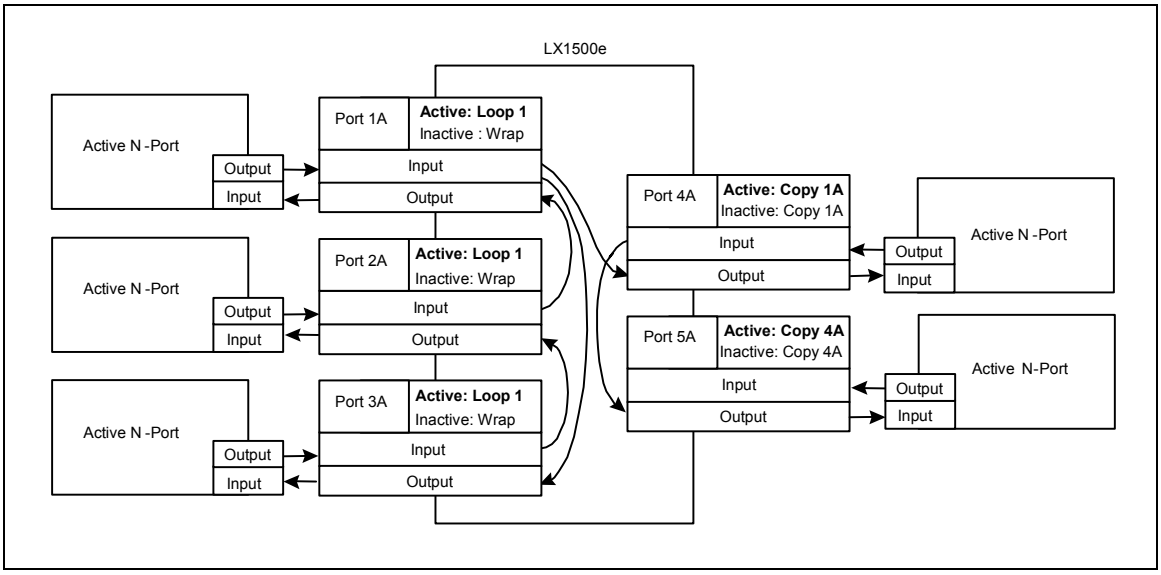



**Figure 4-6 Ports Configured as Copies**

## 4.3.4 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 LX1500e port pair (1A and 1B) connected to a SCRAMNet node and configured as a SCRAMNet wrap.

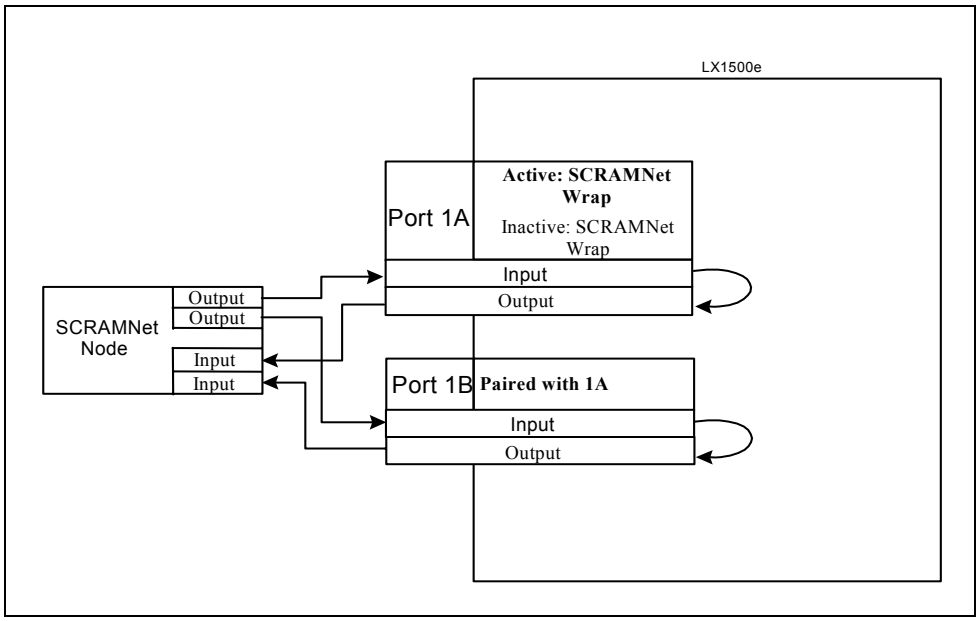



**Figure 4-7 Port Pair in SCRAMNet Wrap Mode**

### 4.3.5 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.

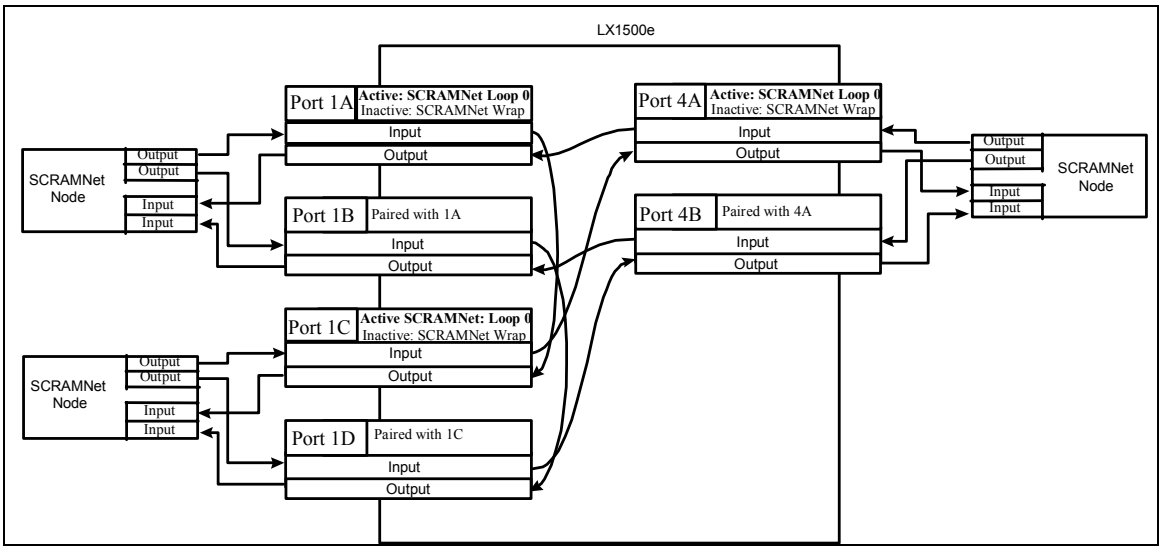



**Figure 4-8 SCRAMNet Loop**

### 4.3.6 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).

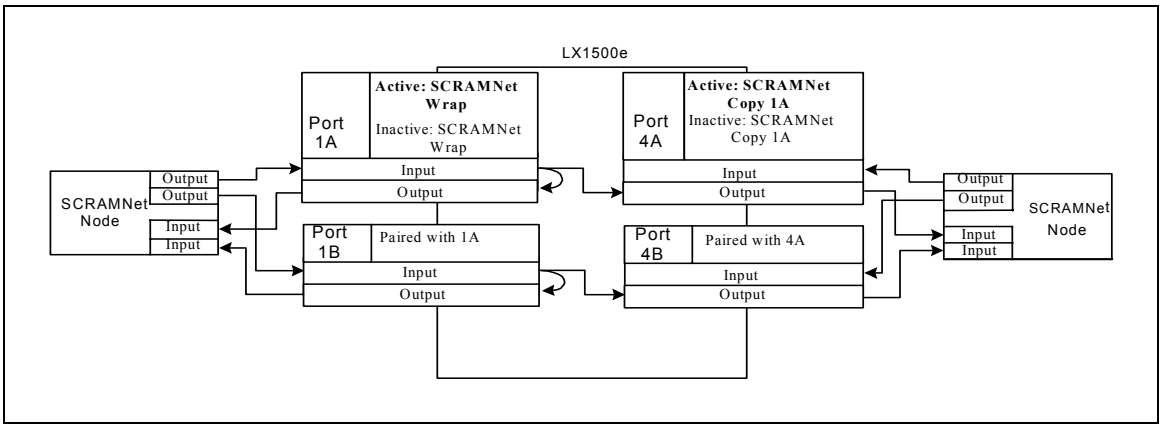



**Figure 4-9 SCRAMNet Copy**

## 4.4 Current and Saved Configurations

The LX1500e has two 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 LX1500e starts in the current configuration.

The current configuration can be saved into either of the two saved configuration banks.

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# 5. USER CONTROL INTERFACE

## 5.1 Overview

The LX1500e is configured through a command line interface. This chapter discusses how to connect to the LX1500e with a terminal and modem, as well as details on the LX1500e command set. For ease of reading, all LX1500e commands are typed in bold text.

## 5.2 Connecting a Terminal

In order to use the LX1500e you must use a VT-100 or equivalent terminal. The terminal is connected to the LX1500e's serial port via a RS-232 cable. Terminal bit rates of 9600, 19200, 38400, and 57600 bps are supported. However, although these multiple bit rates are supported, it is not necessary to manually set the LX1500e bit rate. The LX1500e can autobaud with the terminal after a few initiating key strokes.

Use the following steps to connect the terminal to the LX1500e:

1. Connect the terminal to the LX1500e using an RS-232 cable. (See Appendix C for connector pin definitions).
2. Turn on the power to the terminal.
3. Turn on the power to the LX1500e (if the LX1500e is already on, rebooting is not required).
4. Press 

several times to initiate the LX1500e to detect the new baud rate.

If successful, the LX1500e command line prompt should appear. This shows that the autobaud worked as expected. If not successful, you will not see any command line prompt and should restart the LX1500e and follow the steps above.

### 5.2.1 Connecting a Modem

To control the LX1500e remotely, connect a modem to the RS-232 port. Configure the modem to use no hardware or software flow control.

At power up or reset, the LX1500e 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. Although Systran has tested this configuration only with a Hayes compatible modem operating at 14.4 and 28.8 Kbps, this sequence should not effect any modems that don't use the Hayes AT command set or any other configuration.

# 5.3 LX1500e Commands (Rev. 2.XX)

Table 5-1 lists the LX1500e commands. Subsequent sections provide more information on each command. Please note that although the text in subsequent sections follows the help menus available on the LX1500e, there may be slight differences due to size limitations in the LX1500e help files.

**Table 5-1 LX1500e Command Index**

| Command | Definition | Page |
|---|---|---|
| **ROUTING** | | |
| AL [Loop# [Plist [out]]] | Auto-Loop (with auto-bypassing) | 5-3 |
| SL [Loop# [Plist [out]]] | SCRAMNet Loop | |
| CC [Plist [..Plist]] \| [Plist r \| out] | Complex Copy | 5-4 |
| M Port# [Plist [out]] | Multicast (input) | 5-5 |
| OE [Plist [out]] | Output (laser) Enable control | 5-6 |
| P Port# [Port#] | Port configuration | 5-7 |
| S Port# [Port#] | SCRAMNet port configuration | |
| **STATUS** | | |
| ST [d \| v \| l] | Status (signal detects / loop) | 5-8 |
| **CONFIGURATION** | | |
| BC [pc \| pf[n# text]] \| [vr \| vs \| vsl] \| [tm [time]] \| [cs \| cr n#] \| [x text] \| [pw password] | Box Configuration and setup | 5-10 |
| UI [am \| be \| ec \| vt \| vb \| dw \| pr n#] | User Interface configuration | 5-17 |
| **LEGEND** | | |
| Port# - port ID (e.g., 1a) | Plist - list of ports (e.g., 1a2c5d) | |
| Loop# - loop ID (e.g., 23) | n# - numeric value (e.g., 0) | |
| Type h command_name for details | Type h 1,2,3,4 for all notes | |

# 5.4 Routing Commands

## 5.4.1 AL – Auto-Loop, SL - SCRAMNet Loop (with auto-bypassing) Setup

```
al [Loop# [Plist [out]]]
sl [Loop# [Plist [out]]]        - for SCRAMNet loop
```

### DESCRIPTION:

Adds/removes ports to/from the loop. Port auto-bypassing (fault isolation) feature is activated. Without optional parameters it returns the loop status.

### OPTIONS:

| | |
|---|---|
| out | Reverse action switch (removes ports). |

### EXAMPLES:

| | |
|---|---|
| al5 1a2b3c4d | Adds ports 1a, 2b, 3c, and 4d to loop 5. |
| al5 | Shows members of loop 5.<br>For example, L05=+1a2b4d-3c ('+' precedes active ports '-'precedes inactive ports). |
| al | Returns all currently configured loops. |
| al6 all | Places all ports on loop 6. |
| al6 1a out | Removes port 1a from loop 6 and places it in internal loopback (wrap) mode. |
| al6 all out | Removes only ports currently configured on Loop# 6 (AL06). |

### NOTES:

- Switch <out> places listed ports in internal loopback (wrap) mode.
- If sl is substituted in the above examples, only SCRAMNet info is returned.

### CODE SAMPLE:

```
>al4 all
+AL04=+1a1b1c1d4a4b4c4d5a5b5c5d8a8b8c8d-2a2b2c2d3a3b3c3d6a6b6c6d7a7b7c7d
>al5 1a1b1c1d
+AL05=+1a1b-1c1d
>al4 all out
+AL04=+-
>al
_AL= 04 05
>sl 5 3a3c
+SL05=+-3a3c
>st
  ++1a<1d AL05 04     ++1b<1a AL05 00       1c<1b AL05 00       1d<1c AL05 03
    2a<2a AL04 00       2b<2b AL04 00       2c<2c AL04 00       2d<2d AL04 00
    3a<3a SL05 00 ==    3b<3b SL05 00       3c<3c SL05 00 ==    3d<3d SL05 00
  ++4a<4a PCwr 00     ++4b<4b PCwr 00     ++4c<4c PCwr 00     ++4d<4d PCwr 00
  ++5a<5a PCwr f2     ++5b<5b PCwr ac     ++5c<5c PCwr 54     ++5d<5d PCwr 00
    6a<6a PCwr 00       6b<6b PCwr 00       6c<6c PCwr 00       6d<6d PCwr 00
    7a<7a PCwr 00       7b<7b PCwr 00       7c<7c PCwr 00       7d<7d PCwr 00
  ++8a<8a PCwr 00     ++8b<8b PCwr 00     ++8c<8c PCwr 00     ++8d<8d PCwr 00
```

## 5.4.2 CC – Complex Copy configure

cc [Plist [..Plist]] | [Plist r|out]

### DESCRIPTION:

In its regular form, cc connects the output of the given port to input of the next port on the Plist. The last port output gets connected to the input of the first port on Plist. In its 'r' form, cc will accept a Plist consisting of 32 ports only. Input of a port specified on the list will connect to the output of a port determined by the position on the Plist. "Out" places all ports in PList in an internal loopback mode.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| cc 3a3b 6a7b8a | Sets two independent loops with 2 and 3 ports. |
| cc 3a3b7d...4c r | Connects output of port 1a to input of 3a, output of 1b to input of 3b, output of 1c to input of 7d, and output of 8d to input of 4c. |
| cc 1a2b2c1b out | Sets 1a, 2b, 2c, and 1b into internal loopback mode. |
| cc | Returns routing vector<br>For example, 1a1a1a1a7b7c7d7a.....3a4a. |

### NOTES:

- Very little if any error checking is provided with this command.
- Without a PList, the LX1500e returns an appropriate status vector.
- The Port auto-bypass (fault isolation) feature is deactivated for all affected (output) ports.

### CODE SAMPLE:

```
>cc
_RV=1a1b1c1d2a2b2c2d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d8a8b8c8d
>cc 1a1b1c1d8a8b8c8d
+RV=8d1a1b1c2a2b2c2d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d1d8a8b8c
>cc 2a2b 2c2d
+RV=8d1a1b1c2b2a2d2c3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d1d8a8b8c
>cc 8a8a8a8a7a7a7a7a6a6a6a6a5a5a5a5a4a4a4a4a3a3a3a3a2a2a2a2a1a1a1a1a r
+RV=8a8a8a8a7a7a7a7a6a6a6a6a5a5a5a5a4a4a4a4a3a3a3a3a2a2a2a2a1a1a1a1a
>st
  ++1a<8a PC   04     ++1b<8a PC   00     ++1c<8a PC   00     ++1d<8a PC   03
    2a<7a PC   00       2b<7a PC   00       2c<7a PC   00       2d<7a PC   00
    3a<6a PC   00       3b<6a PC   00       3c<6a PC   00       3d<6a PC   00
  ++4a<5a PC   00     ++4b<5a PC   00     ++4c<5a PC   00     ++4d<5a PC   00
  ++5a<4a PC   f2     ++5b<4a PC   ac     ++5c<4a PC   54     ++5d<4a PC   00
    6a<3a PC   00       6b<3a PC   00       6c<3a PC   00       6d<3a PC   00
    7a<2a PC   00       7b<2a PC   00       7c<2a PC   00       7d<2a PC   00
  ++8a<1a PC   00     ++8b<1a PC   00     ++8c<1a PC   00     ++8d<1a PC   00
>cc all out
+RV=1a1b1c1d2a2b2c2d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d8a8b8c8d
```

## 5.4.3 M – Multicast (input) configure

m Port# [Plist [out]]

### DESCRIPTION:

Configures multicast routing of the specified port or returns the multicast routing vector.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| m1a 1a2b3c4d | Adds ports 1a, 2b, 3c, and 4d to multicast list of port (input) 1a. |
| m1a | Returns a list of all the ports (outputs) copying signal from port 1a input<br>For example, M1a=1a1b2b3c4d7d. |
| m2a all | Multicasts 2a to all 32 ports. |
| m1a 1a2b out | Removes ports 1a and 2b from multicast list of 1a and places them in internal loopback (wrap) mode. |

### NOTES:

- Ports listed with <out> switch are placed in wrap mode only if they are copies of the Port#.

### CODE SAMPLE:

```
>m1a all
+M1a=1a1b1c1d2a2b2c2d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d8a8b8c8d
>m2a 2a2b2c2d
+M2a=2a2b2c2d
>m1a
_M1a=1a1b1c1d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d8a8b8c8d
>m1a 8a8b8c8d out
+M1a=1a1b1c1d3a3b3c3d4a4b4c4d5a5b5c5d6a6b6c6d7a7b7c7d
>m1a all out
+M1a=1a
>st
  ++1a<1a PCwr 00     ++1b<1b PCwr 00     ++1c<1c PCwr 00     ++1d<1d PCwr 00
    2a<2a PCwr 00       2b<2a PC   00       2c<2a PC   00       2d<2a PC   00
    3a<3a PCwr 00       3b<3b PCwr 00       3c<3c PCwr 00       3d<3d PCwr 00
  ++4a<4a PCwr 00     ++4b<4b PCwr 00     ++4c<4c PCwr 00     ++4d<4d PCwr 00
  ++5a<5a PCwr 00     ++5b<5b PCwr 00     ++5c<5c PCwr 00     ++5d<5d PCwr 00
    6a<6a PCwr 00       6b<6b PCwr 00       6c<6c PCwr 00       6d<6d PCwr 00
    7a<7a PCwr 00       7b<7b PCwr 00       7c<7c PCwr 00       7d<7d PCwr 00
  ++8a<8a PCwr 00     ++8b<8b PCwr 00     ++8c<8c PCwr 00     ++8d<8d PCwr 00
```

## 5.4.4 OE – Output (transmitter/laser) Enable control

oe [Plist [out]]

### DESCRIPTION:

Turns on the appropriate laser transmitter for the ports from Plist. Without parameters the laser state vector is displayed representing the state of all transmitters (bit set to '1' if enabled). By default, all lasers are turned on when LX1500e boots, regardless of prior shutdown states.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| oe 1a2b3c4d | Turns laser of 1a, 2b, 3c, and 4d on. |
| oe | Returns the status of all lasers.<br>For example, OE=fff61fff. |
| oe 1a6b out | Turns laser of 1a and 6b off. |

### NOTES:

- The OE command enables/disables signal routing on any port card.
- Proper active laser operation (on and off) requires appropriate port card.

### CODE SAMPLE:

```
>oe 1a out
+OE=7fffffff
>oe 4c out
+OE=7ffdffff
>st
z  1a<1a PCwr 03     ++1b<1b PCwr 00     ++1c<1c PCwr 00     ++1d<1d PCwr 00
   2a<2a PCwr 00       2b<2a PC   00       2c<2a PC   00       2d<2a PC   00
   3a<3a PCwr 00       3b<3b PCwr 00       3c<3c PCwr 00       3d<3d PCwr 00
 ++4a<4a PCwr 00     ++4b<4b PCwr 00    z++4c<4c PCwr 00     ++4d<4d PCwr 00
 ++5a<5a PCwr 04     ++5b<5b PCwr 02     ++5c<5c PCwr 02     ++5d<5d PCwr 00
   6a<6a PCwr 00       6b<6b PCwr 00       6c<6c PCwr 00       6d<6d PCwr 00
   7a<7a PCwr 00       7b<7b PCwr 00       7c<7c PCwr 00       7d<7d PCwr 00
 ++8a<8a PCwr 00     ++8b<8b PCwr 00     ++8c<8c PCwr 00     ++8d<8d PCwr 00
>oe all out
+OE=00000000
>oe all
+OE=ffffffff
```

## 5.4.5 P – Port (output), S – SCRAMNet port (output) configure

p Port# [Port#]

s Port# [Port#] for SCRAMNet ports

### DESCRIPTION:

Modifies the configuration of a port. If only the first Port# is specified the status of the port is returned.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| p4a 4c | Configures port 4a as a copy of 4c. |
| p4a | Returns the status of 4a. |
| s5a 5c | Configure port pair 5a-5b a copy of the port pair 5c-5d. |

### NOTES:

- See application notes for more information on the port's returned status.

### CODE SAMPLE:

```
>p1a
_P1a=z  1a<1a PCwr 03
>p1a 1c
+P1a=z+ 1a<1c PC   03
>s2a 2c
+S2a=   2a<2c SC   00
>st
z+ 1a<1c PC   03     ++1b<1b PCwr 00     ++1c<1c PCwr 00     ++1d<1d PCwr 00
   2a<2c SC   00 ==    2b<2d SC   00       2c<2a PC   00       2d<2a PC   00
   3a<3a PCwr 00       3b<3b PCwr 00       3c<3c PCwr 00       3d<3d PCwr 00
 ++4a<4a PCwr 00     ++4b<4b PCwr 00    z++4c<4c PCwr 00     ++4d<4d PCwr 00
 ++5a<5a PCwr 04     ++5b<5b PCwr 02     ++5c<5c PCwr 02     ++5d<5d PCwr 00
   6a<6a PCwr 00       6b<6b PCwr 00       6c<6c PCwr 00       6d<6d PCwr 00
   7a<7a PCwr 00       7b<7b PCwr 00       7c<7c PCwr 00       7d<7d PCwr 00
 ++8a<8a PCwr 00     ++8b<8b PCwr 00     ++8c<8c PCwr 00     ++8d<8d PCwr 00
```

# 5.5 Status Command

## 5.5.1 ST – Status

st [d | v | l]

### DESCRIPTION:

Displays the switch status and/or signal detects.

### OPTIONS:

| | |
|---|---|
| [] | Depicts the state of all ports including routing and signal detect information. See application notes for help reading the returned status. |
| d | The signal detect vector in hex form<br>For example, SD=00fffffe. The leftmost bit corresponds to port 1a and the rightmost bit corresponds to port 8d. |
| v | Positional vector of signal detects with port code present if its input detects signal and "_" otherwise. |
| l | Positional vector of port loop assignments. Loop ID present if the port is configured in the loop and "__" otherwise |

### EXAMPLES:

| | |
|---|---|
| st d | Returns the signal detect vector<br>For example, SD=ffff1f00. |
| st v | Returns signal detect vector<br>For example, SV=1a1b_1d____8c8d. |
| st l | Returns loop assignment vector For example, LA=01__1224__01...__23. |

### NOTES:

- Using ST without parameters is not recommended in computer-driven applications.
- See cc command for routing vector retrieval.

## CODE SAMPLE:

```
>st
z  1a<1a AL05 03     ++1b<1d AL05 00     ++1c<1b AL05 00     ++1d<1c AL05 00
   2a<2c SC   00 ==    2b<2d SC   00       2c<2a PC   00       2d<2a PC   00
   3a<3a PCwr 00       3b<3b PCwr 00       3c<3c PCwr 00       3d<3d PCwr 00
 ++4a<4b AL04 00     ++4b<4a AL04 00    z++4c<4c PCwr 00     ++4d<4d PCwr 00
 ++5a<5a PCwr 04     ++5b<5b PCwr 02     ++5c<5c PCwr 02     ++5d<5d PCwr 00
   6a<6a PCwr 00       6b<6b PCwr 00       6c<6c PCwr 00       6d<6d PCwr 00
   7a<7a PCwr 00       7b<7b PCwr 00       7c<7c PCwr 00       7d<7d PCwr 00
 ++8a<8a PCwr 00     ++8b<8b PCwr 00     ++8c<8c PCwr 00     ++8d<8d PCwr 00
>std
_SD=700ff00f
>stv
_SV=__1b1c1d_____________4a4b4c4d5a5b5c5d_____________8a8b8c8d
>stl
_LA=05050505_____________0404_____________________________________
```

# 5.6 Configuration Commands

## 5.6.1 BC – Box Configuration

| | |
|---|---|
| bc pc [n# text] | User port card information display or update. |
| bc pf [n# text] | Factory port card information display or update. |
| bc tm [time] | Time (and date) display or update. |
| bc vr | Firmware version. |
| bc vs\|vsl | Vital statistics for the session or lifetime. |
| bc cs\|cr n# | Active configuration save or recall (from n# bank). |
| bc pw password | Locks/unlocks factory configuration fields. |
| bc x text | Echo host-generated pattern for synchronization. |

### DESCRIPTION:

Returns or sets information or settings.

### OPTIONS:

None

### EXAMPLES:

None

### NOTES:

- See individual help menus concerning a specific command by typing: “h bc xx” where xx is a command from the list above.

## 5.6.2 BC CS (CR) – Configuration Save (Recall)

| | |
|---|---|
| bc cs n# | To save |
| bc cr n# | To recall |

### DESCRIPTION:

n# = {1,2}. Saves or recalls previously saved configuration to/from one of two banks of non-volatile memory. Banks CB1 and CB2 are in addition to active configuration bank (CA) of memory used on boot and during normal operation.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| bc cs 2 | Stores the active configuration to bank number 2. |
| bc cr 1 | Recalls configuration from bank number 1. |

### NOTES:

- The saved configuration banks keep the routing information and port assignment (Loop#, copy, etc.). The only exception is the state of Output Enables (OE), which defaults to lasers enabled for all ports on boot.

## 5.6.3 BC PC (PF) – Port Card user and Factory information

bc pc [n# text]
bc pf [n# text]

### DESCRIPTION:

Sets or reports descriptions of the CPU and each port card. This includes factory set, password protected information, and user defined information.

### OPTIONS:

| | |
|---|---|
| n# = {0 - 8} | The slot number. Slot 0 designates the CPU, while 1 - 8 designates the respective port card. |
| text | The string to be associated with the respective slot number. |

### EXAMPLES:

| | |
|---|---|
| bc pc | Returns information of the cpu and port cards. |
| bc pc 0 Intel 960 | Places “intel 960” in the user info for the CPU. |
| bc pc 1 Short wave | Places “short wave” in the user info for port card 1. |
| bc pf 1 A12345678 | Places “A12345678” in the factory info for port card 1. |

### NOTES:

- The user information holds up to 44 characters, and the factory information holds up to 18 characters. To unprotect factory fields, use **bc pw password**, where password is the correct key.

### CODE SAMPLE:

```
>bc pc
_VR00= _CPU__ factory_CPU_info__ You may write box information here
_VR01= _Card1 factory info______ User info  p1a     p1b     p1c    p1d
_VR02= _Card2 factory info______ User info  p2a     p2b     p2c    p2d
_VR03= _Card3 factory info______ User info  p3a     p3b     p3c    p3d
_VR04= _Card4 factory info______ User info  p4a     p4b     p4c    p4d
_VR05= _Card5 factory info______ User info  p5a     p5b     p5c    p5d
_VR06= _Card6 factory info______ User info  p6a     p6b     p6c    p6d
_VR07= _Card7 factory info______ User info  p7a     p7b     p7c    p7d
_VR08= _Card8 factory info______ User info  p8a     p8b     p8c    p8d
>bc pc 1 retimed fibre channel shortwave card
>bcpc
_VR00= _CPU__ factory_CPU_info__ You may write box information here
_VR01= _Card1 factory info______ retimed fibre channel shortwave card
_VR02= _Card2 factory info______ User info  p2a     p2b     p2c    p2d
_VR03= _Card3 factory info______ User info  p3a     p3b     p3c    p3d
_VR04= _Card4 factory info______ User info  p4a     p4b     p4c    p4d
_VR05= _Card5 factory info______ User info  p5a     p5b     p5c    p5d
_VR06= _Card6 factory info______ User info  p6a     p6b     p6c    p6d
_VR07= _Card7 factory info______ User info  p7a     p7b     p7c    p7d
_VR08= _Card8 factory info______ User info  p8a     p8b     p8c    p8d
```

### 5.6.4 BC TM – Time and date setup

bc tm [mm/dd/yy] [hh:mm:ss]

#### DESCRIPTION:

Sets or reports the date and time.

#### OPTIONS:

| | |
|---|---|
| TIME | The current time. Fields must be separated by the : character. The time is in 24 hour format, and must be in order of hour, minutes, and seconds. |
| DATE | The current date. Fields must be separated by the / character. Three fields must be present and in the order of month, day, and year. |

#### EXAMPLES:

| | |
|---|---|
| bc tm 1/31/96 13:56 | Set date to Jan 31, 1996 and time to 1:56 P.M. |
| bc tm | Returns the current date and time. |

#### NOTES:

- Seconds are optional for the time field.

### 5.6.5 BC VR – Version

bc vr

**DESCRIPTION:**

Returns Firmware version.

**OPTIONS:**

None

**EXAMPLES:**

bc vr

**NOTES:**

- The date in parenthesis appearing on the screen is the compilation date.

## 5.6.6 BC VS (VSL) – Vital Statistics for the session (lifetime)

bc vs
bc vsl

### DESCRIPTION

Returns vital statistics including the following information:

| | |
|---|---|
| _TIM | Up time (minutes) |
| _CMD | Number of commands executed |
| _SDT | Signal detect transitions to non-active state |
| _CMDF | Bad commands detected |
| _CMQF | Command queue failures |
| _PRQF | Print queue failures |
| _BOOT | Sessions number |

### OPTIONS

None

### EXAMPLES

| | |
|---|---|
| bc vs | Returns the vital statistics of the current session. |
| bc vsl | Returns the vital statistics for the lifetime. |

### NOTES

None

### CODE SAMPLE:

```
>bc vs
_VSS=_TIM=97 _CMD=2721 _SDT=0 _CMDF=4 _CMQF=0 _PRQF=0 _BOOT=1
>bc vsl
_VSL=_TIM=1340 _CMD=52372 _SDT=32 _CMDF=45 _CMQF=0 _PRQF=0 _BOOT=10
```

## 5.6.7 BC X – Synchronization primitive

bc x text

### DESCRIPTION:

Echos host-generated pattern.

### OPTIONS:

None

### EXAMPLES:

bc x 30 - will return x=30

### NOTES:

- The “x” is used for application synchronization.
- The Output is printed without a leading '_' (IS THIS A MINUS SIGN) or '+' regardless of VB level. This can be used in applications where keeping track of command prompts may lead to errors, or when the application requires a higher level of fault tolerance.

### CODE SAMPLE:

```
>bc x synch
X=synch
```

## 5.6.8 UI VB – Verbose level control

ui vb n#

### DESCRIPTION:

Sets the verboseness to specified level (0, 1, 8). Use n# to change the way LX1500e presents its responses:

| VB | ERRORs | ACKs | STATUSes | PROMPT | DESIGNATION |
|---|---|---|---|---|---|
| 0 - | !## | + | _status | > | computer |
| 1 - | !##text | +status | _status | > | computer and human |

### OPTIONS:

None

### EXAMPLES:

ui vb 1 Changes the verboseness to level 1.

### NOTES:

- Current settings are reported with VB prefix (see UI command).
- Level 8 is not recommended.

## 5.6.9 UI AM – Auto-Messaging Setup

ui am n#

### DESCRIPTION:

n# controls the form of auto-message, and settings are reported with **am** prefix.

| n# | MESSAGE | EXAMPLE |
|---|---|---|
| 0 | none | |
| 1 | {*}event (direction, Port#, time) | *+1a mm/dd/yy hh:mm:ss.mil |
| 2 | {*}most current signal detects vector | *efffffff0 |

### OPTIONS:

### EXAMPLES:

| | |
|---|---|
| ui am 0 | Turns auto-messaging off. |
| ui am 1 | Turns auto-messaging on at level 1. |

### NOTES:

- Bits in vector correspond in order to ports 1a,1b,..8d.
- Messages at level 2 and 8 are terminated with \r character. Messages at level 1 are terminated with \n and they may cause the prompt and command in progress to re-display.
- use n# = 0, 2, or 1 for computer driven applications, and 1, 2, or 0 for human interaction.

## 5.6.10 UI BE – Beeping Enable control

ui be [n#]

### DESCRIPTION:

With beeping enable is on (BE=1), BELL characters will be sent to RS-232 output when port input state changes occur.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| ui be 1 | Turns audible signaling on. |
| ui be 0 | Turns audible signaling off. |

### NOTES:

- Current settings are reported with BE prefix (see UI command).
- Frequent port state changes with BE=1 may cause difficulties in RS-232 stream processing.
- Audible signaling off (BE=0) is recommended for computer-driven applications.

## 5.6.11 UI DW – Display Window setup

ui dw n#

### DESCRIPTION:

Sets level of details presented in display window including on and off: n#={0,1,2,3,4}. At level 0 the window is turned off. Any other level will turn it on with increasing number of details presented. VT100 terminals should turn VT option on (ui vt 1) for proper window operation.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| ui dw 0 | Turns the display window off. |
| ui dw 2 | Turns the display window on at level 2. |

### NOTES:

- Current settings are reported with DW prefix (see UI command).
- Display window should not be used in computer-driven applications.

## CODE SAMPLE:

```
>ui dw 0
+UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=0 _PR=60 _RS=57600
>ui dw 1
 ++1a<8d AL00 00     ++1b<1a AL00 00     ++1c<1b AL00 00     ++1d<1c AL00 00


 ++4a<1d AL00 00     ++4b<4a AL00 00     ++4c<4b AL00 00     ++4d<4c AL00 00
 ++5a<4d AL00 00     ++5b<5a AL00 00     ++5c<5b AL00 00     ++5d<5c AL00 00


 ++8a<5d AL00 00     ++8b<8a AL00 00     ++8c<8b AL00 00     ++8d<8c AL00 00
10/13/00  12:46:05  _UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=1 _PR=60
+UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=1 _PR=60 _RS=57600
>ui dw 2
 ++1a<8d AL00        ++1b<1a AL00        ++1c<1b AL00        ++1d<1c AL00
   2a<2a AL00          2b<2b AL00          2c<2c AL00          2d<2d AL00
   3a<3a AL00          3b<3b AL00          3c<3c AL00          3d<3d AL00
 ++4a<1d AL00        ++4b<4a AL00        ++4c<4b AL00        ++4d<4c AL00
 ++5a<4d AL00        ++5b<5a AL00        ++5c<5b AL00        ++5d<5c AL00
   6a<6a AL00          6b<6b AL00          6c<6c AL00          6d<6d AL00
   7a<7a AL00          7b<7b AL00          7c<7c AL00          7d<7d AL00
 ++8a<5d AL00        ++8b<8a AL00        ++8c<8b AL00        ++8d<8c AL00
10/13/00  12:46:09  _UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=2 _PR=60
+UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=2 _PR=60 _RS=57600
>ui dw 3
 ++1a<8d AL00        ++1b<1a AL00        ++1c<1b AL00        ++1d<1c AL00
   2a<2a AL00          2b<2b AL00          2c<2c AL00          2d<2d AL00
   3a<3a AL00          3b<3b AL00          3c<3c AL00          3d<3d AL00
 ++4a<1d AL00        ++4b<4a AL00        ++4c<4b AL00        ++4d<4c AL00
 ++5a<4d AL00        ++5b<5a AL00        ++5c<5b AL00        ++5d<5c AL00
   6a<6a AL00          6b<6b AL00          6c<6c AL00          6d<6d AL00
   7a<7a AL00          7b<7b AL00          7c<7c AL00          7d<7d AL00
 ++8a<5d AL00        ++8b<8a AL00        ++8c<8b AL00        ++8d<8c AL00
10/13/00  12:46:14  _UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=3 _PR=60
+UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=3 _PR=60 _RS=57600
>ui dw 4
 ++1a<8d AL00 00     ++1b<1a AL00 00     ++1c<1b AL00 00     ++1d<1c AL00 00
   2a<2a AL00 00       2b<2b AL00 00       2c<2c AL00 00       2d<2d AL00 00
   3a<3a AL00 00       3b<3b AL00 00       3c<3c AL00 00       3d<3d AL00 00
 ++4a<1d AL00 00     ++4b<4a AL00 00     ++4c<4b AL00 00     ++4d<4c AL00 00
 ++5a<4d AL00 00     ++5b<5a AL00 00     ++5c<5b AL00 00     ++5d<5c AL00 00
   6a<6a AL00 00       6b<6b AL00 00       6c<6c AL00 00       6d<6d AL00 00
   7a<7a AL00 00       7b<7b AL00 00       7c<7c AL00 00       7d<7d AL00 00
 ++8a<5d AL00 00     ++8b<8a AL00 00     ++8c<8b AL00 00     ++8d<8c AL00 00
10/13/00  12:46:19  _UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=4 _PR=60
+UI= _AM=0 _VB=1 _BE=0 _EC=1 _VT=0 _DW=4 _PR=60 _RS=57600
```

## 5.6.12 UI EC – Echo Command control

ui ec n#

### DESCRIPTION:

Sets echoing of host-transmitted characters accordingly: n#={0,1}.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| ui ec 0 | RS-232 received characters are not echoed. |
| ui ec 1 | Turns the echo on. |

### NOTES:

- Current settings are reported with EC prefix (see UI command).
- Although turning echo off is not recommended for manual operation it can make RS-232 stream processing easier in computer-driven applications.

## 5.6.13 UI PR – Period settings for display window

ui pr n#

### DESCRIPTION:

When turned on, setting n#={10 to 300} determines the display window update frequency in seconds (see also **ui dw** command).

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| ui pr 100 | Sets the update period to 100 seconds. |

### NOTES:

- Current settings are reported with PR prefix (see UI command).
- If the display window (dw) is enabled (DW!=0), the display is updated at the defined pr interval and when signal detects change.

## 5.6.14 UI VT – VT100 escape codes enable

ui vt n#

### DESCRIPTION:

Sets n#={0,1}. If on (n#=1), LX1500e uses VT100 escape codes for window formatting (if display window is on - see **ui dw** command. If n#=0, LX1500e does not use VT100 escape codes.

### OPTIONS:

None

### EXAMPLES:

| | |
|---|---|
| ui vt 1 | Turns vt100 support on. |
| ui vt 0 | Turns vt100 support off. |

### NOTES:

- Current settings are reported with VT prefix (see UI command).
- Turning off VT100 codes is recommended for computer-driven applications.

# APPENDIX A

# SPECIFICATIONS

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Figure A–2 Physical Dimensions of the LX1500e ..... A-2

# 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)

Weight:..... (See Table D-1 and examples in Appendix D)

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

Power Supply Efficiency: ..... 65% (See Table D-1 and examples in Appendix D)

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)

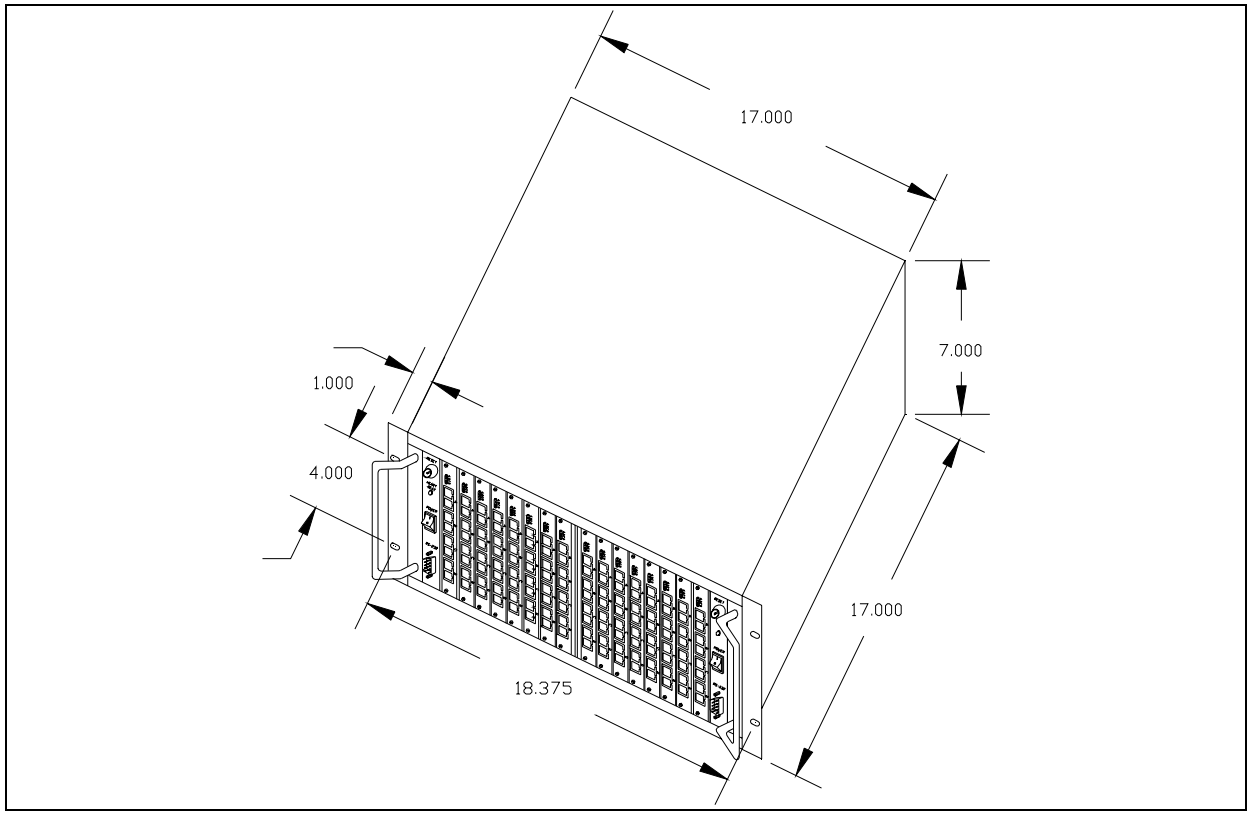



**Figure A–1 Rack-Mount Enclosure Dimensions**

# A.2 LX1500e 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) |
| Weight: | (See Table D-1 and examples in Appendix D) |
| Power Requirements: | +5VDC±5%, 5 Amps<br>+12 VDC ±5%, 1 Amp<br>(base unit only, port cards not included) |
| Storage Temperature Range: | -65° to +85° C on LX1500e<br>(port cards may be more restrictive) |
| Operating Temperature Range: | 0° to +60° C on LX1500e<br>(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 |

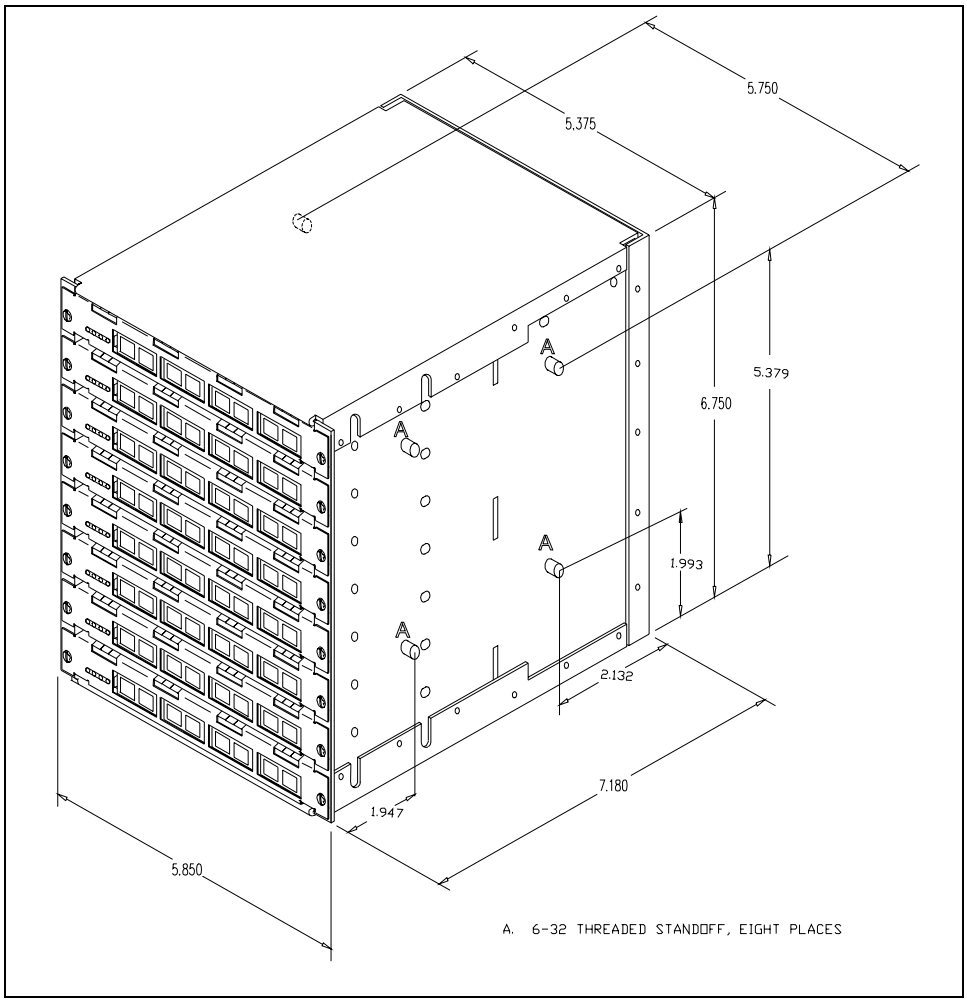



**Figure A–2 Physical Dimensions of the LX1500e**

# APPENDIX B

# AVAILABLE PORT CARDS

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# B.1 Overview

Systran offers Fibre Channel and SCRAMNet port cards for the LX1500e. This appendix contains descriptions of all available LX1500e 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 are 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 LX1500e at Fibre Channel-compatible power levels and speeds of up to 1.0625 Gbps.

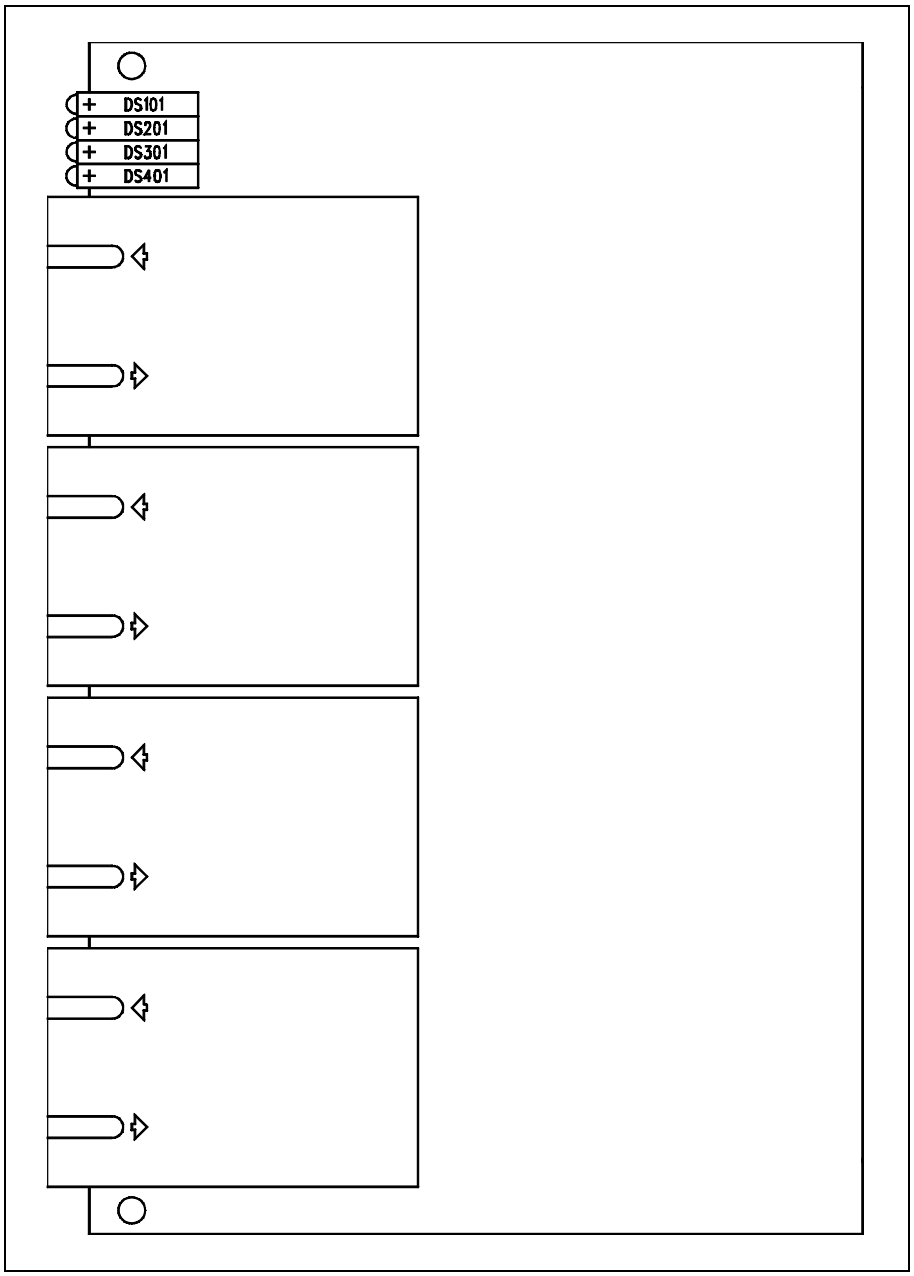



**Figure B-1 Non-Retimed Short Wavelength Optical Port Card**

## FEATURES:

- 10 Mbps to 1.0625 Gbps data rate.
- Four bi-directional ports per card.
- Fits in one Systran LX1500e 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)
- Output laser on/off control. *

* This feature is only available on those port cards shown in Appendix D ORDERING INFORMATION

## OPERATING CONSTRAINTS:

| | |
|---|---|
| Maximum Switch Passes: | Data rate dependent |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 3.55 Watts (0.710 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 50° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 0% to 95% (noncondensing) |

## INTERFACE DESCRIPTION:

| | |
|---|---|
| Connector: | Dual SC |
| Media: | 50 µm or 62.5 µm multimode fiber |
| Maximum Fiber Length: | Data rate dependent:<br>300 m to 2 km in 50 µm fiber<br>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 LX1500e. 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.

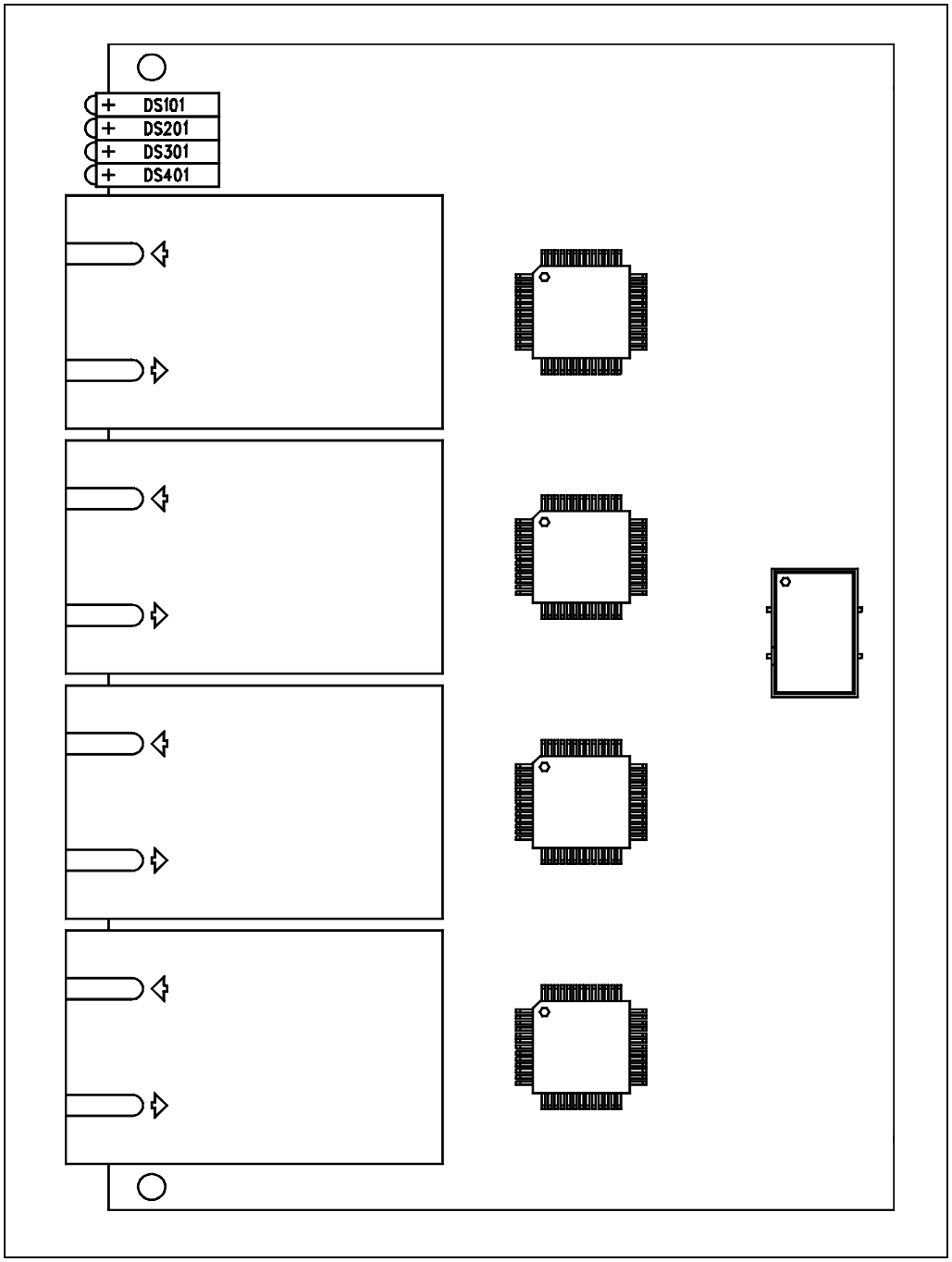



**Figure B-2 Retimed Short Wavelength Optical Port Card**

## FEATURES:

- 1.0625 Gbps data rate.
- Four bi-directional ports per card.
- Fits in one standard Systran LX1500e 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)
- Output laser on/off control. *

* This feature is only available on those port cards shown in Appendix D ORDERING INFORMATION

## OPERATING CONSTRAINTS:

| | |
|---|---|
| Maximum Switch Passes: | 5 |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 10.5 Watts (2.1 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 50° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 0% to 95% (noncondensing) |

## 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 LX1500e. 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.

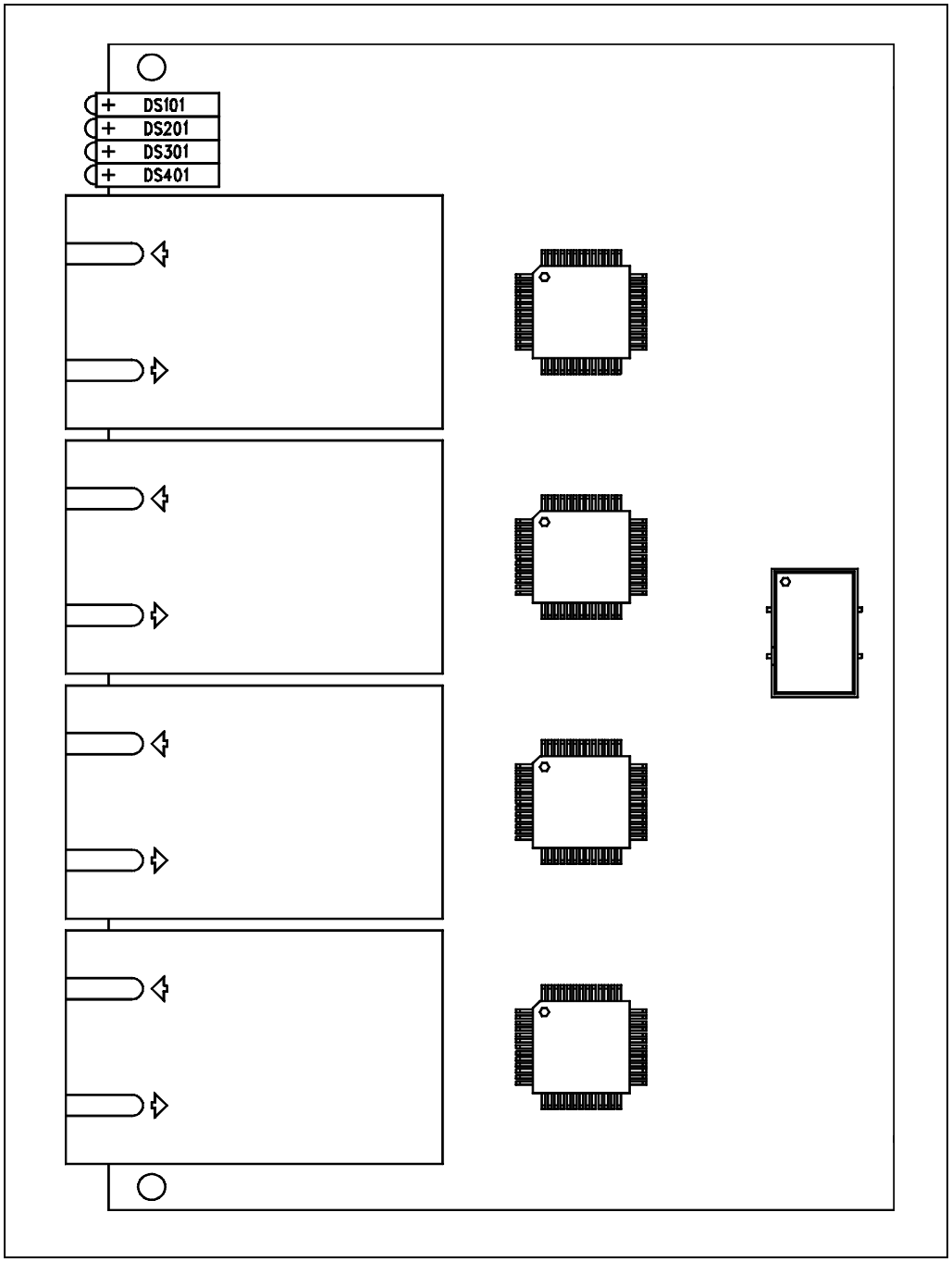



**Figure B-3 Retimed Long Wavelength Optical Port Card**

### FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one LX1500e 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)
- Output laser on/off control. *

* This feature is only available on those port cards shown in Appendix D ORDERING INFORMATION

### OPERATING CONSTRAINTS:

| | |
|---|---|
| Maximum switch passes: | 5 |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 10.5 watts (2.1 amps at 5 volts) |
| Operating Temperature: | 0° to 50° C |
| Storage Humidity Range: | 0% to 95% (noncondensing) |
| Storage Temperature: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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 Non-Retimed HSSDC Copper Port Card

The Non-Retimed HSSDC Copper Port Card is designed to interface differential copper signals with the LX1500e using Fibre Channel “Style-2” copper connectors. This card is intended for speeds up to 1.0625 Gbps.

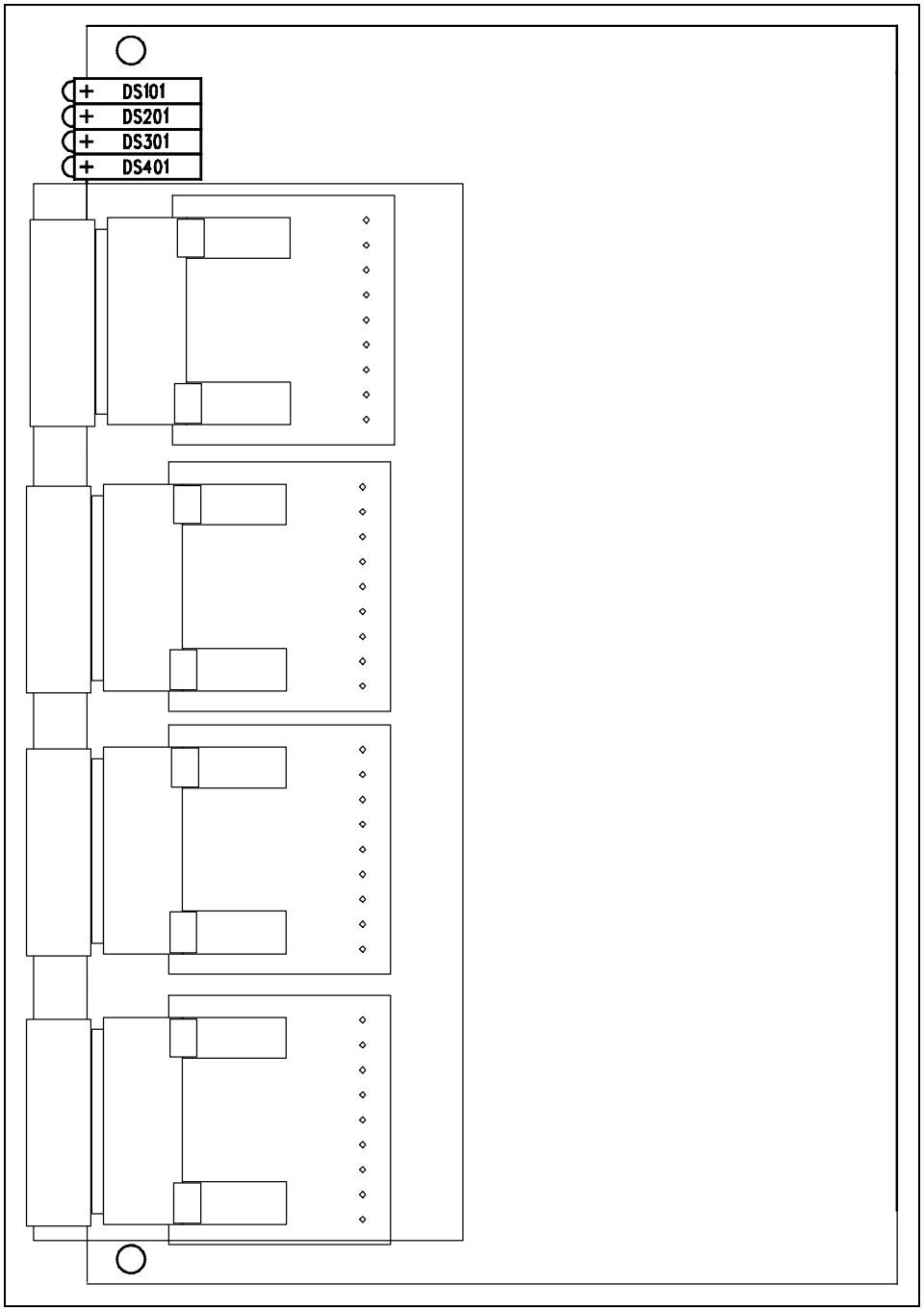



**Figure B-4 Non-Retimed HSSDC Copper Port Card**

## FEATURES:

- Up to 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500e 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: | 3 |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 2.8 Watts (0.56 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 70° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 0% to 95% (noncondensing) |

## INTERFACE DESCRIPTION:

| | |
|---|---|
| Connector: | HSSDC (“Style-2”) |
| Media: | 150 Ω Shielded Quad |
| Maximum Cable Length: | Up to 25 m unequalized;<br>Up to 30 m equalized |

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

- 1.0625 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**.



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

## B.2.5 Retimed HSSDC Copper Port Card

The Retimed HSSDC Copper Port Card is designed to interface 1.0625 Gbps copper Fibre Channel signals with the LX1500e 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.

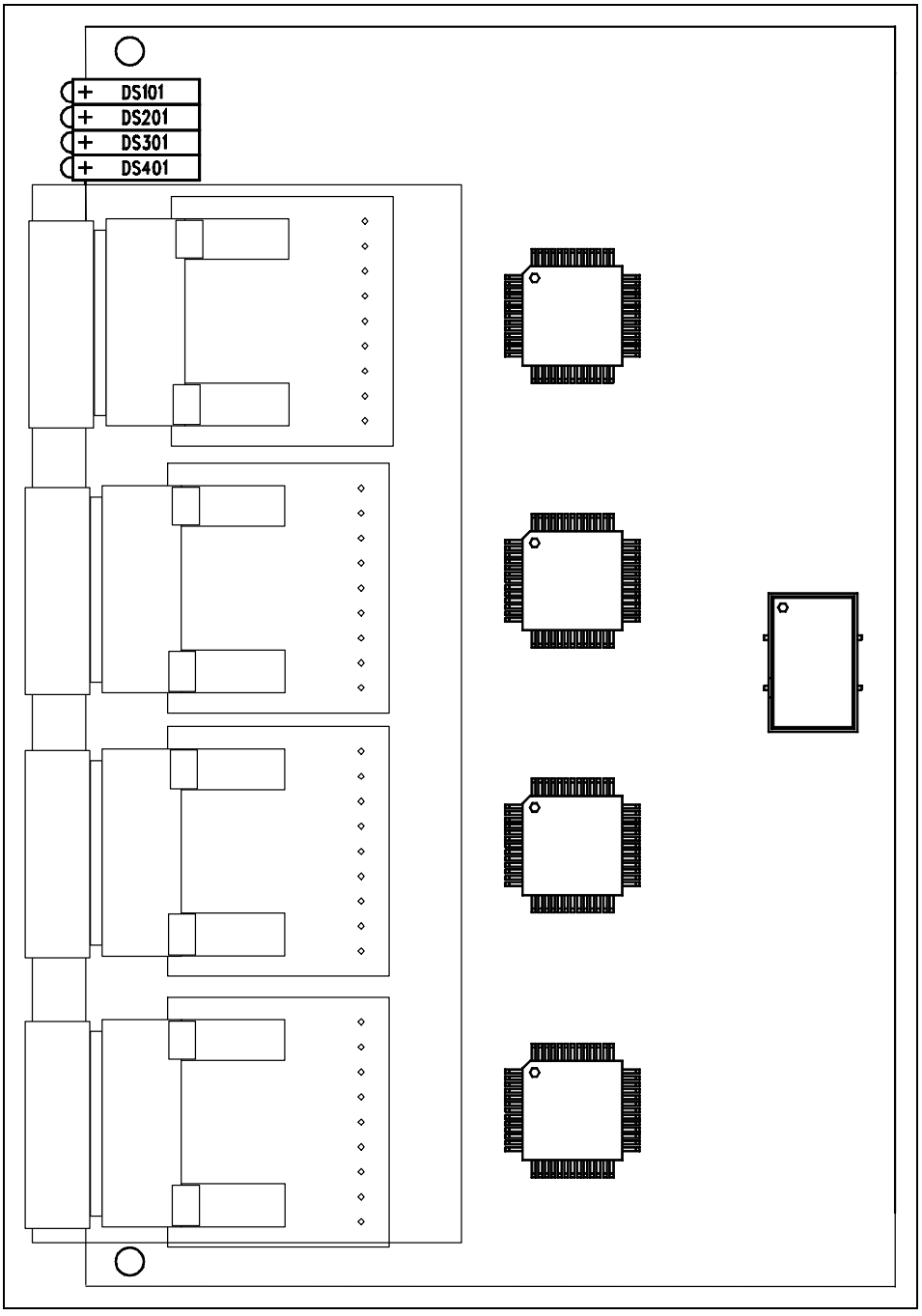



**Figure B-5 Retimed HSSDC Copper Port Card**

## FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500e 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 |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 10.0 Watts (2.0 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 70° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 0% to 95% (noncondensing) |

## INTERFACE DESCRIPTION:

| | |
|---|---|
| Connector: | HSSDC (“Style-2”) |
| Media: | 150 Ω Shielded Quad |
| Maximum Cable Length: | Up to 25m unequalized;<br>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.2.6 Non-Retimed 1x3 Copper Port Card

The Non-Retimed 1x3 Copper Port Card interfaces differential copper signals to the LX1500e at Fibre Channel-compatible signal levels and speeds of up to 1.0625 Gbps.

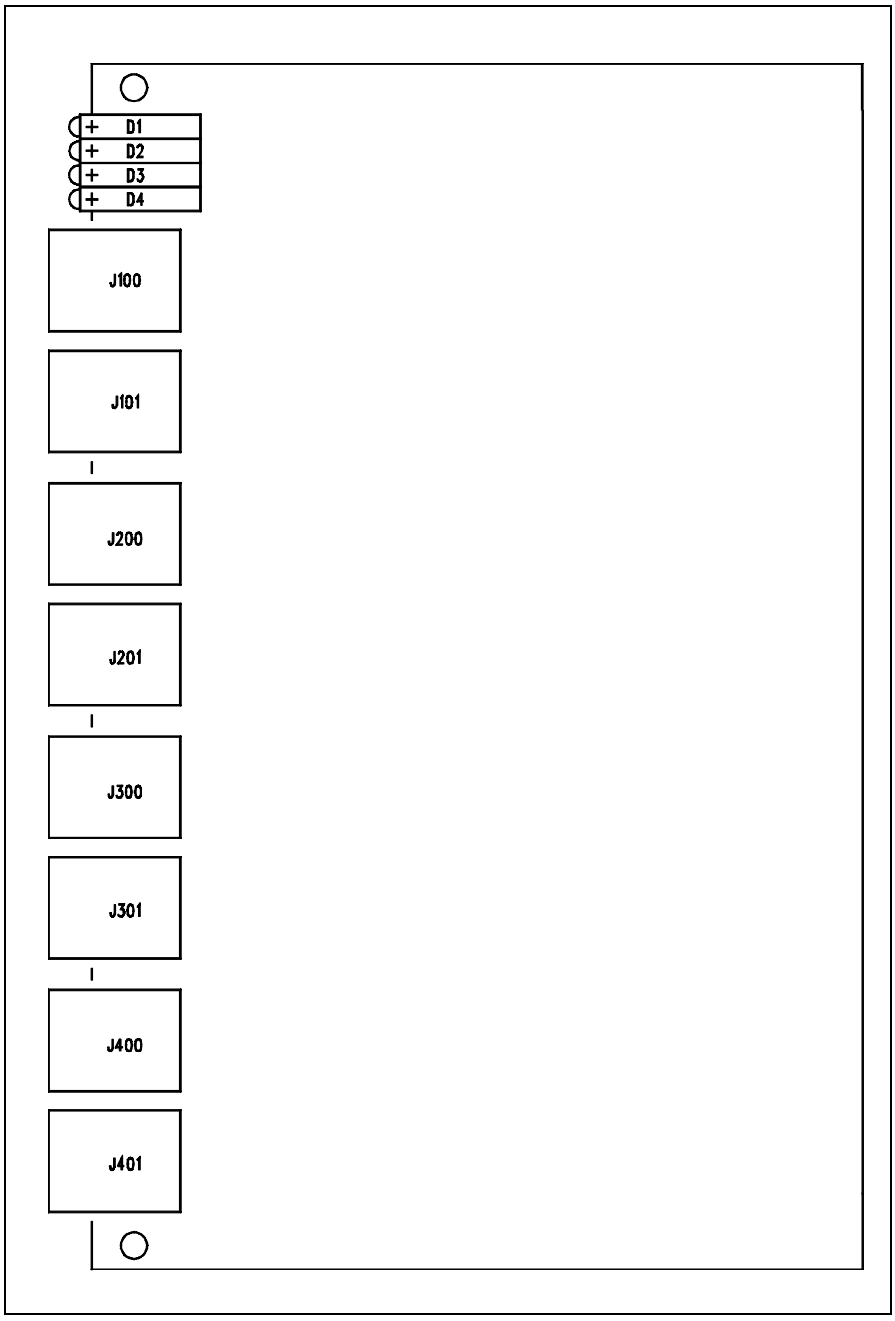



**Figure B-6 Non-Retimed 1x3 Copper Port Card**

## FEATURES

- 10 Mbps to 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500e 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 |
| Weight: | 0.2 lbs (0.10 kg) |
| Power Consumption: | 2.8 Watts (0.56 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 70° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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.2.7 Retimed 1x3 Copper Port Card

The Retimed Copper Port Card is designed to interface 1.0625 Gbps copper Fibre Channel signals with the LX1500e. 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.

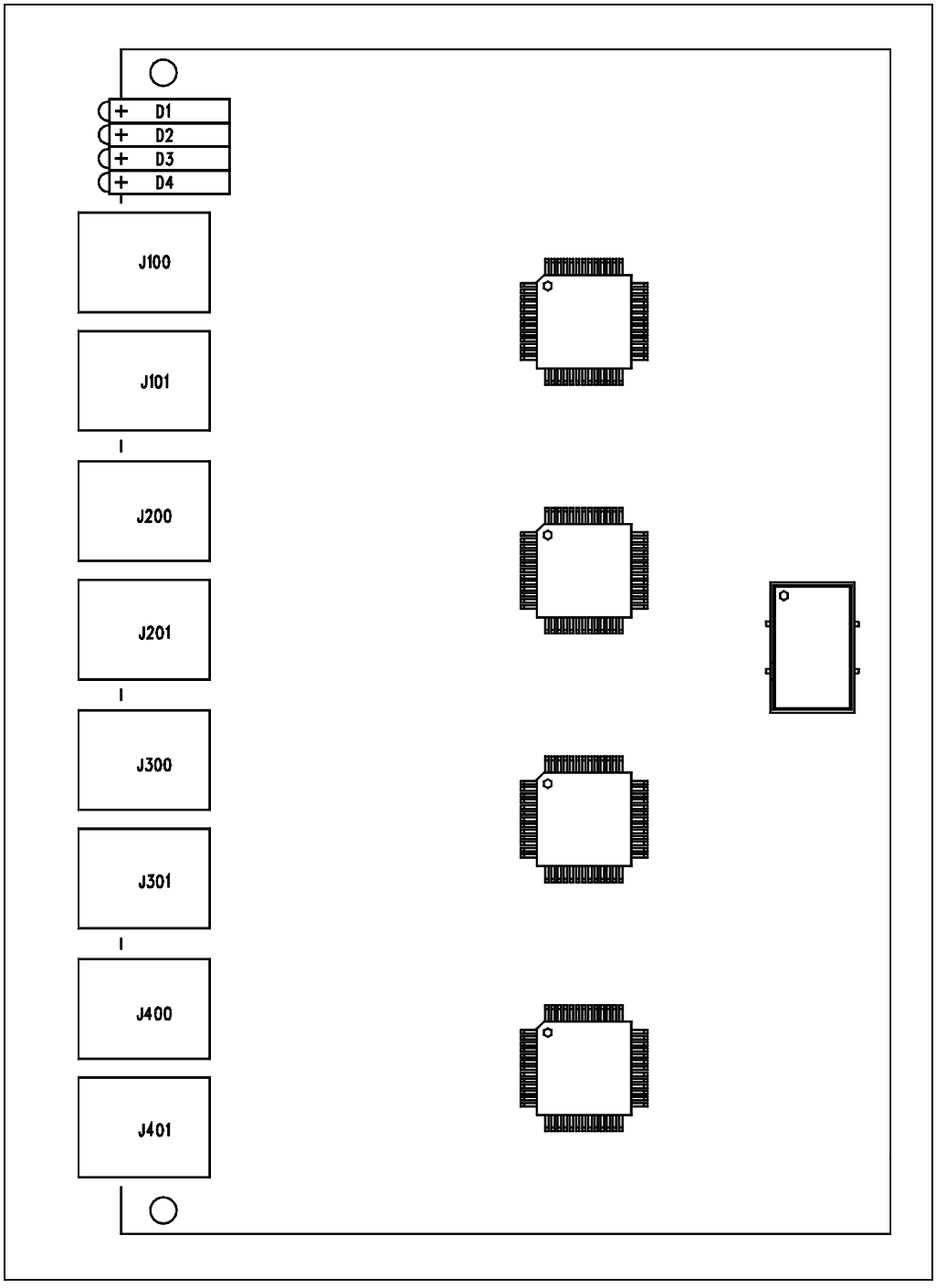



**Figure B-7 Retimed 1x3 Copper Port Card**

## FEATURES:

- 1.0625 Gbps data rate
- Four bi-directional ports per card
- Fits in one Systran LX1500e 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 |
| Weight: | 0.2 lbs (0.10 kg) |
| Power Consumption: | 10.0 Watts (2.0 Amps at 5 Volts) |
| Operating Temperature Range: | 0° to 70° C |
| Storage Temperature Range: | -40° to 85° C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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 LX1500e. Each SCRAMNet port uses two LX1500e channels, so the 32x32 channel LX1500e can route up to 16 SCRAMNet ports.

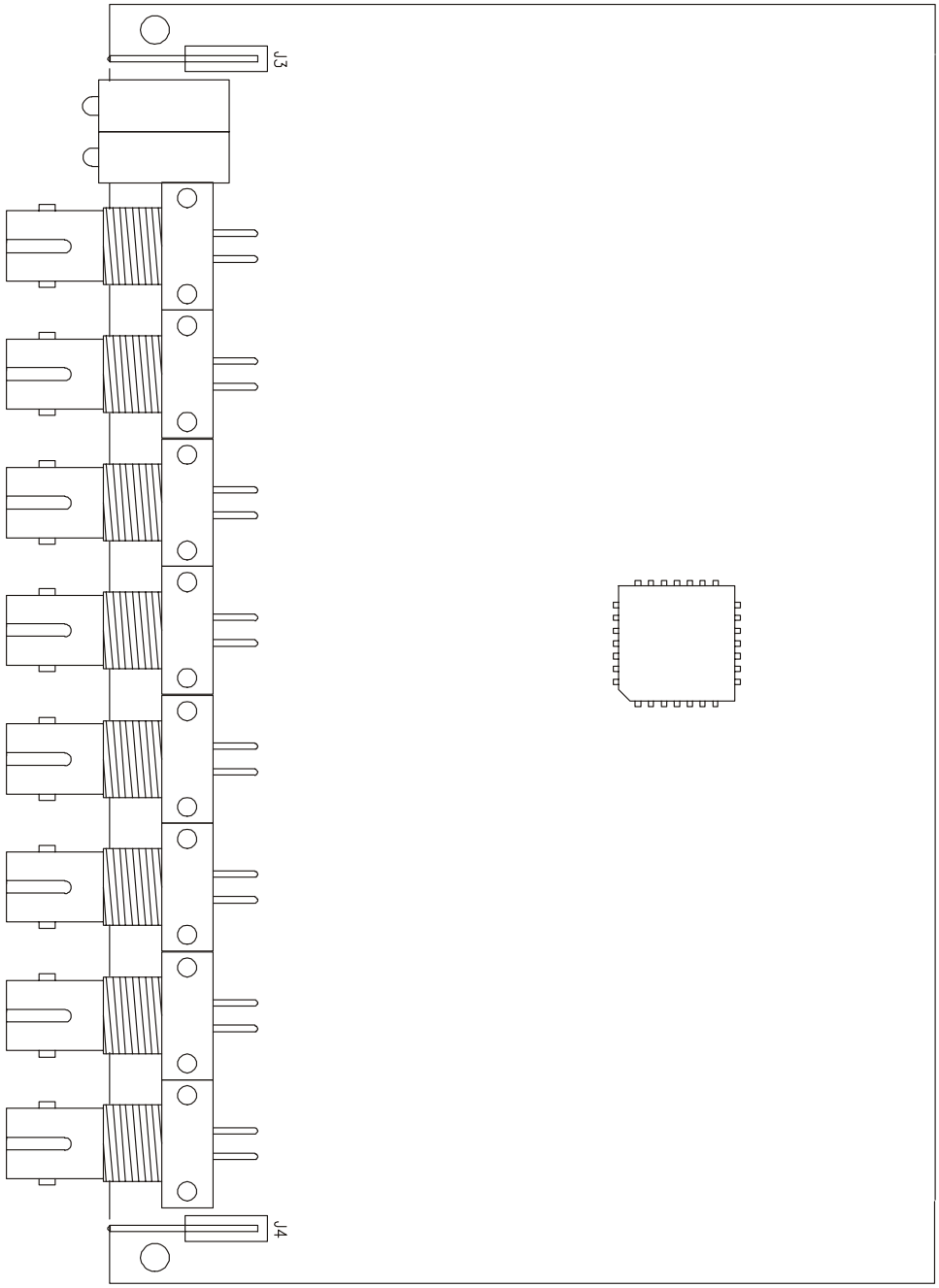



**Figure B-8 SCRAMNet Standard Link Optical Port Card**

## FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500e 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 LX1500e 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 LX1500e 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 LX1500e considers that port to be *active*. The LX1500e 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:

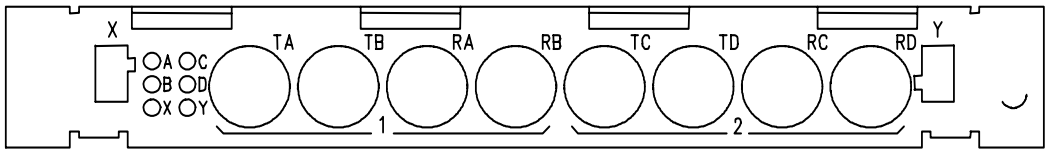



**Figure B-9 SCRAMNet Fiber-optic Faceplate**

## 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 LX1500e 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 LX1500e SCRAMNet Port Cards, page B-26. |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 5.5 Watts (1.1 Amps at 5 Volts) |
| Operating Temperature Range: | 0 to 70 C |
| Storage Temperature Range: | -40 to 85 C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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 LX1500e. Each SCRAMNet port uses two LX1500e channels, so the 32x32-channel LX1500e can route up to 16 SCRAMNet ports.

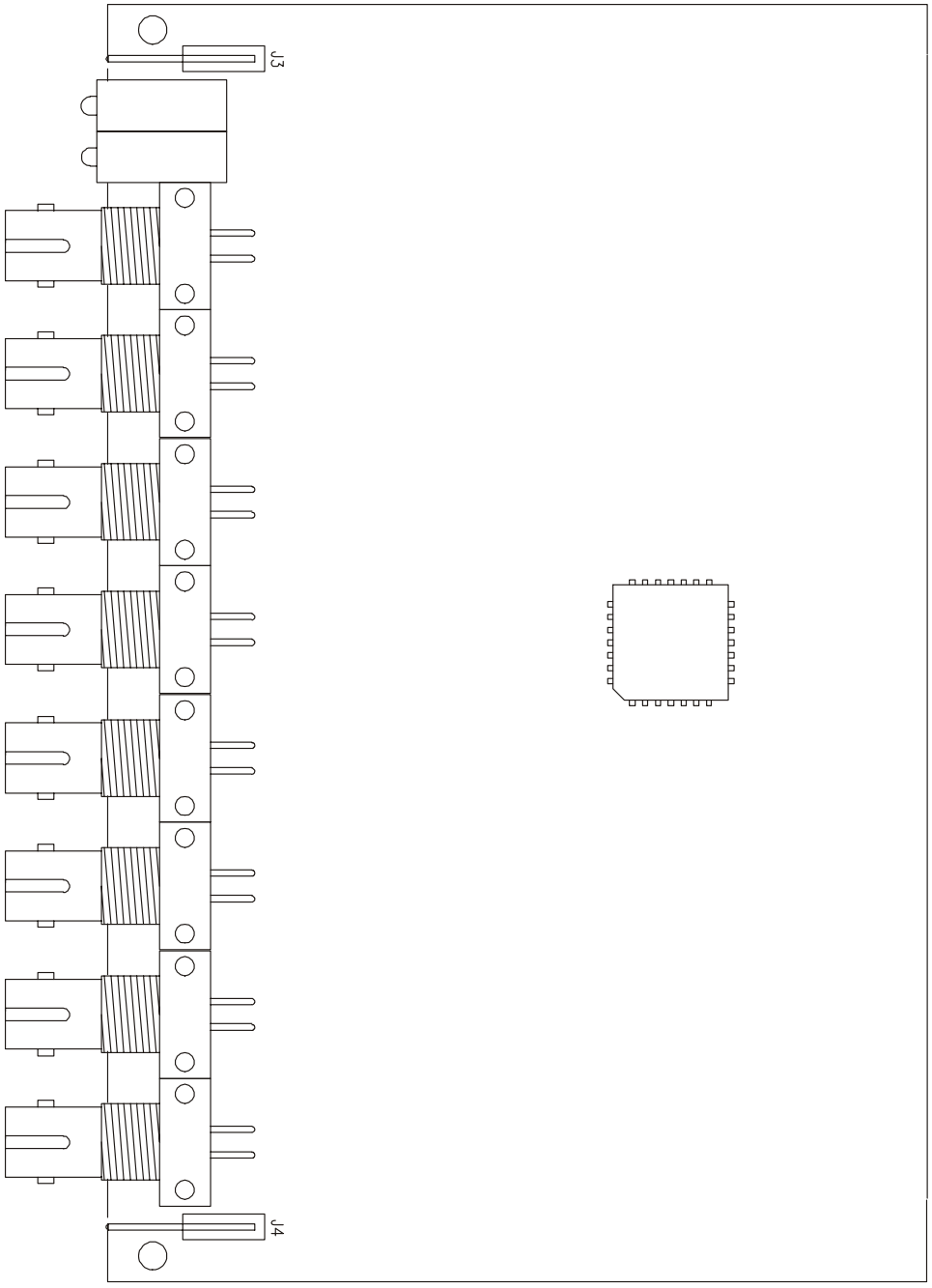



**Figure B-10 SCRAMNet Long-Link Optical Port Card**

## FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500e 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 LX1500e 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 LX1500e 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 LX1500e considers that port to be *active*. The LX1500e 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:

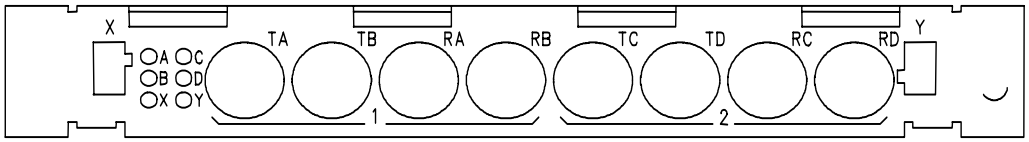



**Figure B-11 SCRAMNet Fiber-optic Faceplate**

## 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 LX1500e 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 LX1500e SCRAMNet Port Cards, page B-26. |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 5.5 Watts (1.1 Amps at 5 Volts) |
| Operating Temperature Range: | 0 to 70 C |
| Storage Temperature Range: | -40 to 85 C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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 LX1500e. Each SCRAMNet port uses two LX1500e channels, so the 32x32-channel LX1500e can route up to 16 SCRAMNet ports.

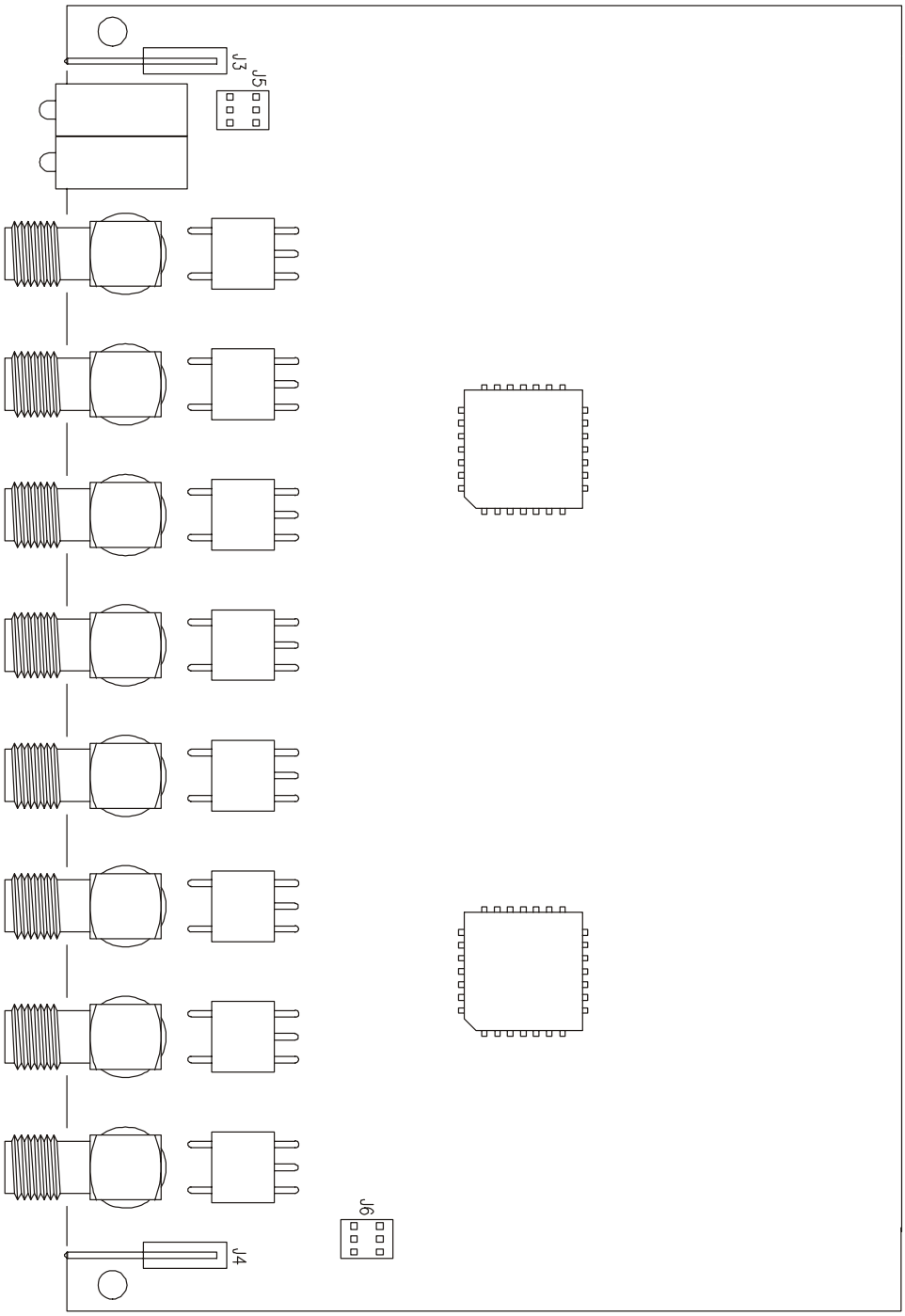



**Figure B-12 SCRAMNet Coax Port Card**

## FEATURES

- Standard SCRAMNet bit rate (150 Mbps)
- Two SCRAMNet ports per card
- Fits in one Systran LX1500e 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 LX1500e 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 LX1500e 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 LX1500e considers that port to be *active*. The LX1500e 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:

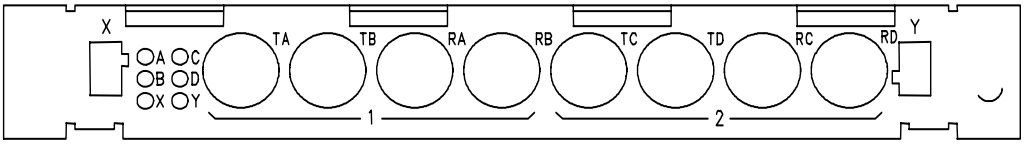



**Figure B-13 SCRAMNet Coax Faceplate**

## 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 LX1500e 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 LX1500e 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 LX1500e common |
| 3 | Connect to LX1500e 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 LX1500e.

## OPERATING CONSTRAINTS:

| | |
|---|---|
| Maximum Switch Passes: | 5 |
| Maximum Cable Length: | See section B.3.4 Link Length Constraints for LX1500e SCRAMNet Port Cards, page B-26. |
| Weight: | 0.3 lbs (0.14 kg) |
| Power Consumption: | 1.5 Watts (0.3 Amps at 5 Volts) |
| Operating Temperature Range: | 0 to 70 C |
| Storage Temperature Range: | -40 to 85 C |
| Operating Humidity Range: | 5% to 95% (noncondensing) |
| Storage Humidity Range: | 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 LX1500e SCRAMNet Port Cards

SCRAMNet networks built using the LX1500e and its SCRAMNet Port Cards are subject to the following three constraints:

1. *LX1500e Switch Passes:* The path from one SCRAMNet node to another must pass through an LX1500e no more than five times.
2. *Maximum link length:* The length of any single link, from node to LX1500e port or from LX1500e port to LX1500e 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-14 shows a signal path from SCRAMNet node 1 through three LX1500e 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 LX1500e 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.

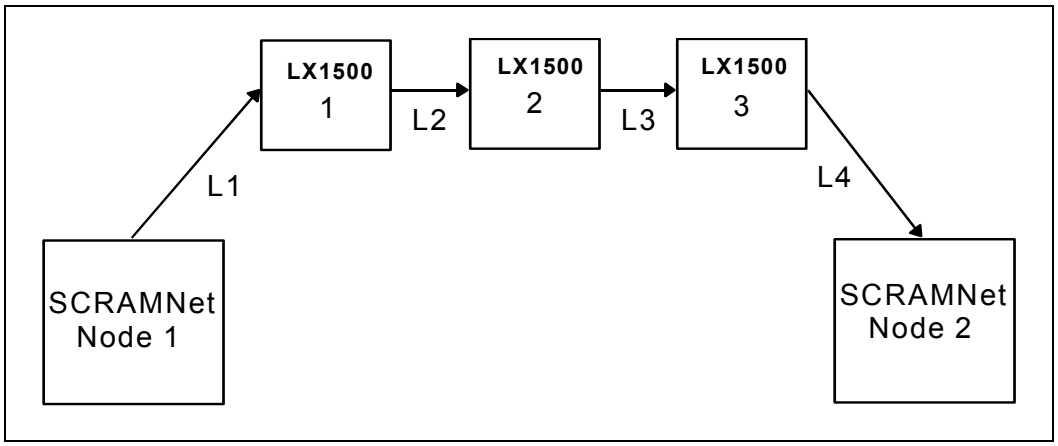



**Figure B-14 SCRAMNet/LX1500e Signal Path**

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# APPENDIX C

# RS-232 CABLES

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Table C-1 LX1500e Pin Assignments ..... C-1

# C.1 Overview

The LX1500e 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 LX1500e 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 LX1500e 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 LX1500e 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.

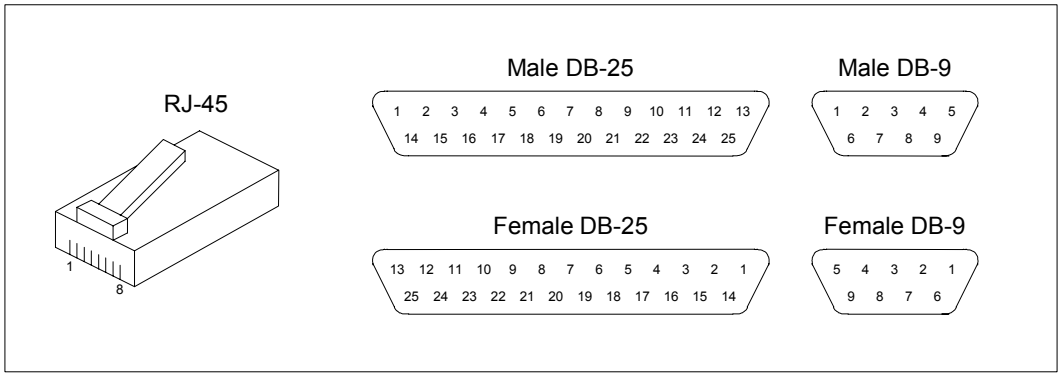



**Figure C-1 RS-232 Connector Pinouts**

# C.3 LX1500e Pin Assignments

Table C-1 shows the signals assigned to each pin for the two RS-232 connectors used by the LX1500e. The "Direction" column indicates the signal direction at the LX1500e. The LX1500e DB-9 pinout is the same as on the DB-9 serial connectors commonly found on personal computers, with the exception that the LX1500e doesn't use the DSR (Data Set Ready) or RI (Ring Indicator) input signals.

**Table C-1 LX1500e Pin Assignments**

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

The current version of the controller software embedded in the LX1500e 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 LX1500e. The

LX1500e 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 LX1500e DB-9 connector to a personal computer's DB-9 serial port.

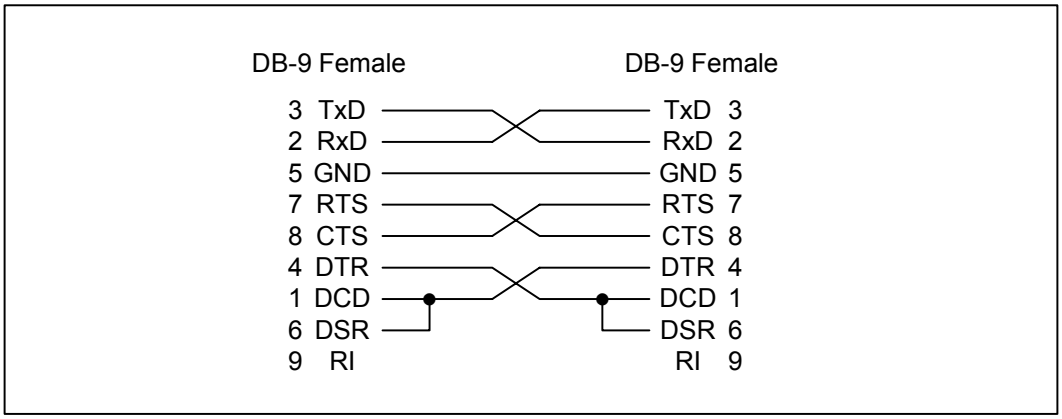



**Figure C-2 DB-9 to DB-9 Null Modem Cable**

The similar cable shown in Figure C-3 can be used to connect the LX1500e to a terminal that uses the traditional Male DB-25 connector and pin assignments.

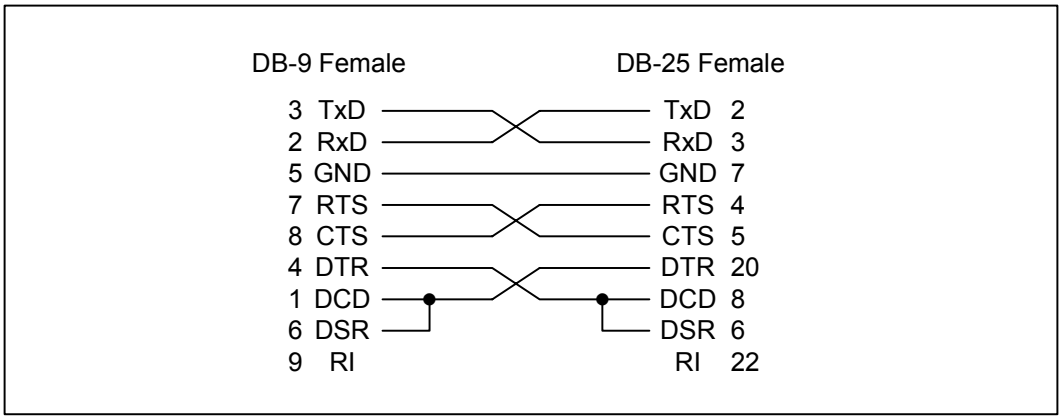



**Figure C-3 DB-9 to DB-25 Null Modem Cable**

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 is the same cable that would be used to connect a personal computer's DB-9 serial port to an external modem.

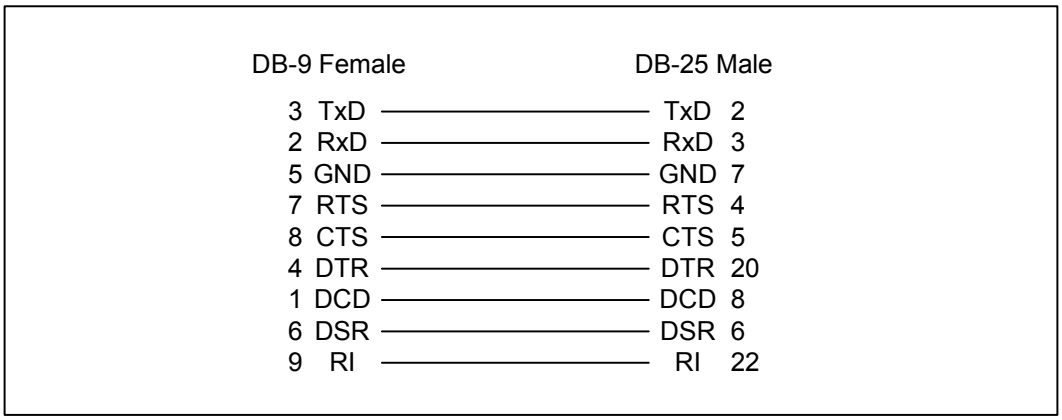



**Figure C-4 DB-9 to DB-25 "Straight Through" Cable**

## C.4.3 Connecting to the Base Unit

Wiring to the RJ-45 jack on the LX1500e 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.

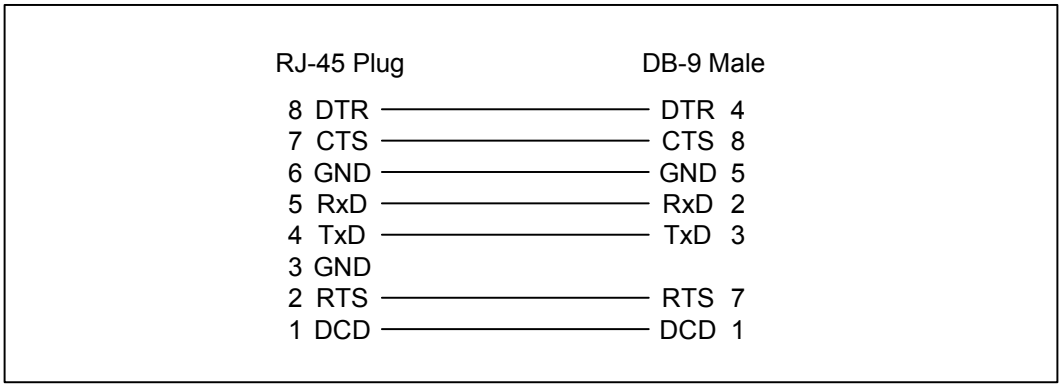



**Figure C-5 RJ-45 Plug to DB-9 Male Cable**

A cable wired as shown in Figure C-6 would allow the LX1500e base unit to be cabled directly to the DB-9 male serial port of a personal computer.

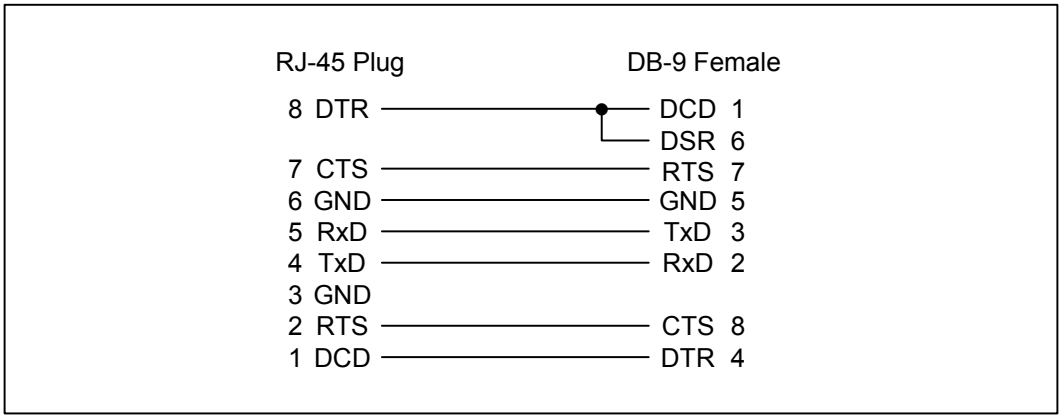



**Figure C-6 RJ-45 Plug to DB-9 Female Cable**

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# APPENDIX D

# ORDERING INFORMATION

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Table D-1 LX1500e Order Numbers ..... D-2

# D.1 Order Numbers

Systran offers the LX1500e products listed below.

## D.1.1 LX1500e Units

The LX1500e is available as the bare base unit, or as one or two units installed in a rack-mountable enclosure. For each LX1500e part number, the "xxxxxxxx" field specifies the port cards that are to be installed in the LX1500e's eight slots. From left to right, the x's specify the cards for slots one through eight. For slots where a "0" is specified, a blank filler plate is installed instead of a port card. Values for "x" for each type of port card are shown in the port card section of Table D-1.



**NOTE:** In calculating total product weight, the blank filler plates are negligible.

## D.1.2 LX1500e Port Cards

Port cards can be ordered separately or as part of the LX1500e unit (see above).

**Table D-1 LX1500e Order Numbers**

**LX1500E UNITS**

| Order Number | Description | Weight (lbs) | Power ($W_{DC}$) |
|---|---|---|---|
| FHS2-xxxxxxxx-00 | LX1500e base unit | 2.9 | 37 |
| FHS2-xxxxxxxx-10 | One base unit in rack-mountable enclosure | 32.8 | 37 |
| FHS2-xxxxxxxx-11 | Second base unit in rack-mountable enclosure (must be ordered with FHS2-xxxxxxxx-10) | 2.9 | 37 |

**LX1500E PORT CARDS**

| Order Number | x | Description | Weight (lbs) | Power ($W_{DC}$) |
|---|---|---|---|---|
| N/A | 0 | No card | N/A | N/A |
| FHSA-S14MW000-00 | A | Retimed Short Wavelength Optical Port Card | 0.3 | 10.5 |
| FHSB-S14C3000-00 | B | Retimed 1x3 Copper Port Card | 0.2 | 10.0 |
| FHSD-S14C3000-00 | D | Non-Retimed 1x3 Copper Port Card | 0.2 | 2.8 |
| FHSE-S11SL000-00 | E | SCRAMNet+ Standard Link Optical Port Card | 0.3 | 5.5 |
| FHSF-S11LL000-00 | F | SCRAMNet+ Long-Link Optical Port Card | 0.3 | 5.5 |
| FHSG-S11CL000-00 | G | SCRAMNet+ Coax Port Card | 0.3 | 1.5 |
| FHSK-S14HS000-00 | K | Retimed HSSDC Copper Port Card | 0.3 | 10.0 |
| FHSL-S14HS000-00 | L | Non-Retimed HSSDC Copper Port Card | 0.3 | 2.8 |
| FHSM-S14MW000-00 | M | Non-retimed Short Wavelength Optical Port Card with LASER on/off control. | 0.3 | 3.55 |
| FHSP-S14MW000-00 | P | Retimed Short Wavelength Optical Port Card with LASER on/off control. | 0.3 | 10.5 |
| FHSQ-S14SW000-00 | Q | Retimed Long Wavelength Optical Port Card with LASER on/off control. | 0.3 | 10.5 |

* Using transceivers purchased from Systran

# D.2 Cables

Systran offers the following cables for use with its LX1500e port cards:

## D.2.1 Short Wavelength: Multimode Optical Fiber

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

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

## D.2.2 Long Wavelength: Singlemode Optical Fiber

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

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

### D.2.3 HSSDC Copper: 150-Ohm Shielded Quad Cable

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

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

### D.2.4 1x3 Copper: 150-Ohm Twinaxial Cable

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

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

# D.3 Sample Weight Calculations

Sometimes it is helpful to know how much an LX1500e product weighs. It is not practical to list the weights for all product combinations; therefore the following three examples illustrate how to calculate the weight. Refer to Table D-1 for weights.

### EXAMPLE 1: FHS2-AABBEE00-00

This combination consists of an LX1500e base unit (FHS2-xxxxxxxx-00), two type "A" port cards (FHSA-S14MW000-00), two type "B" port cards (FHSB-S14C3000-00), two type "E" port cards (FHSE-S11SL000-00), and two blank filler plates.

| Item | Quantity | Weight (each) (lbs) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-00 | 1 | 2.9 | 2.9 |
| Type "A" port card | 2 | 0.3 | 0.6 |
| Type "B" port card | 2 | 0.2 | 0.4 |
| Type "E" port card | 2 | 0.3 | 0.6 |
| Blank filler plates | 2 | Negligible | 0 |
| | | | 4.5 lbs (2.0 kg) |

### EXAMPLE 2: FHS2-PPPP0000-10

This combination consists of an LX1500e base unit in a rack-mountable enclosure (FHS2-xxxxxxxx-10), four type "P" port cards (FHSP-S14MW000-00), and four blank filler plates.

| Item | Quantity | Weight (each) (lbs) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-10 | 1 | 32.8 | 32.8 |
| Type "P" port card | 4 | 0.3 | 1.2 |
| Blank filler plates | 4 | Negligible | 0 |
| | | | 34.0 lbs (15.4 kg) |

### EXAMPLE 3: FHS2-PPPP0000-10 WITH FHS2-EEEEEEEE-11

This combination consists of an LX1500e base unit in a rack-mountable enclosure (FHS2-xxxxxxxx-10), four type "P" port cards (FHSP-S14MW000-00), four blank filler plates, a second base unit (FHS2-xxxxxxxx-11), and eight type "E" port cards (FHSE-S11SL000-00).

| Item | Quantity | Weight (each) (lbs) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-10 | 1 | 32.8 | 32.8 |
| Type "P" port card | 4 | 0.3 | 1.2 |
| Blank filler plates | 4 | Negligible | 0 |
| FHS2-xxxxxxxx-11 | 1 | 2.9 | 2.9 |
| Type "E" port card | 8 | 0.3 | 2.4 |
| | | | 39.3 lbs (17.8 kg) |

# D.4 Sample Power Calculations

The specifications in Appendix A give the maximum AC input current requirement, but sometimes it is helpful to know how much AC and DC power an LX1500 product actually consumes. It is not practical to list the power consumptions for all product combinations. Therefore, the following three examples illustrate how to calculate the power consumption. Refer to Table D-1 for power data.

## EXAMPLE 1: FHS2-AABBEE00-00

This combination consists of an LX1500e base unit (FHS2-xxxxxxxx-00), two type "A" port cards (FHSA-S14MW000-00), two type "B" port cards (FHSB-S14C3000-00), and two type "E" port cards (FHSE-S11SL000-00).

| Item | Quantity | Power (each) ($W_{DC}$) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-00 | 1 | 37.0 | 37.0 |
| Type "A" port card | 2 | 10.5 | 21.0 |
| Type "B" port card | 2 | 10.0 | 20.0 |
| Type "E" port card | 2 | 5.5 | 11.0 |
| | | | 89.0 $W_{DC}$ |



**NOTE:** Power supply efficiency of 65% is used here for illustration only. The actual efficiency factor will depend on your power supply. Contact the manufacturer for this information.

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

$$89.0\,W \times \frac{1}{0.65} = 136.9\,W_{AC}$$ **Equation 1**

## EXAMPLE 2: FHS2-PPPP0000-10

This combination consists of an LX1500e base unit in two rack-mountable enclosures (FHS2-xxxxxxxx-10), and four type "P" port cards (FHSP-S14MW000-00).

| Item | Quantity | Power (each) ($W_{DC}$) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-10 | 1 | 37.0 | 37.0 |
| Type "P" port card | 4 | 10.5 | 42.0 |
| | | | 79.0 $W_{DC}$ |

The rack-mountable LX1500e contains a built-in power supply. See appendix A for power supply efficiency.

The AC power consumed is:

$$79.0\,W \times \frac{1}{0.65} = 121.54\,W_{AC}$$ **Equation 2**

## EXAMPLE 3: FHS2-PPPP0000-10 WITH FHS2-EEEEEEEE-11

This combination consists of an LX1500e base unit in a rack-mountable enclosure (FHS2-xxxxxxxx-10, four type "P" port cards (FHSP-S14MW000-00), a second base unit (FHS2-xxxxxxxx-11), and eight type "E" port cards (FHSE-S11SL000-00).

| Item | Quantity | Power (each) ($W_{DC}$) | Total |
|---|---|---|---|
| FHS2-xxxxxxxx-10 | 1 | 37.0 | 37.0 |
| Type "P" port card | 4 | 10.5 | 42.0 |
| FHS2-xxxxxxxx-11 | 1 | 37.0 | 37.0 |
| Type "E" port card | 8 | 5.5 | 44.0 |
| | | | 160.0 $W_{DC}$ |

The AC power consumed is:

$$160\,W \times \frac{1}{0.65} = 246.2\,W_{AC}$$ **Equation 3**

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# APPENDIX E

# APPLICATION NOTES

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# E.1 Startup Sequence

Use the following startup sequence if you are using computer driven applications. If not using a computer driven application, auto-baud the LX1500e and go to section E.2 for command line examples.

| Action | Command line input |
|---|---|
| Auto-baud | (**\r wait 0.5 s \r wait 0.5 s \r wait 0.5 s**) |
| Disable Auto-Messaging | (**ui am 0**) |
| Disable Beeping | (**ui be 0**) |
| Disable Display Window | (**ui dw 0**) |
| Set Verbose Level to 1 | (**ui vb 1**) |
| Set Echo Enable to 1 | (**ui ec 1**) |

When using the sequence above please note:

- Setting **be!**=0, **dw!**=0, **am!**=0 causes ports to detect multiple signal transitions, some startup applications may encounter problems. You may have to execute the above sequence a few times to make sure that all commands are successful. You can use the **ui** command in your applications to check the current configuration to make sure that all commands were executed successfully.
- Empty your RS-232 input buffer as it may have already overflowed.
- The settings used above are for illustrative purposes only. You are free to choose other settings to suit your specific needs.
- Do not use **st** without tags. Use **std**, **stv**, **cc**, or **al** commands to retrieve all configuration and status information during testing.
- You can use **bc x** command to synchronize your application with the LX1500e.
- Since the LX1500e requires some time for printing responses, you must place time gaps between commands or additional commands may overload the command queue resulting in missed commands. The longer the response of the command, the longer the time delay should be.
- Use **bc vs** from time to time to gather statistics to make sure that no commands were missed and that all printouts were successful.

# E.2 Command Line Examples

## E.2.1 Simplex (Unidirectional) Connection

To set simplex connection from 1a (input) to 7b (output):

```
m1a 7b
```

or

```
p7b la
```

### E.2.2 Loop Back

To set internal loopback (wrap) mode on port 5b:

```
cc 5b out
```

or

```
p5b 5b
```

### E.2.3 Point-To-Point (Duplex) Connection

To set duplex point-to-point connection between ports 3a and 4b:

```
cc 3a4b  - auto-bypass feature not activated.
al9 3a4b - auto-bypass feature activated (assumed loop ID 9
                                          free).
```

To set four duplex point-to-point connections at once:

```
cc 3a4b 7a8b 2c2d 4a8a
```

### E.2.4 Multicast

To add three ports to multicast list of port (input) 1a:

```
m1a 3a4b8b
```

To remove port 4b (output) from the multicast of port 1a (input):

```
m1a 4b out
```

To make sure that port 1a is not multicasting to any other port:

```
m1a all out (configures all ports in multicast list of 1a to
wrap)
```

### E.2.5 Loop

To add ports 4b, 5b, 7a to loop 8 (with auto-bypass):

```
al8 4b5b7a
```

To remove port 5b and 7a from loop 8 use:

```
al8 5b7a out
```

To see members of loop 8 and their status (in bypass or active) use:

```
al8
```

To free loop ID 8 of all ports use:

```
al8 all out
```

To see which loop numbers are in use:

```
al
```

To make fixed (no auto-bypass) loop with ports 4b, 5b, 7a:

```
cc 4b5b7a
```

To make two fixed (no auto-bypass) loops at once:

```
cc 4b5b7a 8a3b1a1b
```

To return the position vector of port loop assignments:

```
st l
```

### E.2.6 Total Routing

To configure global LX1500e routing:

```
cc 2a4a5a6a7a1a5b6c8a8a3b2a4b4b4b1c...2c r (32 port entries)
```

To get retrieve routing vector:

```
cc
```

### E.2.7 Signal Detect State

To return the signal detect status of all 32 ports in vector form:

```
st v
```

To return the signal detect status of all 32 ports in hex form:

```
st d
```

### E.2.8 Output Laser Control

To turn the laser on for a specified PList:

```
oe 1a1b3c8a
oe all
```

To place ports from a PList in tri-state mode:

```
oe 1a2c3d out
oe all out
```

### E.2.9 Switch Statistics

To display statistics for the current session:

```
bc vs
```

To display statistics for the lifetime of the LX:

```
bc vsl
```

# E.3 Port Status Format

The format of the returned status (which is displayed on a VT100 or equivalent terminal) for each port is: abcOP<IP STAT ##
where:

a - state of the port's laser ('z' if laser is off, space if laser is on).
b - routed output signal present ('+' if present, space if not present).
c - input signal present ('+' if present, space if not present).
OP - output port ID (ex 1A).
IP - input (source) port ID (ex 2A).
STAT - current state (configuration) of the output port.

PC or SC - output port is in copy mode (auto-bypass inactive).
PCwr or SCwr - output port in internal loopback (wrap) mode (auto-bypass inactive).
AL## or SL## - port is configured on loop number ## (auto-bypass active).
## - hexadecimal count of signal detect transitions from an active to inactive state.

**EXAMPLES**

z+ 1a<1a CPwr 01 ..... 1a laser off with a present output signal sourced by input 1a (wrap) and has toggled signal detect once.

++1a<1c AL00 0a ..... 1a is configured on loop 0, has valid output (from 1c) and signal present at its input. Signal detect has toggled ten times.

1a<1c PC 00..... 1a is configured as a copy of 1c, has no valid input or output signals, and has not toggled signal detects.

# GLOSSARY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**FibreXpress**----------A Systran trademark name for the Fibre Channel family of products.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**IOCB**----------I/O Control Block. A block of information stored in system memory, usually of fixed length, which contains control codes and data. The

IOCB is created by a host computer and sent to some other computer. The IOCB contains command/instructions, data, and memory pointers intended to direct the other computer to perform some function.

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

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

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

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

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

**KB**----------KiloBytes.

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

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

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

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

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

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

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

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

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

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

**MBps**----------MegaBytes per second.

**MB** ----------MegaBytes.

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

**ms**----------Milliseconds

**µs** ----------Microseconds

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

**multicast**----------A single transmission is sent to multiple destination N_ports.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**switched fabric** ----------(see the definition for "fabric").

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

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

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

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

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

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

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

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

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

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

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

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