

Lucent Technologies
Bell Labs Innovations



Stinger®

SHDSL 48-Port and 72-Port Line Interface Modules (LIM) Guide


Copyright © 2002 Lucent Technologies Inc. All rights reserved.

This material is protected by the copyright laws of the United States and other countries. It may not be reproduced, distributed, or altered in any fashion by any entity (either internal or external to Lucent Technologies), except in accordance with applicable agreements, contracts, or licensing, without the express written consent of Lucent Technologies. For permission to reproduce or distribute, please email your request to techcomm@lucent.com.

Notice

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing, but information is subject to change.

European Community (EC) RTTE compliance

 Hereby, Lucent Technologies, declares that the equipment documented in this publication is in compliance with the essential requirements and other relevant provisions of the Radio and Telecommunications Technical Equipment (RTTE) Directive 1999/5/EC.

To view the official *Declaration of Conformity* certificate for this equipment, according to EN 45014, access the Lucent INS online documentation library at <http://www.lucentdocs.com/ins>.

Safety, compliance, and warranty information

Before handling any Lucent Access Networks hardware product, read the *Edge Access and Broadband Access Safety and Compliance Guide* included in your product package. See that guide also to determine how products comply with the electromagnetic interference (EMI) and network compatibility requirements of your country. See the warranty card included in your product package for the limited warranty that Lucent Technologies provides for its products.

Security statement

In rare instances, unauthorized individuals make connections to the telecommunications network through the use of access features.

Trademarks

Lucent, the Lucent logo, and all Lucent brand and product names are trademarks or registered trademarks of Lucent Technologies Inc. Other brand and product names are trademarks of their respective holders.

Ordering information

You can order the most up-to-date product information and computer-based training online at <http://www.lucentdocs.com/bookstore>.

Feedback

Lucent Technologies appreciates customer comments about this manual. Please send them to techcomm@lucent.com.

Customer Service

Product and service information, and software upgrades, are available 24 hours a day. Technical assistance options accommodate varying levels of urgency.

Finding information and software

To obtain software upgrades, release notes, and addenda for this product, log in to Lucent OnLine Customer Support at <http://www.lucent.com/support>.

Lucent OnLine Customer Support also provides technical information, product information, and descriptions of available services. The center is open 24 hours a day, seven days a week. Log in and select a service.

Obtaining technical assistance

Lucent OnLine Customer Support at <http://www.lucent.com/support> provides easy access to technical support. You can obtain technical assistance through email or the Internet, or by telephone. If you need assistance, make sure that you have the following information available:

- Active service or maintenance contract number, entitlement ID, or site ID
- Product name, model, and serial number
- Software version or release number
- Software and hardware options
- If supplied by your carrier, service profile identifiers (SPIDs) associated with your line
- Your local telephone company's switch type and operating mode, such as AT&T 5ESS Custom or Northern Telecom National ISDN-1
- Whether you are routing or bridging with your Lucent product
- Type of computer you are using
- Description of the problem

Obtaining assistance through email or the Internet

If your services agreement allows, you can communicate directly with a technical engineer through Email Technical Support or Live Chat. Select one of these sites when you log in to <http://www.lucent.com/support>.

Calling the technical assistance center (TAC)

If you cannot find an answer through the tools and information of Lucent OnLine Customer Support or if you have a very urgent need, contact TAC. Access Lucent OnLine Customer Support at <http://www.lucent.com/support> and click Contact Us for a list of telephone numbers inside and outside the United States.

Alternatively, call 1-866-LUCENT8 (1-866-582-3688) from any location in North America for a menu of Lucent services. Or call +1 510-769-6001 for an operator. If you do not have an active services agreement or contract, you will be charged for time and materials.

Contents



Customer Service	iii
About This Guide	xi
What is in this guide	xi
What you should know.....	xi
Documentation conventions.....	xi
Stinger documentation set	xii
Chapter 1 Configuring the SHDSL LIM.....	1-1
Introducing the SHDSL LIMs	1-1
Installing the single-pair high-speed DSL (SHDSL) LIM	1-2
Module specifications.....	1-2
Status indicators	1-3
Interpreting SHDSL LIM status lights	1-3
Embedded Operations Channel (EOC) protocol compliance	1-4
Configuring SHDSL interfaces.....	1-4
Configuring port settings for SHDSL.....	1-4
Sample SHDSL mode configuration	1-11
Binding two SHDSL ports	1-12
Displaying SHDSL port status	1-12
Configuring call control.....	1-13
Checking the status of an SHDSL interface	1-15
Checking the status of the physical interface	1-16
Obtaining statistics about operations	1-17
Diagnostic internal, external, and bit error-rate tests	1-19
Configuring an internal diagnostic test (IDT)	1-21
Configuring a bit-error-rate test (BERT).....	1-21
Configuring an external diagnostic test (EDT)	1-22
Digital loopback.....	1-22
Analog loopback.....	1-23
Chapter 2 Configuring LIM and LIM Port Redundancy.....	2-1
Overview of LIM and LIM port redundancy	2-1
Configuring LIM redundancy.....	2-1
Overview of the lim-sparing-config profile	2-2
Manual LIM redundancy	2-4
Automatic LIM redundancy	2-4
LIM redundancy with IRMs and LPM-Rs	2-6
Checking LIM redundancy status	2-8

Contents

Checking status with the Rearslot command	2-9
Configuring LIM port redundancy.....	2-9
Enabling LIM port redundancy.....	2-11
Manual LIM port redundancy	2-11
Automatic LIM port redundancy	2-12
Checking the status of extended LIM port redundancy	2-12

Figures



Figure 1-1 SHDSL 72-port LIM	1-3
Figure 1-2 Digital loopback	1-22
Figure 1-3 Analog loopback	1-23
Figure 2-1 LIM redundancy in a Stinger FS unit	2-2
Figure 2-2 LIM port redundancy on a Stinger FS unit.....	2-10

Tables



Table 1-1	SHDSL LIMS	1-1
Table 1-2	Specifications for the SHDSL 48-port and 72-port LIMs	1-2
Table 1-3	SHDSL LIM status lights	1-3

About This Guide

What is in this guide

This guide describes how to configure and monitor the Stinger SHDSL line interface module (LIM) and includes configuration examples and module specifications. This guide also describes how to configure LIM redundancy.



Warning Before installing your Stinger unit, be sure to read the safety instructions in the *Edge Access and Broadband Access Safety and Compliance Guide*. For information specific to your unit, see the “Safety-Related Physical, Environmental, and Electrical Information” appendix in the *Getting Started Guide* for your Stinger unit.





What you should know

To make use of the procedures and sample configurations in this guide, you should have a general knowledge of Stinger products and a working knowledge of the command-line interface. You should understand the fundamental concepts of digital subscriber line (DSL) technology and be familiar with the relationship between DSL interfaces and associated configuration profiles.

Documentation conventions

Following are the special characters and typographical conventions used in this manual:

Convention	Meaning
Monospace text	Represents text that appears on your computer’s screen, or that could appear on your computer’s screen.
Boldface monospace text	Represents characters that you enter exactly as shown (unless the characters are also in <i>italics</i> —see <i>Italics</i> , below). If you could enter the characters but are not specifically instructed to, they do not appear in boldface.
<i>Italics</i>	Represent variable information. Do not enter the words themselves in the command. Enter the information they represent. In ordinary text, italics are used for titles of publications, for some terms that would otherwise be in quotation marks, and to show emphasis.

Convention	Meaning
[]	Square brackets indicate an optional argument you might add to a command. To include such an argument, type only the information inside the brackets. Do not type the brackets unless they appear in boldface.
	Separates command choices that are mutually exclusive.
>	Points to the next level in the path to a parameter or menu item. The item that follows the angle bracket is one of the options that appear when you select the item that precedes the angle bracket.
Key1-Key2	Represents a combination keystroke. To enter a combination keystroke, press the first key and hold it down while you press one or more other keys. Release all the keys at the same time. (For example, Ctrl-H means hold down the Control key and press the H key.)
Press Enter	Means press the Enter, or Return, key or its equivalent on your computer.
 Note	Introduces important additional information.
 Caution	Warns that a failure to follow the recommended procedure could result in loss of data or damage to equipment.
 Warning	Warns that a failure to take appropriate safety precautions could result in physical injury.
 Warning	Warns of danger of electric shock.

Stinger documentation set

The Stinger documentation set consists of the following manuals, which can be found at <http://www.lucentdocs.com/ins>:

■ **Read me first:**

- *Edge Access and Broadband Access Safety and Compliance Guide*. Contains important safety instructions and country-specific information that you must read before installing a Stinger unit.
- *TAOS Command-Line Interface Guide*. Introduces the TAOS command-line environment and shows you how to use the command-line interface effectively. This guide describes keyboard shortcuts and introduces commands, security levels, profile structure, and parameter types.

■ **Installation and basic configuration:**

- *Getting Started Guide* for your MAX platform. Shows how to install your Stinger chassis and hardware. This guide also shows you how to use the command-line interface to configure and verify IP access and basic access security on the unit, and how to configure Stinger control module redundancy on units that support it.
- Module guides. For each Stinger line interface module (LIM), trunk module, or other type of module, an individual guide describes the module's features and provides instructions for configuring the module and verifying its status.

■ **Configuration:**

- *Stinger ATM Configuration Guide*. Describes how to integrate the MAX into the ATM and Digital Subscriber Line (DSL) access infrastructure. The guide explains how to configure PVCs, and shows how to use standard ATM features such as quality of service (QoS), connection admission control (CAC), and subtending.
- *Stinger IP2000 Configuration Guide*. For MAX systems with the IP2000 control module, this guide describes how to integrate the system into the IP infrastructure. Topics include IP-routed switch-through ATM PVCs and RFC 1483 PVCs that terminate on the IP2000, IEEE 802.1Q VLAN, and forwarding multicast video transmissions on DSL interfaces.
- *Stinger Private Network-to-Network Interface (PNNI) Supplement*. For the optional PNNI software, this guide provides quick-start instructions for configuring PNNI and soft PVCs (SPVCs), and describes the related profiles and commands.
- *Stinger SNMP Management of the ATM Stack Supplement*. Describes SNMP management of ATM ports, interfaces, and connections on a MAX unit to provide guidelines for configuring and managing ATM circuits through any SNMP management utility.
- *Stinger T1000 Module Routing and Tunneling Supplement*. For the optional T1000 module, this guide describes how to configure the Layer 3 routing and virtual private network (VPN) capabilities.

■ **RADIUS:** *TAOS RADIUS Guide and Reference*. Describes how to set up a unit to use the Remote Authentication Dial-In User Service (RADIUS) server and contains a complete reference to RADIUS attributes.

■ **Administration and troubleshooting:** *Stinger Administration Guide*. Describes how to administer the Stinger unit and manage its operations. Each chapter focuses on a particular aspect of Stinger administration and operations. The chapters describe tools for system management, network management, and Simple Network Management Protocol (SNMP) management.

■ **Reference:**

- *Stinger Reference*. An alphabetic reference to Stinger profiles, parameters, and commands.
- *TAOS Glossary*. Defines terms used in documentation for Stinger units.

Configuring the SHDSL LIM



1

Introducing the SHDSL LIMs	1-1
Installing the single-pair high-speed DSL (SHDSL) LIM	1-2
Module specifications	1-2
Status indicators	1-3
Configuring SHDSL interfaces	1-4
Configuring call control	1-13
Checking the status of an SHDSL interface	1-15
Diagnostic internal, external, and bit error-rate tests	1-19

The Stinger SHDSL 48-port and 72-port line interface modules (LIMs) support single-pair high-speed digital subscriber line (SHDSL) mode. In addition, four wire support combines the bandwidth of two ports to double the available bandwidth. When an SHDSL LIM is installed in a Stinger slot, the Stinger chassis connects the LIM to a line protection module (LPM), which provides the physical connections for incoming lines. The 48-port SHDSL LIM provides 48 SHDSL interfaces per LIM. The 72-port SHDSL LIM provides 72 SHDSL interfaces per LIM.

Introducing the SHDSL LIMs

Stinger units support SHDSL LIMs with 48 and 72 ports, each of which is available in two versions. Table 1-1 list the SHDSL LIM models and the supported platforms.

Table 1-1. SHDSL LIMs (page 1 of 2)

Platform	Product code	Description
Stinger FS Stinger FS+ Stinger RT	STGR-LIM-48	48-port SHDSL LIM
Stinger FS Stinger FS+ Stinger RT	STGR-LIM-72	72-port SHDSL LIM

Configuring the SHDSL LIM

Installing the single-pair high-speed DSL (SHDSL) LIM

Table 1-1. SHDSL LIMs (page 2 of 2)

Platform	Product code	Description
Stinger RT	STGRRT-LIM-SL-48	48-port SHDSL LIM
Stinger RT	STGRRT-LIM-SL-72	72-port SHDSL LIM

A Stinger unit using an SHDSL LIM supports symmetric data transfer rates from 72Kbps through 2312Kbps. SHDSL technology is spectrally compatible with other loop technologies such as ISDN, T1, and HDSL.

Installing the single-pair high-speed DSL (SHDSL) LIM

Install the SHDSL module in the same manner as you install other LIM modules. For details, see the Stinger *Getting Started Guide* for your unit. After installation, follow the instructions in this document to configure the module.

Module specifications

Table 1-2 shows the specifications for the SHDSL 48-port and 72-port LIMs.

Table 1-2. Specifications for the SHDSL 48-port and 72-port LIMs (page 1 of 2)

Category	Specification
Physical dimensions	Height: 15 inches (38.1cm). Width: 1.06 inches (2.69cm). Depth: 9 inches (22.8cm).
Weight	48-port model—3.8 pounds (1.7kg) 72-port model—4.7 pounds (2.1kg)
Maximum power requirements	48-port model—80W 72-port model—119W Add .48W for each line that has sealing current enabled.
Temperature	FS/LS version: 32°F through 131°F (0°C through 55°C) RT version: -40°F through 149°F (-40°C through 65°C)
Relative Humidity	10% through 95% (noncondensing)
Operating Altitude	RT version: Up to 13,123 feet (4,000m)

Table 1-2. Specifications for the SHDSL 48-port and 72-port LIMs (page 2 of 2)

Interface standards	ITU G.991.2 (G.shdsl) Annex A (North America) Annex B (Europe) ETSI TS 101 524 (similar to ITU Annex B implementation) ITU G.994.1 (G.hs) ITU G.997.1 (physical layer management)
Range	Maximum 24,000 feet with 24 AWG wire at 192Kbps Maximum 12,000 feet with 24 AWG wire at 2.312Mbps

Status indicators

Several status lights on the front panel of SHDSL LIMs indicate the status of the modules and their ports. Status lights are the same for both models of the SHDSL LIM. Figure 1-1 shows the front panel and status lights of the SHDSL 72-port LIM.

Interpreting SHDSL LIM status lights

All status lights illuminate briefly upon startup or restart, then remain dark until the module passes its power-on self test (POST). When the module passes its POST and becomes operational, the ACTIVE light illuminates. Table 1-3 explains SHDSL LIM status lights.

Table 1-3. SHDSL LIM status lights

Light	Color	Indication
STBY	Orange	The module is a designated spare. The control module switches traffic to the module if one of the other modules fails.
ACTIVE	Green	The module or port is fully operational and no errors have been detected.
FAULT	Orange	The module failed to pass its POST.
BYPASS	Orange	The module is in bypass mode. (The module redundancy feature is activated.)
PORT	Green	The local and remote ends of the physical line have achieved frame synchronization, and the local end of the ATM link has achieved cell delineation. If the light is not illuminated, the port is inactive.



Figure 1-1. SHDSL 72-port LIM

Embedded Operations Channel (EOC) protocol compliance

Embedded Operations Channel (EOC) protocol compliance is defined within the G.991.2 standard specification. The EOC protocol provides identification and statistical information about the SHDSL interface and its remote repeaters and associated customer premises equipment (CPE) and central office equipment nodes.

To display basic statistics, view the `shdsl-stat` profile.

Configuring SHDSL interfaces

The SHDSL 48-port LIM supplies up to 48 interfaces per LIM. The SHDSL 72-port LIM supplies up to 72 interfaces per LIM. Except for the number of interfaces, configuration of the two SHDSL models is identical. A Stinger unit creates an `shdsl` profile for each SHDSL interface in the system.

For example, for an SHDSL 72-port LIM installed in slot 1, the system creates profiles such as the following:

```
admin> dir shdsl
 18 06/20/1999 23:18:51 { shelf-1 slot-1 1 } 1:1:1
 18 06/20/1999 23:18:51 { shelf-1 slot-1 2 } 1:1:2
 18 06/20/1999 23:18:51 { shelf-1 slot-1 3 } 1:1:3
 18 06/20/1999 23:18:51 { shelf-1 slot-1 4 } 1:1:4
 18 06/20/1999 23:18:51 { shelf-1 slot-1 5 } 1:1:5
 18 06/20/1999 23:18:51 { shelf-1 slot-1 6 } 1:1:6
 18 06/20/1999 23:18:51 { shelf-1 slot-1 7 } 1:1:7
 18 06/20/1999 23:18:51 { shelf-1 slot-1 8 } 1:1:8
```

Configuring port settings for SHDSL

SHDSL ports are configured in each port's `shdsl` profile. The default `shdsl` profile is as follows:

```
[in SHDSL/{ any-shelf any-slot 0 } (new)]
name = ""
physical-address* = { any-shelf any-slot 0 }
enabled = no
sparing-mode = inactive
ignore-lineup = system-defined
line-config = { 0 1 15 static { any-shelf any-slot 0 } coe no not-eligible midd+
```

Parameter	Setting
name	Name of the interface. The default value is the interface address in <code>shelf:slot:item</code> format (for example, <code>1:2:1</code>), but you can assign a text string of up to 16 characters.
physical-address	Physical address of the interface in the Stinger unit.
enabled	Enable or disable the interface. Specify one of the following values: <ul style="list-style-type: none">■ no (the default)—Line is disabled until you activate it in the <code>shdsl</code> profile.■ yes—Line is enabled.

- ignore-lineup Value of the ignore-lineup parameter. Possible values are:
- system-defined—Ignore line up value is picked from system profile.
 - no—Do not ignore line up.
 - yes—Ignore line up

The default line-config subprofile is listed below with its defaults:

```
[in SHDSL/{ any-shelf any-slot 0 }:line-config]
trunk-group = 0
nailed-group = 1
vp-switching-vpi = 15
activation = static
call-route-info = { any-shelf any-slot 0 }
unit-type = coe
ntr-enabled = no
clock-source = not-eligible
clock-priority = middle-priority
loop-back = none
margin = 2db
snext-margin = disable
rate-mode = auto
min-rate = 72000
max-rate = 2312000
gshdsl-standard-network-type = north-american-annex-a
annexb-anfp-enabled = no
gshdsl-psd-type = symmetric
master-binding-port = no
```

Parameter	Setting
trunk-group	<i>Not currently used.</i> Use the default value (zero).
nailed-group	Nailed-group number for the SHDSL physical interface. A connection or RADIUS profile specifies this number to make use of the interface. Each interface is assigned a unique default number, so you need not modify this parameter. If you assign a new value, it must be a number from 1 through 1024 that is unique within the system.
vp-switching-vpi	The virtual path identifier (VPI) to use for virtual path switching on the LIM port. The default is 15. All other VPIs are used for virtual circuit (VC) switching.
activation	<i>Not currently used.</i> Leave the default value (static).
call-route-info	<i>Not currently used.</i> Leave the default value (the zero address).

Parameter	Setting
unit-type	<p>Type of unit. Remote equipment must have opposite setting. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>coe</code> (the default)—The unit is central office equipment (COE).■ <code>cpe</code>—The unit is customer premises equipment (CPE).
ntr-enabled	<p>Enable or disable network time reference (NTR) capability. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>no</code> (the default)—NTR capability is disabled.■ <code>yes</code>—NTR capability is enabled. <p>If the <code>unit-type</code> parameter is set to <code>coe</code>, the system clock is taken as the input and the CPE, if equipped to do so, can recover the clock.</p> <p>If the <code>unit-type</code> parameter is set to <code>cpe</code>, the port outputs the recovered clock as the system clock if the <code>clock-source</code> parameter is set to <code>eligible</code> and the <code>clock-priority</code> parameter is set to allow the clock to be selected.</p>
clock-source	<p>Eligibility of the 8kHz clock from the SHDSL line to be used as the 8kHz system clock. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>eligible</code>—The line can be used as the master clock source. The <code>unit-type</code> parameter must be set to <code>cpe</code>. The <code>ntr-enabled</code> parameter must be set to <code>yes</code>.■ <code>not-eligible</code>—The line cannot be used as the master clock source.
clock-priority	<p>Clock priority assigned to the SHDSL line. Used to select a particular shdsl line as the 8kHz system clock source. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>high-priority</code>—A line with this priority is selected over lines with lower priorities. If more than one line has the highest priority, the first one to become available is the source.■ <code>middle-priority</code>—Second-highest clock priority.■ <code>low-priority</code>—Last clock priority.
loop-back	<p>Whether the line passes normal data or is in loopback mode. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>none</code> (default)—The line is not being used for loopback testing.■ <code>analog</code>—The line is enabled for analog loopback testing. (You might need to terminate the DSL line with a 150-ohm resistor).■ <code>digital</code>—The line is enabled for digital loopback testing.

Parameter	Setting
margin	<p>Noise margin value (in decibels). Specifying a value that is less than 6 decibels causes modems to train at higher rates, but on noisy loops, also causes them to become unstable and retrain. If this parameter is set to a value that is more than 6 decibels, the modems train at lower rates, but are more stable and are less likely to retrain on noisy loops. Specify one of the following values:</p> <ul style="list-style-type: none">■ 0db■ 1db■ 2db (the default)■ 3db■ 4db■ 5db■ 6db■ 7db■ 8db■ 9db■ 10db■ disable

Parameter	Setting
snext-margin	<p>Selects an Snext margin range that allows compensation for self-noise generated by adjacent SHDSL lines in the same bundle. A value other than <code>disable</code> will reduce the maximum rate that the loop trains at.</p> <p>Specify one of the following values:</p> <ul style="list-style-type: none">■ 0db■ 1db■ 2db■ 3db■ 4db■ 5db■ 6db■ 7db■ 8db■ 9db■ 10db■ -10db■ -9db■ -8db■ -7db■ -6db■ -5db■ -4db■ -3db■ -2db■ -1db■ <code>disable</code> (the default)
rate-mode	<p>Specifies whether the line rate is fixed or automatic. Specify one of the following values:</p> <ul style="list-style-type: none">■ <code>fixed</code>—The modem attempts to train only at the rate specified by the <code>max-rate</code> parameter.■ <code>auto</code> (default)—The modem attempts to train at a rate within the range specified by the <code>min-rate</code> and <code>max-rate</code> parameters.

Parameter	Setting
min-rate	<p>Minimum rate in kilobits per second at which a modem trains when the rate-mode parameter is set to auto. Specify one of the following values:</p> <ul style="list-style-type: none">■ 72000 (the default)■ 136000■ 200000■ 264000■ 328000■ 392000■ 520000■ 776000■ 1032000■ 1160000■ 1288000■ 1544000■ 2056000■ 2312000
max-rate	<p>Maximum rate at which the modem trains when rate-mode is set to auto. When rate-mode is set to fixed, the modem attempts to train only to the rate specified by this parameter. You need only configure the central office equipment (COE) for the maximum rate value. The modem uses a G.994.1 handshake protocol to communicate the maximum rate value to the customer premises equipment (CPE).</p> <ul style="list-style-type: none">■ 72000■ 136000■ 200000■ 264000■ 328000■ 392000■ 520000■ 776000■ 1032000■ 1160000■ 1288000■ 1544000■ 2056000■ 2312000 (the default)

Parameter	Setting
gshdsl-standard-network-type	<p>The G.991.2 standard network type for the network that is connected to the SHDSL port. This setting specifies the modem output characteristics for either a North American or European network. Specify one of the following values:</p> <ul style="list-style-type: none">■ north-american-annex-a—North American Annex A network.■ european-annex-b—European Annex B network.■ auto-detect—Select network type automatically. This value is valid only if unit-type is CPE.
annexb-anfp-enabled	<p>Special test parameter for internal test purposes. Leave at default value of no.</p>
gshdsl-psd-type	<p>The LIM outputs a symmetric power spectral density (PSD), based on the G.shdsl standard G.991.2. Specify one of the following values:</p> <ul style="list-style-type: none">■ symmetric—The modem outputs a symmetric power spectral density for all rates.■ asymmetric-776k-psd—The modem outputs an asymmetric power spectral density at 776Kbps only. This setting applies only if the rate-mode parameter is set to fixed, the max-rate parameter is set to is 776000, and the network-type parameter is set to north-american-annex-a.■ asymmetric-1544k-psd—The modem outputs an asymmetric power spectral density at 1544Kbps only. This setting applies only if the rate-mode parameter is set to fixed, the max-rate parameter is set to is 1544000, and the network-type parameter is set to north-american-annex-a.■ asymmetric-2056k-psd—The modem outputs an asymmetric power spectral density at 2056Kbps only. This setting applies only if the rate-mode parameter is set to fixed, the max-rate parameter is set to is 2056000, and the network-type parameter is set to european-annex-b.■ asymmetric-2312k-psd—The modem outputs an asymmetric power spectral density at 2312Kbps only. This setting applies only if the rate-mode parameter is set to fixed, the max-rate parameter is set to is 2312000, and the network-type parameter is set to european-annex-b.■ automatic—Select network type automatically. This value is valid only if unit-type is CPE

Parameter	Setting
master-binding-port	<p>Specifies whether an SHDSL port is configured for binding to the next adjacent port. Binding two SHDSL ports together aggregates their bandwidths together.</p> <p>Binding is enabled by configuring an odd numbered port as master. The next even numbered port is bound to the master port. The <code>rate-mode</code> parameter must be set to <code>fixed</code>. The <code>enabled</code> parameter must be set to <code>yes</code> for both ports. The master ports <code>max-rate</code> and <code>rate-mode</code> parameter values are used for both ports.</p> <p>Specify one of the following values for <code>master-binding-port</code> parameter:</p> <ul style="list-style-type: none"> ■ <code>no</code>—Do not set the port to master binding port. ■ <code>yes</code>—Set the port to master binding port.

Sample SHDSL mode configuration

Following is an example of an `shdsl` profile configured for typical use:

```
admin> read shdsl { 1 3 1 }
SHDSL/{ shelf-1 slot-3 1 } read
admin >list
[in SHDSL/{ shelf-1 slot-3 1 }]
name = 1:3:1
physical-address* = { shelf-1 slot-3 1 }
enabled = yes
sparing-mode = inactive
line-config = { 0 101 15 static { any-shelf any-slot 0 } coe no
not-eligible mi+
admin> list line
[in SHDSL/{ shelf-1 slot-3 1 }:line-config]
trunk-group = 0
nailed-group = 1
vp-switching-vpi = 15
activation = static
call-route-info = { any-shelf any-slot 0 }
unit-type = coe
ntr-enabled = no
clock-source = not-eligible
clock-priority = middle-priority
loop-back = none
margin = 2db
snext-margin = disable
rate-mode = auto
min-rate = 72000
max-rate = 2312000
gshdsl-standard-network-type = north-american-annex-a
annexb-anfp-enabled = no
```

```
gshdsl-psd-type = symmetric
master-binding-port = no
```

Binding two SHDSL ports

Port binding allows the combining of two adjacent ports to double the available bandwidth. The port pairs on both the COE and CPE sides must support port binding. Stinger-to-Stinger connections can be supported by setting one pair of ports to a unit-type of coe and the other to a unit-type of cpe.

In this example we connect Stinger #1 to Stinger #2 using port binding to support greater bandwidth. We bind ports 5 and 6 on the SHDSL LIM in slot 3 on Stinger #1 and ports 1 and 2 on the SHDSL LIM in slot 2 for Stinger #2. Note that the slave ports automatically assume the settings from the master ports:

For Stinger #1:

```
admin> read shdsl {1 3 5}
admin> set enabled = yes
admin> set line-config rate-mode = fixed
admin> set line-config master-binding-port = yes
admin> set line-config unit-type = coe
admin> write
admin> read shdsl {1 3 6}
admin> set enabled = yes
admin> write
```

For Stinger #2:

```
admin> read shdsl {1 2 1}
admin> set enabled = yes
admin> set line-config rate-mode = fixed
admin> set line-config master-binding-port = yes
admin> set line-config unit-type = cpe
admin> write
admin> read shdsl {1 2 2}
admin> set enabled = yes
admin> write
```

Displaying SHDSL port status

To display the port status and nailed group for each SHDSL port, use the `shdsl` lines command. For a description of the command's syntax, enter the command name, as in the following example:

```
admin> shdsl lines
usage: shdsl lines -[ a | d | f | u | t ]
-a show (a)ll shdsl lines
-d show (d)isabled lines
-f show all (f)ree lines
-u show in-(u)se lines
-t toggle debug flag
```

The following example (which is truncated) shows status of the first 16 ports on an SHDSL LIM in slot 4:

```
admin> shdsl1lines -a
All SHDSL lines:      (dvOp  dvUpSt  dvRq   sAdm  nailg)
  Line { 1 4 1 }      (Down  Idle   DOWN   DOWN  00151)
  Line { 1 4 2 }      (Down  Idle   DOWN   DOWN  00152)
  Line { 1 4 3 }      (Up    Idle   UP     UP    00153)
  Line { 1 4 4 }      (Down  Idle   DOWN   DOWN  00154)
  Line { 1 4 5 }      (Down  Idle   DOWN   DOWN  00155)
  Line { 1 4 6 }      (Down  Idle   DOWN   DOWN  00156)
  Line { 1 4 7 }      (Up    Idle   UP     UP    00157)
  Line { 1 4 8 }      (Down  Idle   DOWN   DOWN  00158)
  Line { 1 4 9 }      (Up    Idle   UP     UP    00159)
  Line { 1 4 10 }     (Up    Idle   UP     UP    00160)
  Line { 1 4 11 }     (Down  Idle   DOWN   DOWN  00161)
  Line { 1 4 12 }     (Down  Idle   DOWN   DOWN  00162)
  Line { 1 4 13 }     (Up    Idle   UP     UP    00163)
  Line { 1 4 14 }     (Down  Idle   DOWN   DOWN  00164)
  Line { 1 4 15 }     (Down  Idle   DOWN   DOWN  00165)
  Line { 1 4 16 }     (Down  Idle  DOWN   DOWN  00166)
```

Configuring call control

By default, a Stinger unit monitors the physical line states of its interfaces and allows connections to be established only when the line state is fully up. Using the call-control procedures, you can configure a Stinger unit to allow connections to be established even when the line state is not fully up. You can configure the unit to use these procedures system wide or on a per-port basis on SHDSL LIMs.

The call-control mechanism enables the Stinger unit to establish and maintain soft PVCs (SPVCs) across port state changes. This feature allows xDSL subscribers to establish connections on LIM interfaces in the operating states that exist before the modems are fully trained, as well as in the standard `port-up` state. SPVC connections are accepted when the modem has not fully trained to the `port-up` state. If a LIM interface with an active SPVC connection changes from a `port-up` state to the state before it was fully trained, the SPVC remains connected. Connections are broken only if the physical slot or line stops operating or is disabled by an administrator.

Following are examples of the call-control parameters in different profiles, shown with their default settings:

```
[in SYSTEM]
ignore-lineup = no

[in SHDSL/{ any-shelf any-slot 0 }]
ignore-lineup = system-defined

[in DS3-ATM/{ any-shelf any-slot 0 }]
ignore-lineup = system-defined
```

Parameter	Setting
In the system profile: <code>ignore-lineup</code>	Enable or disable the Stinger system's ability to ignore line status when determining whether calls are established or not. Specify one of the following values: <ul style="list-style-type: none">■ <code>no</code> (the default)—The Stinger call-control mechanism allows calls to be established if the line state is up and disallows calls if the line state is down.■ <code>yes</code>—The Stinger call-control mechanism ignores the line state and allows calls to be established on a port as long as the specified slot is operational and the specified port is enabled.
In a LIM profile: <code>ignore-lineup</code>	Whether the line status of a slot has an effect on the Stinger call-control mechanism on the specified port. Specify one of the following values: <ul style="list-style-type: none">■ <code>system-defined</code> (the default)—The Stinger unit inherits the <code>ignore-lineup</code> value from the system profile.■ <code>no</code>—The Stinger call-control mechanism ignores the systemwide setting, allows calls to be established if the line state is operational, and disallows calls on the port if the line state is down.■ <code>yes</code>—The Stinger call-control mechanism ignores the line state and the systemwide setting and allows calls to be established on the specified port as long as the specified slot is operational and the specified port is enabled.

The commands in the following example configure the unit to use the call-control procedures systemwide:

```
admin> read system
SYSTEM read
admin> set ignore-lineup = yes
admin> write
SYSTEM written
```

When call control is enabled systemwide, you can disable it on specific interfaces by modifying the line profile. For example, the following commands disable call-control procedures on port one of the SHDSL LIM in slot 12:

```
admin> read shdsl { 1 12 1 }
SHDSL/{ shelf-1 slot-12 1 } read
admin> set ignore-lineup = no
admin> write
SHDSL/{ shelf-1 slot-12 1 } written
```

Checking the status of an SHDSL interface

A Stinger unit creates an `shdsl-stat` profile for each SHDSL interface in the system. Following is an example for an active line (line 1 in this case) connected to a LIM in slot 6:

```
[in SHDSL-STAT/{ shelf-1 slot-6 1 }]  
physical-address* = { shelf-1 slot-6 1 }  
line-state = active  
spare-physical-address = { any-shelf any-slot 0 }  
sparing-state = sparing-none  
sparing-change-reason = unknown  
sparing-change-time = 0  
sparing-change-counter = 0  
vpi-vci-range = vpi-0-15-vci-32-127  
vp-switching-vpi = 15  
physical-status = { 226 coe g-shdsl startup-handshake 0 "R2.0 " 0 annex-a }  
physical-statistic = { { 0 0 0 } yes 0 0 passed 7 out-of-sync 0 0+ }
```

Parameter	Description
<code>line-state</code>	Indicates the overall state of the line. Possible values are as follows: <code>does-not-exist</code> —Link is not physically present on board. <code>disabled</code> —Line is disabled. <code>active</code> —Multipoint is established.
<code>spare-physical-address</code>	Indicates the shelf, slot, and port number of the spare (redundant) LIM.
<code>sparing-state</code>	Indicates the state of the redundancy function. If redundancy is not enabled, <code>sparing-none</code> is the value. If sparing is enabled and the LIM slot is a primary LIM, the value can be <code>primary-active</code> or <code>primary-inactive</code> . If sparing is enabled and the LIM slot is the secondary (spare) LIM, the value can be <code>secondary-active</code> or <code>secondary-inactive</code> .
<code>sparing-change-reason</code>	Indicates how redundancy is activated. Valid values are <code>inactive</code> , <code>manual</code> and <code>automatic</code> .
<code>sparing-change-time</code>	Indicates the time that the last change in redundancy state occurred.
<code>sparing-change-counter</code>	Indicates each redundancy change, for example, <code>primary to secondary</code> , <code>secondary to primary</code> , which increments the counter. The counter resets when the Stinger starts or restarts.
<code>vpi-vci-range</code>	Indicates the valid range of VPI and VCI for the circuits established for the line. This range can change only after LIM reboot.
<code>vp-switching-vpi</code>	Indicates the VPI to be used for the VP switching. The rest of the VPIs are used for the VC switching.

Checking the status of the physical interface

An `shdsl-stat` profile's `physical-status` subprofile provides information about the physical interface. For example:

```
admin> list physical-status
[in SHDSL-STAT/{ shelf-1 slot-2 10 }:physical-status]
if-group-index = 226
unit-type = coe
interface-type = g-shdsl
dev-line-state = startup-handshake
operational-rate = 0
firmware-ver = "R2.0 "
hardware-ver = 0
network-type = annex-a
```

Parameter	Indicates
<code>if-group-index</code>	SNMP interface group index of the line.
<code>unit-type</code>	Operating mode specified by the <code>unit-type</code> parameter in the <code>shdsl</code> profile.
<code>interface-type</code>	Whether the module is operating in SHDSL mode (<code>g-shdsl</code>), HDSL2 mode (<code>hds12</code>), or if the module is not an SHDSL LIM (<code>default</code>).
<code>dev-line-state</code>	Current state of the interface, which can be one of the following: <ul style="list-style-type: none">■ <code>port-up</code>—Connected to CPE and data can be transferred.■ <code>test</code>—Line is in test mode.■ <code>start-up-handshake</code>—Startup handshake is occurring.■ <code>start-up-training</code>—Startup training is occurring.■ <code>start-up-download</code>—Startup download is occurring.■ <code>idle</code>—Line is idle.■ <code>down</code>—Line is not currently operational.■ <code>out-of-service</code>—Line is out of service.■ <code>unknown</code>—Line status is unknown.■ <code>analog-loopback</code>—Line is in analog loopback mode.■ <code>digital-loopback</code>—Line is in digital loopback mode.
<code>operational rate</code>	Data rate for this symmetric interface. The data rate is currently fixed at 1.544 Mbps.
<code>firmware-ver</code>	Version number of the SHDSL firmware.
<code>hardware-ver</code>	Hardware version of the SHDSL modem.

Parameter	Indicates
network-type	This lists current Standard Network type. Possible values are: <ul style="list-style-type: none">■ annex-a■ annex-b■ annex-b-anfp

Obtaining statistics about operations

An shdsl-stat profile's physical-statistic subprofile enables administrators to check interface operations, as in the following example:

```
admin> list physical-statistic
[in SHDSL-STAT/{ shelf-1 slot-2 10 }:physical-statistic]
line-up-timer = { 0 0 3 }
rx-signal-present = yes
line-quality = 36
up-dwn-cntr = 3
self-test = passed
transmit-power = 10
framer-sync-status = in-sync
code-violations = 17
errored-second = 2
severely-errored-second = 1
losw-second = 1
unavailable-second = 0
loop-attenuation = 10
snr = 40
stur-loop-attenuation = 2
stur-snr = 40
```

Parameter	Indicates
line-up-timer	How long the line has been up (days, hours, and minutes in {dd hh mm} format).
rx-signal-present	Whether a receiving signal is present (yes or no).
line-quality	Line quality in decibels. A value of 25dB or better is required for reliable data transfer.
up-down-cntr	Number of times the link has transitioned from an up state to a down state since the module was last reset.
self-test	Outcome of modem chipset self-test.
transmit-power	Current transmission power that the transceiver is using, reported in dBm.

Configuring the SHDSL LIM

Checking the status of an SHDSL interface

Parameter	Indicates
framer-sync-status	State of the SHDSL framer. Provides troubleshooting information and can assist in determining loss of signal (LOS). This parameter reports one of the following values: <ul style="list-style-type: none">■ in-sync—Framer is in sync. The SHDSL framers are successfully transmitting SHDSL frames.■ out-of-sync—SHDSL framer is out of sync and is not trying to gain sync.
code-violations	Number of SHDSL cyclic redundancy check (CRC) anomalies occurring during the accumulation period.
errored-second	Number of 1-second intervals during which one or more CRC anomalies are declared and/or one or more loss of synchronous word (LOSW) defects are declared.
severely-errored-second	Number of 1-second intervals during which at least 50 CRC anomalies are declared or one or more LOSW defects are declared.
losw-second	Number of 1-second intervals during which one or more SHDSL LOSW defects are declared.
unavailable-second	Number of 1-second intervals for which the SHDSL line is unavailable. The SHDSL line becomes unavailable at the onset of 10 contiguous severely errored seconds (SES)-Ls. Once unavailable, the SHDSL line becomes available at the onset of 10 contiguous seconds with no SES-Ls.
loop-attenuation	Current loop attenuation in decibels.
snr	Signal-to-noise ratio on the line, in decibels. The signal-to-noise ratio defines a relationship between the noise floor and the signal. For an SHDSL interface, a reading of 24dB or higher is required for reliable data transfer.
stur-loop-attenuation	Indicates the current signal reduction in the loop, in decibels. The stur-loop-attenuation parameter value is received by the central office equipment (COE) from the customer premises equipment (CPE), and thus characterizes how the loop attenuation looks from the CPE's perspective.
stur-snr	Signal-to-noise ratio on the line (in decibels). For an SHDSL interface, a reading of 24dB or higher is required for reliable data transfer. The stur-snr parameter value is received by reported message from the customer premises equipment (CPE) as a direct request from the central office equipment (COE), and thus is the CPE's snr reading.

Diagnostic internal, external, and bit error-rate tests

You can use the internal diagnostic test to identify problems that might occur during data transfer between the control module and line interface modules (LIMs). If the internal diagnostic test (IDT) feature is enabled for a line, the system generates a data stream internally from the control module and sends it to that line. The line loops the data back to the control module. The control module then analyzes the data and reports the statistics in the `line-diag-stat` profile.

You can run a bit-error-rate test (BERT) to check the data integrity of the interface or connection. While a BERT is running, normal data transmission is interrupted on the line.

The `line-diag` profile contains the parameters that you use to configure a line for an IDT and a BERT. Following is a listing of the profile, shown with default values:

```
[in LINE-DIAG/{ shelf-1 slot-2 1 }]  
physical-address* = { shelf-1 slot-2 1 }  
bert-timer = 1 minute  
bert-enable = no  
idt-enable = no  
idt-num-of-msg = 1000  
bert-bit-duration = 6-power  
bert-direction = down-stream
```

Parameter	Setting
<code>bert-timer</code>	Duration of the bit-error-rate test (BERT). Specify one of the following values: <ul style="list-style-type: none">■ 1 minute (the default)■ 2 minutes■ 3 minutes■ 4 minutes■ 5 minutes■ 10 minutes■ 15 minutes■ 20 minutes■ 30 minutes
<code>bert-enable</code>	Enable or disable bit-error-rate test (BERT). (Note that a BERT disrupts data transmission.) Specify one of the following values: <ul style="list-style-type: none">■ no (default)—Line is disabled for BERT.■ yes—Line is enabled for BERT.
<code>idt-enable</code>	Whether internal diagnostic testing is enabled on the line. <ul style="list-style-type: none">■ no (default)—Line is disabled for loopback testing.■ yes—Enables internal diagnostic testing on the line.

Configuring the SHDSL LIM

Diagnostic internal, external, and bit error-rate tests

Parameter	Setting
idt-num-of-msg	Number of messages that the control module sends to the line. Each message corresponds to four ATM cells. The data payload of each message consists of sequential numeric data. By default, the value of this parameter is set to 1000. Enter a value from 0 to 10000.
bert-bit-duration	Applies only to VDSL LIMs.
bert-direction	Applies only to VDSL LIMs.

The read-only line-diag-stat profile reports the statistics obtained from the IDT and BERT and the status of the test. Following is a listing of the profile, shown with sample read-only values:

```
[in LINE-DIAG-STAT/{ shelf-1 slot-2 1 }]  
physical-address* = { shelf-1 slot-2 1 }  
bert-operation-state = stopped  
idt-operation-state = stopped  
bert-error-counter = 0  
idt-send-count = 0  
idt-recv-count = 0  
idt-error-counter = 0
```

Parameter	Specifies
bert-operation-state	State of the BERT when it is enabled and the BERT timer has not expired. This parameter reports one of the following states: <ul style="list-style-type: none">■ waiting-for-511-sync—Waiting for remote synchronization before starting the BERT.■ local-loop-active—The interface is in local analog loopback and is running the test. No remote device is involved.■ active—BERT is running with remote device.■ stopped—BERT was disabled.■ loop-back-setup—The interface is being put into analog loopback.■ start-up—BERT is starting up.
bert-error-counter	Number of bit errors counted by BERT.
idt-operation-state	Whether an internal diagnostic test is active on the line. (This parameter is read-only.) <ul style="list-style-type: none">■ stopped (default)—The test is inactive.■ active—The line is undergoing internal diagnostic testing.
idt-send-count	Number of messages sent from the LIM to the control module. (This parameter is read-only.)
idt-recv-count	Number of messages received by the control module. (This parameter is read-only.)

Parameter	Specifies
idt-error-counter	Number of erroneous messages received by the control module. (This parameter is read-only.)

Configuring an internal diagnostic test (IDT)

To configure a line for internal diagnostic testing, set the `idt-enable` parameter to `yes` and set the `idt-num-of-msg` parameter to specify the number of test messages to be sent. For example:

```
admin> read line-diag {1 2 1}
LINE-DIAG/{ shelf-1 slot-2 1 } read
admin> list
[in LINE-DIAG/{ shelf-1 slot-2 1 }]
admin> set idt-enable = yes
admin> set idt-num-of-msg = 1000
admin> write
```

You can view the results of the internal diagnostic test by displaying the contents of the `line-diag-stat` profile, as shown in the following example:

```
admin> read line-diag-stat {1 2 1}
LINE-DIAG-STAT/{ shelf-1 slot-2 1 } read
admin> list
[in LINE-DIAG-STAT/{ shelf-1 slot-2 1 }]
physical-address* = { shelf-1 slot-2 1 }
bert-operation-state = stopped
idt-operation-state = stopped
bert-error-counter = 0
idt-send-count = 1000
idt-recv-count = 1000
idt-error-counter = 0
```

If you attempt to change the setting of the `idt-enable` parameter while an internal diagnostic test is active for a line, the system generates a warning message, as in the following example:

```
admin> set idt-enable = no
admin> write
LOG warning, Shelf 1, Controller-1, Time: 20:12:30--
IDT Test for {1 3 1} is running !
LINE-DIAG/{ shelf-1 slot-3 1 } written
```

Configuring a bit-error-rate test (BERT)

To run a BERT, set the `bert-enable` parameter to `yes`. The test counts bit errors continuously for the interval specified by the `bert-timer` parameter. If both the CPE and COE are connected and have BERT enabled, the test runs between the two systems. If the two ends are not connected, the test runs within the SHDSL interface in the Stinger unit.

Configuring the SHDSL LIM

Diagnostic internal, external, and bit error-rate tests

Following is an example of setting up a BERT:

```
[in LINE-DIAG/{ shelf-1 slot-4 1 }]  
admin> set bert-timer = 5  
admin> set bert-enable = yes  
admin> write  
LINE-DIAG/{ shelf-1 slot-4 1 } written
```

To view the status and results of the BERT, display the contents of the line-diag-stat profile for the tested line.

Configuring an external diagnostic test (EDT)

The external diagnostic test (EDT) feature puts the DSL modem into loopback mode. If a complete circuit is established, you can then send a data stream from an external device (such as a network traffic generator) through the trunk to the modem. The modem loops back the data stream to the external device, where it can be analyzed. The loop-back parameter is described in “Configuring port settings for SHDSL” on page 1-4.

```
[in SHDSL/{ shelf-1 slot-2 1 }:line-config]  
loop-back = none
```

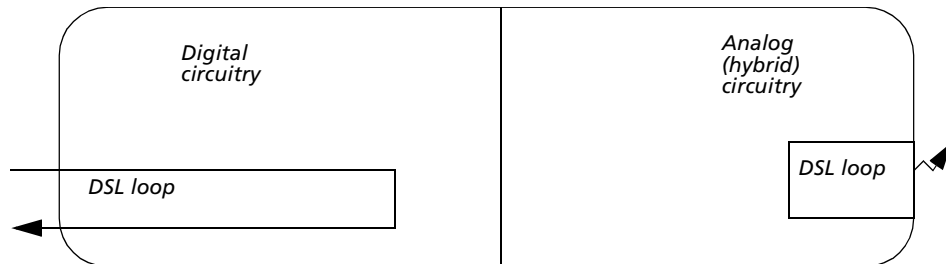
You configure a line for external diagnostic testing by putting it into loopback mode, as shown in the following example:

```
admin> read shdsl {1 1 1}  
SHDSL/{ shelf-1 slot-1 1 } read  
admin> set loop-back = analog  
admin> write
```

Digital loopback

When a line is enabled for digital loopback, data is looped only at the digital circuitry of the modem. Data does not reach the analog circuitry, as shown in Figure 1-2.

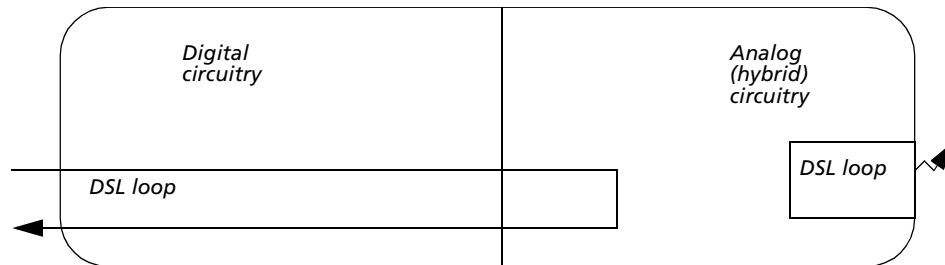
Figure 1-2. Digital loopback



Analog loopback

When the line is enabled for analog loopback, the data passes from the digital circuitry to analog circuitry and is then looped back, as shown in Figure 1-3. Analog loopback tests more circuitry.

Figure 1-3. Analog loopback



The following example puts a line into analog loopback mode:

```
admin> read shdsl {1 1 1}
SHDSL/{ shelf-1 slot-1 1 } read
admin> set loop-back = analog
admin> write
```

Configuring LIM and LIM Port Redundancy

2

Overview of LIM and LIM port redundancy	2-1
Configuring LIM redundancy.	2-1

You can configure LIM and LIM port redundancy for more than one kind of LIM in a single Stinger chassis. For example, a single Stinger unit with both asymmetric digital subscriber line (ADSL) and symmetric digital subscriber line (SDSL) LIMs can be configured with a spare ADSL LIM and a spare SDSL LIM.

Overview of LIM and LIM port redundancy

A spare LIM can replace an entire failed LIM or a single failed port. LIM redundancy transfers *all* logical connections from a failed LIM to the spare LIM. LIM port redundancy transfers the logical connection from a particular failed *port* on a LIM to the corresponding port on the spare LIM. The remaining ports on the spare LIM remain available to provide additional LIM port redundancy.

Each LIM to be used as a spare must have either a path selector module (PSM) or copper loop test (CLT) module plugged in behind or next to it in place of a line protection module (LPM). All other LIMs must use an LPM with port redundancy (LPM-PR) for line protection.



Note Some older Stinger units are equipped with an interface redundancy module (IRM) located behind the spare LIM, and LPMs with redundancy (LPM-R) located behind the LIMs to be backed up. In this case, additional configuration steps might be needed. For more information, see “LIM redundancy with IRMs and LPM-Rs” on page 2-6.

Configuring LIM redundancy

LIM redundancy provides a one-to-one backup function for LIMs. Each type of LIM to be backed up requires a spare LIM with a PSM or CLT module plugged in behind or next to it. For example, a Stinger FS unit configured with 14 ADSL 24-port LIMs can be set up with the following module pairs:

- 13 pairs each consisting of an ADSL LIM and an LPM-RP
- 1 pair consisting of an ADSL LIM and a PSM or CLT module

The resulting system has 13 active ADSL LIMs and one spare that can be substituted for any one of the 13 LIMs if a failure occurs.

In the same way, a unit can be equipped with the following module pairs:

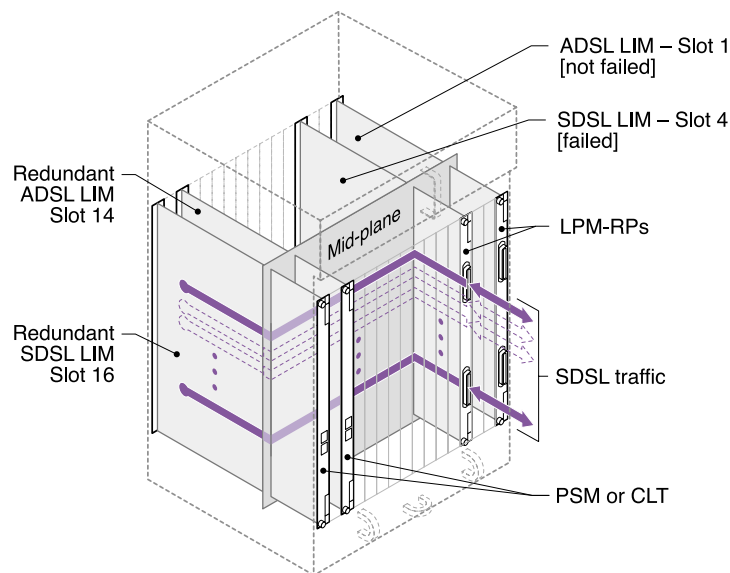
- 6 SDSL LIM–LPM-RP pairs
- 1 SDSL–PSM pair or SDSL–CLT module pair
- 6 ADSL LIM–LPM-RP pairs
- 1 ADSL–PSM pair or ADSL–CLT module pair

The resulting system has six active SDSL LIMs and six active ADSL LIMs, with one spare LIM of each type available in case of failure.

When the redundancy function is invoked, the primary LIM is deactivated. Its logical connections are terminated and reestablished on the spare (secondary) LIM. When the redundancy function is disabled, the spare LIM is deactivated. Its logical connections are terminated and reestablished on the primary LIM.

Figure 2-1 illustrates LIM redundancy for a failed SDSL LIM in slot 4 of a Stinger FS chassis. A Stinger LS chassis has its LPMs and PSMs or CLT modules *next to* its LIMs rather than behind them as shown here.

Figure 2-1. LIM redundancy in a Stinger FS unit



Overview of the `lim-sparing-config` profile

When a Stinger unit is booted, it checks for the presence of PSMs or CLT modules. A `lim-sparing-config` profile is created for each PSM or CLT module detected. You manage LIM redundancy by configuring the `lim-sparing-config` profile on a spare LIM of the same type as the LIM to be backed up.

Following is a listing of a `lim-sparing-config` profile with all parameters set to their default values:

```
[in LIM-SPARING-CONFIG/{ any-shelf any-slot 0 }]
```

```
physical-address* = { any-shelf any-slot 0 }
spare-slot-type = none
sparing-mode = inactive
spare-slot-number = slot-16
manually-spared-slot-number = any-slot
auto-lim-sparing-config = { [ { yes 10 100 12 } { yes 10 100 12 } { yes 10 100 +
```

The auto-lim-sparing-config subprofiles are discussed separately in “Automatic LIM redundancy” on page 2-4.

Parameter	Specifies
spare-slot-type	Type of spare LIM installed in the slot. This value is automatically detected and set by the software when the Stinger powers up.
sparing-mode	Enable/disable redundancy. You can enable two LIM redundancy modes. <ul style="list-style-type: none"> ■ inactive setting—disables the LIM redundancy function. ■ manual setting—deactivates the LIM specified in the manually-spared-slot-number parameter, terminating its connections and then reestablishing them on the spare LIM. For more information, see “Manual LIM redundancy” on page 2-4. ■ automatic setting—allows automatic LIM redundancy to be activated as defined in the auto-lim-sparing-config subprofile. See “Automatic LIM redundancy” on page 2-4.
spare-slot-number	Number of the slot containing the spare LIM and PSM or CLT module. This parameter value is automatically set by the software when the Stinger unit is turned on.
manually-spared-slot-number	Slot number of the primary LIM to be manually deactivated and replaced by the spare LIM.

For example, suppose a Stinger unit is configured with an ADSL LIM in slot 1 and an SDSL LIM in slot 4. Slot 14 contains a spare ADSL LIM with a PSM, and slot 16 contains a spare SDSL LIM also with a PSM.

The system creates two lim-sparing-config profiles like the following:

```
admin> dir lim-sparing-config
      72 06/20/1999 01:21:15 { shelf-1 slot-14 0 }
      72 06/21/1999 17:14:09 { shelf-1 slot-16 0 }
```

The spare ADSL LIM has the following profile:

```
admin> read lim-sparing-config { 1 14 0 }
LIM-SPARING-CONFIG/{ shelf-1 slot-14 0 } read
admin> list
[in LIM-SPARING-CONFIG/{ shelf-1 slot-14 0 }]
physical-address* = { shelf-1 slot-14 0 }
spare-slot-type = al-dmtadsl-atm-card
sparing-mode = inactive
spare-slot-number = slot-14
```

```
manually-spared-slot-number = slot-any
auto-lim-sparing-config = { [ { yes 10 100 12 } { yes 10 100 12 } { yes 10 100 +
```

Similarly, you can display the profile for the spare SDSL LIM:

```
admin> read lim-sparing-config { 1 16 0 }
LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } read
admin> list
[in LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 }]
physical-address* = { shelf-1 slot-16 0 }
spare-slot-type = sdsl-atm-card
sparing-mode = inactive
spare-slot-number = slot-16
manually-spared-slot-number = slot-any
auto-lim-sparing-config = { [ { yes 10 100 12 } { yes 10 100 12 } { yes 10 100 +
```

Manual LIM redundancy

You can invoke the redundancy function manually by setting the `sparing-mode` parameter to `manual`. To disable manual redundancy, set the `sparing-mode` parameter to `inactive`.

If manual redundancy is currently in use, setting the parameter to `inactive` causes the spare LIM to become inactive again, terminating its connections and then reestablishing them on the primary LIM that was replaced.

For example, referring to Figure 2-1, suppose that the SDSL LIM in slot 4 fails. To enable the spare SDSL LIM in slot 16, proceed as follows:

```
admin> read lim-sparing-config { 1 16 0 }
LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } read
admin> set manually-spared-slot-number = 4
admin> set sparing = manual
admin> write
LIM-SPARING-CONFIG/{ shelf-1 slot-160 } written

LOG notice, Shelf 1, Slot 8, Time: 01:30:02--
  LIM 16 ACTIVATED as spare for LIM 4
```

Automatic LIM redundancy

Automatic LIM redundancy detects a LIM failure and automatically sets up all the virtual channels of that LIM on the spare. When automatic LIM redundancy is activated, the primary LIM is monitored. If modem errors exceed the specified thresholds, all connections to the primary LIM are transferred to the spare (secondary) LIM.

Monitoring continues on the secondary LIM. If modem errors exceed thresholds, the connections are transferred back to the primary LIM and the automatic redundancy process stops. You can restart the process by resetting the system or by setting the `sparing-mode` parameter to `inactive` and then back to `automatic`.

The parameters related to automatic LIM redundancy are found in the `auto-lim-sparing-config` subprofiles. The subprofiles are numbered according to the LIM slot numbers. These subprofiles apply only to those LIMs that are of the same type as the LIM specified by the `spare-slot-type` parameter in the `lim-sparing-config` profile.

For example, suppose slot 16 in a Stinger FS units contains a spare SDSL LIM, slots 1 through 7 contain SDSL LIMs, but slots 10 through 15 contain ADSL LIMs. Only the parameters contained in LIM-Sparing-Config subprofiles 1 through 7 are applied to automatically replace the SDSL LIMs in slots 1 through 7.



Note Following an automatic LIM or LIM port redundancy switchover, some sessions might not start up even though the physical port switchover is successful.

Following is a listing of an `auto-lim-sparing-config` subprofile with all parameters set to their default values:

```
[in LIM-SPARING-CONFIG:auto-lim-sparing-config:lim-sparing-config[1]]
active = yes
error-averaging-period = 10
error-threshold = 100
up-down-threshold = 3
modem-failure-threshold = 12
```

Parameter	Setting
<code>active</code>	When redundancy mode is set to <code>automatic</code> , this parameter enables or disables the LIM slot to participate in automatic LIM redundancy. Only slots for which this parameter is set to <code>yes</code> can be backed up by the spare. The default value is <code>yes</code> .
<code>error-averaging-period</code>	Number of seconds during which the number of errors specified by <code>error-threshold</code> must be observed on the line before the modem is considered nonfunctional. The default value is 10.
<code>error-threshold</code>	Number of errors that can occur during the specified <code>error-averaging-period</code> interval before a modem on this LIM is considered nonfunctional. The default value is 100.
<code>up-down-threshold</code>	Number of times during the specified <code>error-averaging-period</code> interval that the line is connected and disconnected by the modem before the modem is considered nonfunctional. The default value is 3.
<code>modem-failure-threshold</code>	Number of modems on this LIM that are considered nonfunctional before this LIM is considered nonfunctional. The default value is 12.

To activate automatic LIM redundancy for a particular LIM, you must set the following two parameters:

- In the `lim-sparing-config` profile for the spare LIM, set the following active parameter to `yes`: `auto-lim-sparing-config:lim-sparing-config[slot number of backed-up LIM]:active`.
- In the `lim-sparing-config` profile for the spare LIM, set the `sparing-mode` parameter to `automatic`.

For example, if you install a spare SDSL LIM in slot 15 of a Stinger FS unit and want to activate automatic LIM redundancy for the SDSL LIMs in slots 1 through 7, proceed as follows:

1 List the `auto-lim-sparing-config` profile for slot 1.

```
admin> list 1
[in LIM-SPARING-CONFIG/{ shelf-1 slot-15 0 }
:auto-lim-sparing-config:lim-sparing-config[1]]
active = yes
error-averaging-period = 10
error-threshold = 100
up-down-threshold = 3
modem-failure-threshold = 12
```

Because the Auto-LIM-Sparing-Config subprofiles are numbered according to the LIM slot numbers, the `list 1` command here lists the LIM-Sparing-Config subprofile for the LIM in slot 1.

Note that the `active` parameter is set to `yes`. Because this is the default value for all seven slots, you do not have to set it unless you have previously changed it.

2 Set the redundancy mode.

```
admin> list
[in LIM-SPARING-CONFIG/{ shelf-1 slot-15 0 }]
physical-address* = { shelf-1 slot-15 0 }
spare-slot-type = sdsl-atm-card
sparing-mode = inactive
spare-slot-number = slot-15
manually-spared-slot-number = any-slot
auto-lim-sparing-config = { [ { yes 10 100 3 12 } { yes 10}]}

admin> set sparing-mode = automatic
admin> write
LIM-SPARING-CONFIG/{ shelf-1 slot-15 0 } written
```

Assuming that the `active` parameters in the `lim-sparing-config` subprofiles for slots 2 through 7 are also set to the default, LIM redundancy is now activated for the SDSL LIMs in slots 1 through 7.

LIM redundancy with IRMs and LPM-Rs

If you upgrade the software to TAOS 7.11.4 or later, a previously existing LIM-Sparing-Config profile is automatically converted to a redundancy profile indexed to the spare LIM slot. Enter the `dir lim-sparing-config` command to verify that the profile has been created.

For example, suppose a Stinger FS unit already has a spare SDSL LIM and IRM installed and configured in slot 16 before the software upgrade. Enter the `dir` command to show the profile:

```
admin> dir lim-sparing-config
      213 06/20/1999 02:25:18 { shelf-1 slot-16 0 }
```

Then list the profile:

```
admin> read lim-sparing-config { 1 16 0 }
admin> list
[in LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } ]
physical-address* = { shelf-1 slot-16 0 }
spare-slot-type = sdsl-atm-card
sparing-mode = inactive
spare-slot-number = slot-16
manually-spared-slot-number = any-slot
if-sparing-config = [ any-slot any-slot any-slot any-slot any-slot any-slot any+
auto-lim-sparing-config = { [ { yes 10 100 3 12 } { yes 10 100 3 12 } { yes 10 +
```

If a profile exists, nothing further needs to be done until the LIM redundancy function is activated. If no profile exists, you must create the profile manually for the slot number containing the spare LIM and IRM. All the LIMs to be backed up must have either LPM-Rs or LPM-RPs installed in the slots behind or next to them.

When the profile is created, the software automatically assigns a value to the `spare-slot-type` and `spare-slot-number` parameters.

For example, if a Stinger unit has an SDSL LIM and an IRM installed in slot 16, and it also has an SDSL LIM with an LPM-R installed in slot 4, you must first create a LIM-Sparing-Config profile for slot 16:

```
admin> new lim-sparing-config { 1 16 0 }
LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } read
admin> write
LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } written
admin> list
[in LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } (new)]
physical-address* = { shelf-1 slot-16 0 }
spare-slot-type = sdsl-atm-card
sparing-mode = inactive
spare-slot-number = slot-16
manually-spared-slot-number = any-slot
if-sparing-config = [ any-slot any-slot any-slot any-slot any-slot any-slot any+
auto-lim-sparing-config = { [ { yes 10 100 3 12 } { yes 10 100 3 12 } { yes 10 +
```

Suppose the SDSL LIM in slot 4 fails. You can then activate manual LIM redundancy as follows:

```
admin> set manually-spared-slot-number = 4
admin> set sparing-mode = manual
admin> write
LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 } written
LOG notice, Shelf 1, Slot 8, Time: 26:30:01--
      LIM 16 ACTIVATED as spare for LIM 4
```

Checking LIM redundancy status

You can check the status of LIM redundancy by examining the `lim-sparing-status` profile. Following are the parameters with sample read-only values:

```
[in LIM-SPARING-STATUS]
spare-slot-type = none
sparing-mode = primary-inactive
spare-slot-number = any-slot
spared-slot-number = any-slot
sparing-change-reason = unknown
sparing-change-time = 0
sparing-change-counter = 0
lim-sparing-status = [ { yes yes sparing-none } { yes yes sparing-none } { yes +
```

A `lim-sparing-status` subprofile is defined for each slot as follows:

```
[in LIM-SPARING-STATUS:lim-sparing-status[1]]
active = yes
lim-status-ok = yes
sparing-state = sparing-none
```

Parameter	Indicates
<code>spare-slot-type</code>	Shelf, slot, and port number of the spare LIM.
<code>sparing-mode</code>	State of the redundancy function. If redundancy is not enabled, <code>sparing-none</code> is the value. If redundancy is enabled and the LIM slot is a primary LIM, the value can be <code>primary-active</code> or <code>primary-inactive</code> . If redundancy is enabled and the LIM slot is the secondary (spare) LIM, the value can be <code>secondary-active</code> or <code>secondary-inactive</code> .
<code>spare-slot-number</code>	Slot number of the spare LIM for that type of LIM.
<code>spared-slot-number</code>	Slot number of the LIM being replaced by the spare LIM.
<code>sparing-change-reason</code>	How redundancy is activated. Valid values are <code>inactive</code> , <code>automatic</code> , and <code>manual</code> .
<code>sparing-change-time</code>	Time that the last change in redundancy state occurred.
<code>sparing-change-counter</code>	Number of redundancy changes (for example, primary to secondary or secondary to primary). The counter is reset to zero each time the Stinger is turned on.
<code>active</code>	Valid values are <code>yes</code> and <code>no</code> .
<code>lim-status-ok</code>	Valid values are <code>yes</code> and <code>no</code> .

Parameter	Indicates
sparing-state	State of the redundancy function. If redundancy is not enabled, sparing-none is the value. If redundancy is enabled and the LIM slot is a primary LIM, the value can be primary-active or primary-inactive. If redundancy is enabled and the LIM slot is the secondary (spare) LIM, the value can be secondary-active or secondary-inactive. A value of not-applicable indicates that LIM redundancy is not applicable to this module.

Checking status with the Rearslot command

The `rearslot` command shows the status of all the slots used for LPMs, PSMs, and CLT modules. It also reports on the status of the midplane redundancy bus. Slots that are equipped with IRMs or LPM-Rs are reported as Empty by the `rearslot` command.



Note When a copper loop is being tested on a Stinger LS unit with a PSM or a CLT module, the `rearslot` command does not display any midplane sparing bus usage.

For example, suppose that a Stinger FS is equipped with ADSL LIMs and SDSL LIMs. The ADSL 24-port LIM in slot 1 has failed and is being replaced by the ADSL 24-port LIM in slot 14. The `rearslot` command reports the following information.

```
admin> rearslot
  Slot  Slot ID
[ 1 ]  91 24 port Enhanced LPM
[ 2 ]   0 Empty ( IRM, LPM )
[ 3 ]   0 Empty ( IRM, LPM )
[ 4 ]  92 48 port Enhanced LPM)
[ 5 ]   0 Empty ( IRM, LPM )
[ 6 ]   0 Empty ( IRM, LPM )
[ 7 ]   0 Empty ( IRM, LPM )
[ 10 ]  0 Empty ( IRM, LPM )
[ 11 ]  0 Empty ( IRM, LPM )
[ 12 ]  0 Empty ( IRM, LPM )
[ 13 ]  0 Empty ( IRM, LPM )
[ 14 ]  93 Path Selector Module ( PSM )
[ 15 ]  0 Empty ( IRM, LPM )
[ 16 ]  94 Copper Loop Tester ( CLT )

Midplane sparing bus usage :
4      4      3      2      1
8765 4321 0987 6543 2109 8765 4321 0987 6543 2109 8765 4321
.... .... .... .... .... .... XXXX XXXX XXXX XXXX XXXX XXXX
```

Configuring LIM port redundancy

LIM port redundancy allows an individual port of a LIM to be backed up by the corresponding port of a spare LIM. The LIM to be backed up (the primary LIM) must be of the same type as the spare. The remaining ports on the spare LIM remain available to back up other failed ports on any LIMs of the same type in the system.

More than one kind of LIM port can be backed up. An additional LIM-PSM pair (or LIM-CLT module pair) of another type installed in a Stinger unit can be used to back up other LIMs of that type in the system. For example, a spare SDSL LIM in slot 16 can back up any failed port on any other SDSL LIMs in a Stinger FS chassis. Likewise, a spare ADSL LIM in slot 14 can back up any failed ADSL ports.

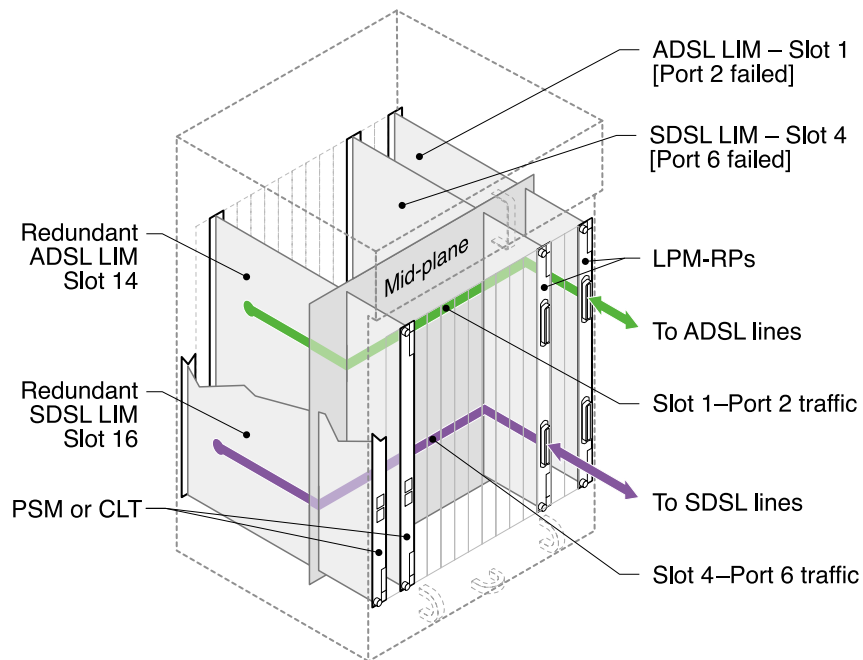
However, because the midplane redundancy bus in a Stinger unit contains only one path for each port number, port redundancy can back up only one path of a particular number at a time. For example, suppose port 1 on an SDSL LIM fails and is replaced. As long as redundancy is active on that port, no other failed SDSL or ADSL port 1 on that unit can be replaced by a spare LIM port.

For example, port 2 on an ADSL LIM in slot 1 can be backed up by port 2 of the spare ADSL LIM in slot 14. A subsequent failure of port 6 on an SDSL LIM in slot 4 can be backed up by port 6 on the spare SDSL LIM in slot 16. This example is illustrated for a Stinger FS chassis in Figure 2-2. A Stinger LS chassis has its LPMs and PSMs or CLT modules *next to* its LIMs rather than behind them.



Note Following an automatic LIM or LIM port redundancy switchover, some sessions might not start up even though the physical port switchover is successful.

Figure 2-2. LIM port redundancy on a Stinger FS unit



When a port on a LIM that is being backed up is replaced, the virtual channels for that port are terminated and set up on the spare. All other line parameters are also transferred to the spare port.

Enabling LIM port redundancy

Redundancy for a particular slot and port is controlled by the `sparing-mode` parameter in the appropriate LIM profile.

The `sparing-mode` parameter appears in all LIM profiles, as in the following SDSL profile for slot 2, port 6:

```
[in SDSL/{ shelf-1 slot-2 6 }]  
name = 1:2:32  
physical-address* = { shelf-1 slot-2 6 }  
enabled = yes  
sparing-mode = inactive  
line-config = { 0 232 15 static { any-shelf any-slot 0 } singlebaud 784000 2720+
```

Parameter	Specifies
<code>sparing-mode</code>	Enables or disables port redundancy and specifies the mode. You can set the following port-redundancy modes: <ul style="list-style-type: none">■ <code>inactive</code>—disables LIM port redundancy. This is the default.■ <code>manual</code>—deactivates the LIM port and then reestablishes the connection on the same port of the spare LIM.■ <code>automatic</code>—activates automatic redundancy for the port. The error threshold parameters specified in the <code>auto-lim-sparing-config</code> subprofile of the <code>lim-sparing-config [slot number]</code> profile are used.

Manual LIM port redundancy

You can invoke the redundancy function manually by setting the `sparing-mode` parameter in the LIM profile to `manual`. The connection on the primary LIM is transferred to the spare (secondary) LIM. To disable manual port redundancy, set the `sparing-mode` parameter to `inactive`.

If manual redundancy is currently in use, setting the parameter to `inactive` causes the spare LIM port to become inactive again, terminating its connections and then reestablishing them on the primary LIM port that was replaced.

For example, suppose a Stinger FS unit is equipped with an ADSL LIM in slot 1 and an SDSL LIM in slot 4. Spare LIMs are located in slots 14 and 16 respectively. Port 2 fails on the ADSL LIM, and port 6 fails on the SDSL LIM. To provide redundancy for these ports, proceed as follows:

- 1 Activate redundancy for failed port 2 in slot 1:

```
admin> read al-dmt {1 1 2}  
admin> set sparing-mode = manual  
admin> write  
LOG notice, Shelf 1, Slot 8, Time: 11:58:49--  
LIM 14 port 2 ACTIVATED as spare for LIM 1 Port 2
```
- 2 Activate redundancy for failed port 6 in slot 4:

```
admin> read sdsl {1 4 6}  
admin> set sparing-mode = manual  
admin> write
```

```
LOG notice, Shelf 1, Slot 8, Time: 12:07:51--  
LIM 16 port 6 ACTIVATED as spare for LIM 4 Port 6
```

Automatic LIM port redundancy

Automatic LIM port redundancy detects a LIM port failure and automatically transfers the port connection to the same port on the spare LIM. When automatic LIM port redundancy is activated, the primary LIM port is monitored. If modem errors exceed the specified thresholds, the port connection to the primary LIM is transferred to the spare (secondary) LIM.

Monitoring continues on the secondary LIM port. If modem errors again exceed thresholds, the connection is transferred back to the primary LIM port and the automatic redundancy process stops. You can restart the process by resetting the system or by setting the `sparing-mode` parameter to `inactive` and then back to `automatic`.

The parameters used for automatic LIM port redundancy are found in the `auto-lim-sparing-config` subprofile of the `lim-sparing-config` profile for the spare LIM of the same type.

For example, suppose you want to set up automatic port redundancy for port 1 in an SDSL LIM in slot 5 with an error threshold of 50. The spare SDSL LIM is located in slot 16 of a Stinger FS.

The threshold parameters reside in the `auto-lim-sparing-config` subprofile of the `lim-sparing-config` profile in slot 16.

1 List the parameters:

```
admin> list 1  
[in LIM-SPARING-CONFIG/{ shelf-1 slot-16 0 }:  
auto-lim-sparing-config:lim-sparing-config[1]]  
active = yes  
error-averaging-period = 10  
error-threshold = 100  
up-down-threshold = 3  
modem-failure-threshold = 12
```

2 Set the error-threshold parameter:

```
admin > set error-threshold = 50  
admin > write  
SDSL/{ shelf-1 slot-16 0 } written
```

3 Activate automatic redundancy for port 1 in slot 5:

```
admin > read sds1 {1 5 1}  
admin > set sparing-mode = automatic  
admin > write  
SDSL/{ shelf-1 slot-5 1 } written
```

Checking the status of extended LIM port redundancy

The line status profile for a particular LIM shows port redundancy status for the selected port, and information about a spare LIM if one exists. The LIM line status profiles have five parameters to indicate the port redundancy status.

Following are the relevant parameters, shown with sample read-only settings for an active line using an SDSL LIM:

```
[in SDSL-STAT/{ shelf-1 slot-4 6 }]  
spare-physical-address = { shelf-1 slot-16 6 }  
sparing-state = primary-inactive  
sparing-change-reason = manual  
sparing-change-time = 309108872  
sparing-change-counter = 1
```

Parameter	Indicates
spare-physical-address	Shelf, slot, and port number of spare LIM.
sparing-state	State of the redundancy function. If redundancy is not enabled, <code>sparing-none</code> is the value. If redundancy is enabled and the LIM slot is a primary LIM, the value can be <code>primary-active</code> or <code>primary-inactive</code> . If redundancy is enabled and the LIM slot is the secondary (spare) LIM, the value can be <code>secondary-active</code> or <code>secondary-inactive</code> .
sparing-change-reason	How redundancy is activated. Valid values are <code>inactive</code> , <code>manual</code> , and <code>automatic</code> .
sparing-change-time	Time that the last change in redundancy state occurred.
sparing-change-counter	Number of redundancy changes (for example, primary to secondary or secondary to primary). The counter is reset to zero each time the Stinger unit is turned on.

