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Stinger®

SDSL 48-Port Line Interface Module (LIM) Guide

For software version 9.2-167
December 2001

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About This Guide

What is in this guide

This guide describes how to configure and monitor the Stinger SDSL 48-port 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 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 (CLI). 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 that might be 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 ***`italics`***—see *Italics*, below). If you could enter the characters but are not specifically instructed to, they do not appear in boldface.
Italics	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 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 unit. 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.

  - 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 use the command-line interface to configure Asynchronous Transfer Mode (ATM) operations on a Stinger unit. The guide explains how to configure permanent virtual circuits (PVCs), and shows how to use standard ATM features such as quality of service (QoS), connection admission control (CAC), and subtending.
  - *Stinger Private Network-to-Network Interface (PNNI) Supplement*. Provides quick-start instructions for configuring PNNI and soft PVCs (SPVCs), and describes the related profiles and commands in the Stinger command-line interface.
  - *Stinger SNMP Management of the ATM Stack Supplement.* Describes SNMP management of ATM ports, interfaces, and connections on a Stinger unit to provide guidelines for configuring and managing ATM circuits through any SNMP management utility.
  - *Stinger T1000 Module Routing and Tunneling Supplement.* Describes how to configure the Layer 3 routing and virtual private network (VPN) capabilities supported by a Stinger T1000 module.
  - *TAOS RADIUS Guide and Reference*. Describes how to set up a TAOS 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 SDSL 48-Port Line Interface Module (LIM)

1

The Stinger symmetric digital subscriber line (SDSL) 48-port line interface module (LIM) provides data link support and asynchronous transfer mode (ATM) multiplexing using 2B1Q encoding. The 48 interfaces support upstream and downstream speeds of up to 2.32Mbps. Within a single Stinger chassis, one or more SDSL LIMs can be used in conjunction with a mix of any supported Stinger xDSL access technologies.

Installing an SDSL 48-port LIM

Install an SDSL 48-port LIM for Stinger units in the same manner as any other LIM. See the *Stinger Getting Started Guide* for details. After installation, configure the LIM as described in this document.

Module specifications

Table 1-1 lists specifications for the SDSL 48-port LIM.

Table 1-1. SDSL 48-port LIM specifications

Category	Specification
Physical dimensions	Height: 15 inches (38.1cm). Width: 1.06 inches (2.69cm). Depth: 5 inches (12.7cm). Weight: 1.5 pounds (0.68kg).
Power requirements	62.4 W @ 784kbps or 1.5Mbps; 81 W @ 2.3Mbps.

Table 1-1. SDSL 48-port LIM specifications (continued)

Category	Specification
Temperature range	FS/LT version: 32°F to 131°F (0°C to 55°C). RT version: -40°F to 149°F (-40°C to 65°C).
Interface standards	ANSI T1E1.4/94-006.
Physical connectors	USOC RJ21X 50-pin telco connector. Must meet JIS C5973 standards.

Status indicators

Several status lights on the front panel of the SDSL 48-port LIM indicate the status of the module and its ports. Figure 1-1 shows the front panel and status lights of the SDSL 48-port LIM.

Figure 1-1. SDSL 48-port LIM

Interpreting SDSL 48-port 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 the POST and becomes operational, the ACTIVE light illuminates. It is the only light that is on during normal operation.

Table 1-2 explains the SDSL 48-port LIM status lights.

Table 1-2. SDSL 48-port 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.

Configuring SDSL interfaces

A Stinger unit creates an SDSL profile for each SDSL interface in the system. For example, for a LIM installed in slot 1, the system creates profiles such as the following:

```
admin> dir sdsl
    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
    18  06/20/1999 23:18:51  { shelf-1 slot-1 9 }  1:1:9
    19  06/20/1999 23:18:51  { shelf-1 slot-1 10 }  1:1:10
    19  06/20/1999 23:18:51  { shelf-1 slot-1 11 }  1:1:11
    19  06/20/1999 23:18:51  { shelf-1 slot-1 12 }  1:1:12
    ...
```

Overview of SDSL profile settings

To configure SDSL ports, you must set relevant parameters in SDSL profiles. Following are the SDSL parameters, shown with default settings:

```
[in SDSL/{ any-shelf any-slot 0 }]
name = ""
physical-address* = { any-shelf any-slot 0 }
enabled = no

[in SDSL/{ 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 }
data-rate-mode = singlebaud
max-rate = 784000
unit-type = coe
```

Parameter	Specifies
Name	Name of the interface. The default value is the interface address in *shelf*`:`*slot*`:`*item* format (for example, `1:2:3`), but an administrator 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 SDSL interface. SDSL lines are disabled until an administrator activates the line in the SDSL profile.
Trunk-Group	*Not currently used.* Use the default value (zero).
Nailed-Group	Nailed-group number for the SDSL physical interface. A Connection or RADIUS profile specifies this number to make use of the interface, as described in the *Stinger ATM Configuration Guide*. Each interface is assigned a unique default number, so you do not need to modify this parameter. If you assign a new value, it must be a number from 1 through 1024 that is unique within the system. For related information, see "Displaying SDSL port status and nailed groups" on page 1-6.
VP-Switching-VPI	VPI to use for VP switching on the LIM port. The default is 15. All other VPIs are used for VC switching. For related information, see the *Stinger ATM Configuration Guide*.
Activation	*Not currently used.* Leave the default value (`static`).
Call-Route-Info	*Not currently used.* Leave the default value (the zero address).
Data-Rate-Mode	Per-session SDSL data-rate mode. Must be set to `singlebaud`, which causes the LIM to train to a single data rate, even if the modem can train at a higher or lower data rate.
Max-Rate	Maximum data rate for the line, expressed in bits per second. The loop can be set to support up to 2.32Mbps. The following maximum data rates are supported: 144000, 272000, 400000, 528000, 784000 (the default), 1168000, 1552000, 2320000.
Unit-Type	Type of unit: COE or CPE. Remote equipment must have opposite setting.

Displaying SDSL port status and nailed groups

To display the nailed-group numbers for SDSL ports, enter the SDSL command. For example, the command output that follows shows the nailed-group numbers for SDSL LIMs. In this example, the administrator includes the `-a` (all) flag, and the system has one SDSL LIM installed in slot 6:

```
admin> sdsl -a

All SDSL lines:
(dvOp   dvUpSt  dvRq    sAdm    nailg)
Line    {    1  6  1 }        (Down    Idle    UP      UP     00251)
Line    {    1  6  2 }        (Down    Idle    UP      UP     00252)
Line    {    1  6  3 }        (Down    Idle    UP      UP     00253)
Line    {    1  6  4 }        (Down    Idle    UP      UP     00254)
Line    {    1  6  5 }        (Down    Idle    UP      UP     00255)
Line    {    1  6  6 }        (Down    Idle    UP      UP     00256)
Line    {    1  6  7 }        (Down    Idle    UP      UP     00257)
Line    {    1  6  8 }        (Down    Idle    UP      UP     00258)
Line    {    1  6  9 }        (Down    Idle    UP      UP     00259)
Line    {    1  6 10 }        (Down    Idle    UP      UP     00260)
Line    {    1  6 11 }        (Down    Idle    UP      UP     00261)
Line    {    1  6 12 }        (Down    Idle    UP      UP     00262)
...
```

Maximum data rates and session data rates

After the administrator configures a maximum data rate for an SDSL line, the unit initially establishes a CPE session on the line at that rate. If the Connection or RADIUS profile for the CPE session specifies a different rate, the unit terminates the session and then reestablishes it at the rate specified in the Connection or RADIUS profile. The next time the CPE initiates a connection, the Stinger unit does not retrain if the initial rate is the same as the rate used previously for that CPE.

VPI used for VP switching on SDSL port

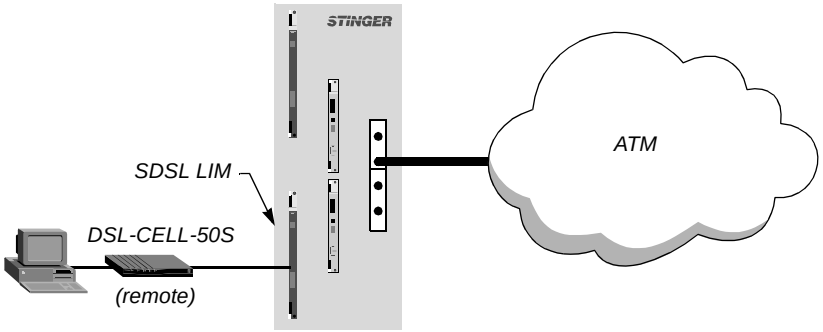
By default, VPI 15 is reserved for VP switching on LIM ports. Administrators can reserve any VPI other than zero for VP switching, as long as the number is within the valid range of VPIs on the LIM slot, as described in the *Stinger ATM Configuration Guide.*

When an ATM circuit is established between a LIM port and a trunk port, and uses the VPI reserved for VP switching, the Stinger unit switches the traffic on the basis of the VPI number alone. It does not examine or change the VCI number. For more information, see the *Stinger ATM Configuration Guide*.

Example of SDSL interface configuration

In the example shown in Figure 1-2, an SDSL interface of a Stinger unit is configured to support a symmetric DSL connection to a DSL-CELL-50S CPE. For details about the Connection profile settings for the CPE, see the *Stinger ATM Configuration Guide*.

Figure 1-2. SDSL ATM LIM configuration



The following commands enable the SDSL interface and increase the maximum data rate to 1.5Mbps:

```
admin> read sdsl { 1 11 22 }
SDSL/{ shelf-1 slot-11 22 } read

admin> set enabled = yes

admin> set line-config max-rate = 1552000

admin> write
SDSL/{ shelf-1 slot-11 22 } written
```

The following commands reserve VPI 3 for VP switching on the interface:

```
admin> read sdsl { 1 11 22 }
SDSL/{ shelf-1 slot-11 22 } read

admin> set line-config vp-switching-vpi = 3

admin> write
SDSL/{ shelf-1 slot-11 22 } written
```

Configuring call-control

Using the call-control procedures, you can configure the Stinger to allow connections to be established even when the line state is not fully up. You can configure the unit to use these procedures systemwide or on a per-port basis on the DS3-ATM, OC3-ATM, and E3-ATM trunk modules and on the SDSL, ADSL, and SHDSL/HDSL2 LIMs.

The call-control mechanism enables the Stinger unit to establish and maintain SPVCs across port state changes. This allows xDSL subscribers to establish connections on LIM interfaces in the operating states before they are fully trained, as well as in the standard port-up state (in which the modem has successfully trained up). Soft PVC (SPVC) connections are accepted when the modem has not fully trained up to the port-up state. If a LIM interface with an active SPVC connection changes from a port-up state to the state it was in 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.

By default, the Stinger unit monitors the physical line state of its interfaces and allows connections to be established only when the line state is fully up.

Following are examples of the relevant parameters, shown with default settings:

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

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

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

Parameter	Specifies
`ignore-lineup`	In the System profile, enables or disables the Stinger unit's ability to ignore line status when determining whether calls are established or not. Specify one of the following values: • `no` (the default)—The Stinger call-control mechanism allows calls to be established when the line state is up and disallows calls when the line state is down. • `yes`—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.
`ignore-lineup`	In a Line profile, specifies 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: • `system-defined` (the default)—Sets the Stinger unit to inherit the Ignore-Lineup value from the system profile. • `no`—Sets the Stinger call-control mechanism to ignore the systemwide setting and allow calls to be established when the line state is operational and disallow calls on the port when the line state is down. • `yes`—Sets the Stinger call-control mechanism to ignore the line state and the systemwide setting and allow 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 new 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. The commands in the following example disable call-control procedures on port one of the SDSL 48-port LIM in slot 12:

```
admin> read sdsl { 1 12 1 }
SDSL/{ shelf-1 slot-12 1 } read

admin> set ignore-lineup = no
```

```
admin> write
SDSL/{ shelf-1 slot-12 1 } written
```

Monitoring SDSL LIM performance

The Stinger unit creates status profiles for each SDSL interface and AL-DMT interface in the system. The profiles provide information about the physical interfaces and their operational status. The Stinger unit also creates LIM-redundancy and bandwidth status profiles that reflect sparing and bandwidth status of all the LIMs.

Checking the status of an SDSL interface

Following are the SDSL-Stat parameters, shown with sample settings for an active line:

```
[in SDSL-STAT/{ shelf-1 slot-11 22 }]
physical-address* = { shelf-1 slot-11 22 }
line-state = active
error-count = 0
physical-status = { 0 coe port-up 784000 784000 13 2 2 }
physical-statistic = { { 1 1 1 } yes 15 0 passed 4 normal-operation 5+}
```

The Line-State setting in this example specifies that the line is active (it has been enabled). Error-Count indicates the number of errors experienced since the last reset.

Checking the status of the physical interface

The Physical-Status subprofile provides information about the physical interface. For example:

```
[in SDSL-STAT/{ shelf-1 slot-11 22 }:physical-status]
if-group-index = 0
unit-type = coe
dev-line-state = port-up
up-stream-rate = 784000
down-stream-rate = 784000
major-firmware-ver = 13
minor-firmware-ver = 2
hardware-ver = 2
```

Parameter	Indicates
IF-Group-Index	SNMP interface group index of the line
Unit-Type	Operating mode specified by the Unit-Type setting in the SDSL profile
Dev-Line-State	Current state of the interface (described below)
Up-Stream-Rate	Upstream data rate
Down-Stream-Rate	Downstream data rate
Major-Firmware-Ver	Major version number of the SDSL modem firmware
Minor-Firmware-Ver	Minor version number of the SDSL modem firmware
Hardware-Ver	Hardware version of the SDSL modem

The Dev-Line-State parameter shows one of the following possible states:

Dev-Line-State value	Meaning
`config`	The interface is being configured.
`deactivate`	Transitioning to the Down state.
`inactive`	Starting up.
`activating`	Waiting for remote to start up.
`active-rx`	Waiting for four-level transmission from remote.
`port-up`	Connected to CPE and data can be transferred.
`portup-pending-deactive`	Loss-of-signal or noise-margin error (noise greater than -5dB).
`deactivate-lost`	Waiting for loss-of-signal timer to expire.
`hardware-test`	Hardware self-test in progress.
`out-of-service`	Interface out of service.
`tip-ring-detect`	Running a simple internal bit-error-rate test (BERT) to detect correct tip-ring orientation.
`tip-wait1`	Running internal BERT to detect correct tip-ring orientation.
`tip-hunt`	Running internal BERT to detect correct tip-ring orientation.
`tip-wait2`	Running internal BERT to detect correct tip-ring orientation.
`cell-delineation`	Attempting to recover ATM cells (idle cells as well as data cells) from the receiving octets. If recovery is successful, the interface transitions to the Up state.
`deactivate-wait`	Waiting to transition to the Down state.

Obtaining statistics about operations

The Physical-Statistic subprofile enables administrators to check interface operations. For example:

```
[in SDSL-STAT/{ shelf-1 slot-11 22 }:physical-statistic]
line-up-timer = { 1 1 1 }
rx-signal-present = yes
line-quality = 15
up-dwn-cntr = 0
self-test = passed
far-end-db-attenuation = 4
firmware-startup-stage = normal-operation
hdlc-rx-crc-error-cnt = 5
```

Parameter	Indicates
Line-Up-Timer	How long the line has been up (days, hours, and minutes in {*dd hh mm*} format).

Parameter	Indicates
RX-Signal-Present	Receiving signal from the remote (Yes or No).
Line-Quality	Line quality in decibels. A value of -5dB 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.
Far-End-Db-Attenuation	Attenuation level of the signal received from remote.
Firmware-Startup-Stage	Current firmware state.
HDLC-RX-CRC-Error-Cnt	Number of CRC errors. A few CRC errors are normal. The line disconnects if 1500 errors occur within a two-second period.

Configuring LIM and LIM Port Redundancy 2

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 2-7.

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:

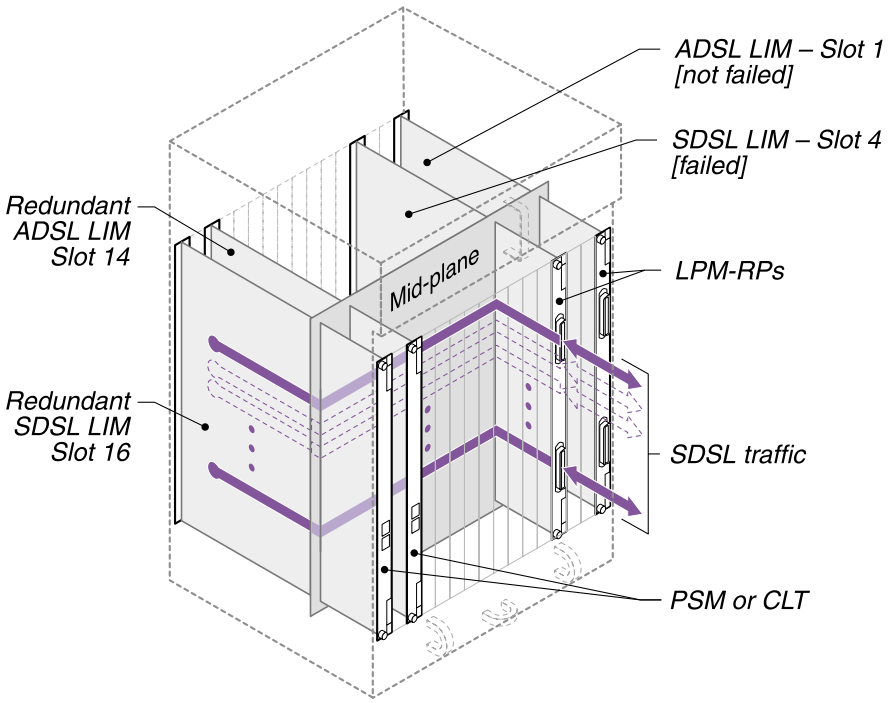
- 6 SDSL LIM–LPM-RP pairs
- 1 SDSL–PSM pair or SDSL–CLT module pair
- 6 ADSL LIM–LPM-RP pairs
- 1 ADSL–PSM pair or ADSL–CLT module pair

The resulting system has 6 active SDSL LIMs and 6 active ADSL LIMs, with 1 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 2-5.

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. • `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 2-5.
`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	Specifies
`active`	When redundancy mode is set to `automatic`, this parameter enables or disables the LIM slot to participate in automatic LIM redundancy. Only slots for which this parameter is set to `yes` can be backed up by the spare. The default value is `yes`.
`error-averaging-period`	Number of seconds during which the number of errors specified by `error-threshold` must be observed on the line before the modem is considered nonfunctional. The default value is `10`.
`error-threshold`	Number of errors that can occur during the specified `error-averaging-period` interval before a modem on this LIM is considered nonfunctional. The default value is `100`.

Parameter	Specifies
`up-down-threshold`	Number of times during the specified `error-averaging-period` interval that the line is connected and disconnected by the modem before the modem is considered nonfunctional. The default value is `3`.
`modem-failure-threshold`	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

When 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
`spare-slot-type`	Shelf, slot, and port number of the spare LIM.
`sparing-mode`	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`.
`spare-slot-number`	Slot number of the spare LIM for that type of LIM.
`spared-slot-number`	Slot number of the LIM being replaced by the spare LIM.

Parameter	Indicates
`sparing-change-reason`	How redundancy is activated. Valid values are `inactive`, `automatic`, and `manual`.
`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 is turned on.
`active`	Valid values are `yes` and `no`.
`lim-status-ok`	Valid values are `yes` and `no`.
`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.

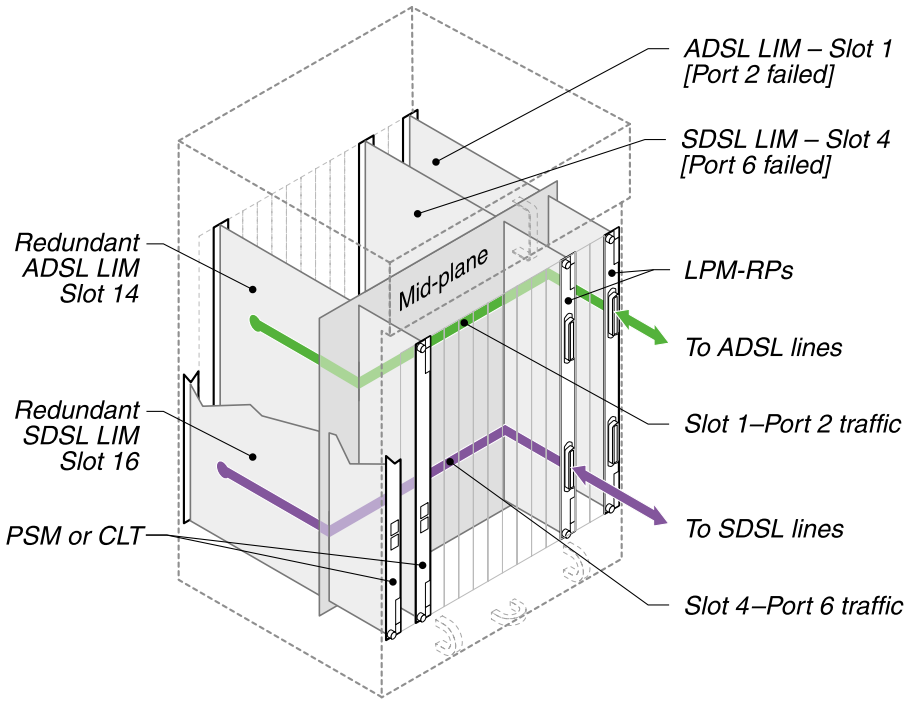
More than one kind of LIM port can be backed up. An additional LIM-PSM pair (or LIM-CLT module pair) of another type installed in a Stinger unit can be used to back up other LIMs of that type in the system. For example, a spare SDSL LIM in slot 16 can back up any failed port on any other SDSL LIMs in 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
`sparing-mode`	Enables or disables port redundancy and specifies the mode. You can set the following port-redundancy modes: • `inactive`—disables LIM port redundancy. This is the default. • `manual`—deactivates the LIM port and then reestablishes the connection on the same port of the spare LIM. • `automatic`—activates automatic redundancy for the port. The error threshold parameters specified in the `Auto-LIM-Sparing-Config` subprofile of the LIM-Sparing-Config [*`slot number`*]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 sdsl {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, `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`.
`sparing-change-reason`	How redundancy is activated. Valid values are `inactive`, `manual`, and `automatic`.
`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.