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Stinger™

ADSL 48-Port Annex A Line Interface Module (LIM) Guide

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About This Guide

What is in this guide

This guide describes how to configure and monitor the Stinger ADSL 48-port Annex A 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 Stinger *Getting Started Guide* for this 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:

- **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.

  - 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.
  - *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 an ADSL 48-Port Annex A Line Interface Module (LIM)

1

The Stinger asymmetric digital subscriber line (ADSL) 48-port Annex A line interface module (LIM) provides 48 ADSL interfaces that support high-speed asymmetric data transfer using the ANSI discrete multitone (DMT), G.lite, and G.dmt ADSL protocols.

One version of the ADSL 48-port Annex A LIM, product code STGR-LIM-AD-48, supports the Stinger FS and Stinger LS chassis.

Installing an ADSL 48-port Annex A LIM

Install the ADSL 48-port LIM in the same manner as other LIMs. See the *Stinger Getting Started Guide* your unit for details. After installation, the module must be configured following the instructions in this guide.

Module specifications

The specifications for the ADSL 48-port Annex A LIM are as follows:

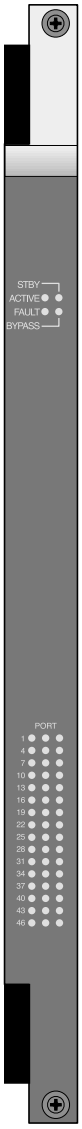
Physical dimensions	Height: 15 in. (38.1 cm). Width: 1.06 in. (2.69 cm). Depth: 9 in. (22.8 cm). Weight: 4 lb. (1.8 kg).
Power requirements	135 W. (maximum)
Temperature range	32°F to 131°F (0°C to 55°C).
Interface standards	ANSI T1E1.4/99-006 (draft).

Network Timing Reference (NTR)	An 8Khz reference clock is provided over the ADSL line for any CPE with the capability to recover it.
Physical connectors	USOC RJ21X 50-pin telco connector. Must meet JIS C5973 standards.

Interpreting ADSL 48-port Annex A status lights

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

Figure 1-1. ADSL 48-port Annex A LIM



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 1-1 explains the ADSL 48-port Annex A status lights.

Table 1-1. ADSL 48-port Annex A 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 ATM ADSL-DMT interfaces

A Stinger unit creates an Al-Dmt profile for each ADSL-DMT interface in the system. For example, for an ADSL-DMT LIM installed in slot 14, the system creates the following profiles:

```
admin> dir al-dmt
    28  06/20/1999 00:27:37  { shelf-1 slot-14 1 }  1:14:1
    28  06/20/1999 00:27:37  { shelf-1 slot-14 2 }  1:14:2
    28  06/20/1999 00:27:37  { shelf-1 slot-14 3 }  1:14:3
    28  06/20/1999 00:27:37  { shelf-1 slot-14 4 }  1:14:4
    28  06/20/1999 00:27:37  { shelf-1 slot-14 5 }  1:14:5
    28  06/20/1999 00:27:37  { shelf-1 slot-14 6 }  1:14:6
    28  06/20/1999 00:27:37  { shelf-1 slot-14 7 }  1:14:7
    28  06/20/1999 00:27:37  { shelf-1 slot-14 8 }  1:14:8
    28  06/20/1999 00:27:37  { shelf-1 slot-14 9 }  1:14:9
    29  06/20/1999 00:27:37  { shelf-1 slot-14 10 }  1:14:10
    29  06/20/1999 00:27:37  { shelf-1 slot-14 11 }  1:14:11

....
```

Overview of the Al-Dmt profile

Various discrete multitone (DMT) standards define the fast and interleave data latencies for each direction (upstream and downstream) of ADSL transmission. In the Stinger Al-Dmt profiles, you set parameters to specify the data rate, signal quality and power, and data delay of the interface. The Stinger unit references these parameters in the training process.

The following sets of parameters are active in the current software version:

- Line activation and DMT parameters
- Rate adaptive mode parameters
- Power spectral density (PSD) and power-level parameters
- Fast and interleaved bit-rate parameters
- Interleaving delay parameters
- Noise margin parameters
- Dynamic rate adaptive parameters
- Trellis encoding
- Automatic Gain Control

The following AL-DMT features are not currently supported, but will be soon:

- Dual latency
- Dynamic rate adaptation

These features are not present in the current software version. However, the parameters related to these features are present in the Al-Dmt profile.

ADSL protocol support

The ADSL 48-port Annex A LIM supports the following protocol standards:

- ANSI DMT—ANSI T1.413.2
- G.dmt—ITU 992.1
- G.lite—ITU 992.2, ITU 994.1

By setting the `line-code` parameter in the Line-Config subprofile to `auto-select`, the LIM automatically detects and configures itself with the correct ADSL protocol. This is the optimum setting for the ADSL 48-port Annex A LIM.

No matter which protocol is used, in general, the Al-Dmt profile parameters remain the same and are configured in the same way. Exceptions are the `line-latency-down` and `line-latency-up` parameters. When the G.lite protocol is specified or detected, these parameters are automatically set to the value `interleave`.

Line activation and DMT parameters

Each direction of traffic (upstream and downstream) on an ADSL-DMT line can have a different minimum and maximum bit rate. The ADSL 48-port Annex A LIM does not support dual latency, which can use both the fast and interleaved channels in both directions.

The Al-Dmt profile

The Al-Dmt profile contains the following parameters and subprofiles, shown with default values, for activating and setting up an AL-DMT line. These profile and subprofile parameters are described in the following tables.

```
[in AL-DMT/{ any-shelf any-slot 0 }]
name = ""
physical-address* = { any-shelf any-slot 0 }
enabled = no
sparing-mode = inactive
```

Parameter	Description
`name`	Specifies the name of the interface. The default value is the interface address in *shelf*`:`*slot*`:`*port* format (for example, `1:2:3`), but you can assign a text string of up to 16 characters.
`physical-address`	Specifies the physical address of the interface in the Stinger unit.
`enabled`	Enables the ADSL-DMT interface. An ADSL-DMT line is disabled until you activate the line in the Al-Dmt profile.
`sparing-mode`	Enables or disables port redundancy (sparing) and specifies the mode. The default value, `inactive`, disables LIM port redundancy (sparing). The `automatic` setting activates automatic sparing for the port. The values of the error threshold parameters specified in the Auto-Lim-Sparing-Config:Lim-Sparing-Config [*slot number*] profile are used. The `manual` setting deactivates the LIM port and reestablishes the connection on the same port of the spare LIM.

Line-Config subprofile

The Line-Config subprofile parameters configure an ADSL-DMT line. The parameters activate and set up the line and are shown with default values. The rate adaptive and power parameters are describes separately.

```
[in AL-DMT/{ any-shelf any-slot 0 }:line-config]
nailed-group = 1
vp-switching-vpi = 15
rate-adapt-mode-up = automatic-at-startup
rate-adapt-mode-down = automatic-at-startup
rate-adapt-ratio-up = 100
rate-adapt-ratio-down = 100
max-aggr-power-level-up = 13
max-aggr-power-level-down = 20
max-power-spectral-density = 40
line-code = auto-select
line-latency-down = fast
line-latency-up = fast
```

```
trellis-encoding = yes
gain-default = 20-db
upstream-start-bin = 6
upstream-end-bin = 31
downstream-start-bin = 32
downstream-end-bin = 255
loop-back = none
bit-swapping = no
fbm-dbm-mode = fbm
alcatel-us-413-boost = unknown
```

Parameter	Description
`nailed-group`	Specifies the nailed-group number for the ADSL-DMT physical interface. A Connection or RADIUS profile uses this number to specify the interface. Because each interface is assigned a unique default number, you do not need to modify the value of this parameter. If you assign a new value, it must be a number from 1 to 1024 that is unique within the system.
`vp-switching-vpi`	Specifies the virtual path identifier (VPI) to use for virtual path (VP) switching on the LIM port. The default is 15. All other VPIs are used for virtual channel (VC) switching.
`line-code`	Specifies the DMT line code to be used for training. Valid values are `auto-select`, `ansi-dmt`, `g.lite`, and `g.dmt`. The default value is `auto-select`, which enables automatic detection of the ADSL line coding.
`line-latency-down`	Specifies the latency path (`fast` or `interleave`) to be used for downstream data transport. Default value is `interleave` for G.lite and `fast` for all other line protocols. For related settings, see “Fast and interleaved bit-rate parameters” on page 1-9.
`line-latency-up`	Specifies the latency path (`fast` or `interleave`) to be used for upstream data transport. Default value is `interleave` for G.lite and `fast` for all other line protocols. For related settings, see “Fast and interleaved bit-rate parameters” on page 1-9.
`trellis-encoding`	Enables/disables trellis encoding. Trellis encoding is specified in the DMT standard. Disabling this parameter (`no`) can increase performance, but at the cost of becoming noncompliant with the standard. The default is `yes`.
`upstream-start-bin`	Specifies the starting frequency bin for upstream transmission. Valid range is 0 to 31 for the 48-port Annex A LIM. The default value is 6.
`upstream-end-bin`	Specifies the ending frequency bin for upstream transmission. Valid range is 0 to 31 for the 48-port Annex A LIM. The default value is 31.

Parameter	Description
`downstream-start-bin`	Specifies the starting frequency bin for downstream transmission. Valid range is 32 to 255 for the 48-port Annex A LIM. The default value is 32.
`downstream-end-bin`	Specifies the ending frequency bin for downstream transmission. Valid range is 32 to 255 for the 48-port Annex A LIM. The default value is 255.
`loop-back`	Provides a digital or analog loop-back on the ADSL interface when set to `digital` or `analog`. No loopback is present when the default setting of `none` is set.
`bit-swapping`	Used as a noise compensation feature on Annex A full-rate lines. For optimum performance under most conditions this should be set to `yes`.
`fbm-dbm-mode`	This parameter is only valid with the Annex C LIM.
`alcatel-us-413-boost`	Provides an increase in the upstream rate on Annex A LIMs when used with Alcatel based CPE.

The upstream and downstream start and end bins define the frequency ranges for upstream and downstream data. The frequency for a particular bin is defined as F = bin# x 4.135kHz. You must also make sure to adjust the `max-bitrate` and `min-bitrate` parameters to match the frequency range defined by the start and end bin numbers.

You can use the bitrate parameters to adjust the frequency content of the ADSL signals. For example, splitterless ANSI DMT can be supported by appropriate adjustment of the frequency range. This eliminates the need for splitters or filters at the subscriber location.

For optimum performance under most conditions when using the 48-port Annex A LIM, bit swapping should be turned on for all interfaces. The following example shows how this can be accomplished for the first interface of a 48-port Annex A LIM in slot 2.

```
admin> read al-dmt {1 2 1}
AL-DMT/{ shelf-1 slot-2 1 } read
admin> set line-config bit-swapping = yes
admin> write
```

Rate-adaptive mode parameters

The `rate-adapt-mode-up` and `rate-adapt-mode-down` parameters in the Line-Config subprofile specify rate-adaptive operations from the subscriber (upstream) or to the subscriber (downstream). Dynamic rate adaptation is not currently supported, so you must choose between the values `automatic-at-startup` (the default) and `operator-controlled`.

Automatic-at-startup rate adaptation means that the rate is selected during the training (startup) process. The line initializes at a minimum specified bit rate and target noise margin. If the line fails to achieve the minimum bit rate in either direction, it cannot start, and it sends a message that the requested bit rate was too high. If the line can support a bit rate that is higher than the minimum and not higher than the maximum bit rate, it can train up to a higher rate within the acceptable noise margin. Each direction can have a different minimum and maximum bit rate

and use the fast or interleaved ADSL channel. (Dual latency, which can use both the fast and interleaved channels in both directions is not currently supported.)

Operator-controlled rate adaptation means that the line must start at and maintain a specific planned bit rate with an acceptable target noise margin. If the line fails to achieve the planned bit rate in either direction, it fails to start, and reports that the requested bit rate was too high. The line does not use a higher bit rate, even if it can support one.

For details about specifying bit rates, see "Fast and interleaved bit-rate parameters" on page 1-9. For information about defining acceptable noise margins, see "Noise margin parameters" on page 1-12.

The following parameters in the Line-Config subprofile, shown with default values, define how rate adaptation operates on the line:

```
[in AL-DMT/{ any-shelf any-slot 0 }:line-config]
rate-adapt-mode-up = automatic-at-startup
rate-adapt-mode-down = automatic-at-startup
rate-adapt-ratio-up = 100
rate-adapt-ratio-down = 100
```

Parameter	Description
`rate-adapt-mode-up`	Specifies the rate-adaptive mode for upstream training. The default is `automatic-at-startup`. With the setting `operator-controlled` the line trains upstream using a constant planned bit rate. The `dynamic` setting is not currently supported.
`rate-adapt-mode-down`	Specifies the rate-adaptive mode for downstream training. The default is `automatic-at-startup`. With the setting `operator-controlled`, the line trains downstream using a constant planned bit rate. The `dynamic` setting is not currently supported.
`rate-adapt-ratio-up`	*Not supported in this release.* Ratio for distributing excess upstream bit rate among the fast and interleaved channels when dual latency is supported.
`rate-adapt-ratio-down`	*Not supported in this release.* Ratio for distributing excess downstream bit rate among the fast and interleaved channels when dual latency is supported.

Power-level parameters and power spectral density (PSD)

Maximum aggregate power level is the maximum output power allowed on the line at the transmitter output. This value is expressed in decibels with reference to one milliwatt (dBm), where zero dBm equals 1 milliwatt. It is defined for both directions. If you lower the default value, the line consumes less power and has less capacity. The default value is the maximum allowed setting.

Power spectral density (PSD) is the power of a signal per unit of frequency, the dimensions are those of a power divided by Hertz. In the Line-Config subprofile, the `max-power-spectral-density` parameter specifies the PSD allowed on the line at the transmitter output, expressed in dBm/Hz. It is defined for the downstream direction only, with

a valid range of -34 to -52 in even-number increments. If you lower the value from its default value of -40, the line consumes less power but also has a lower capacity. Increasing the value can boost the PSD to achieve a higher capacity.

Following are the Line-Config subprofile parameters, shown with default values, for configuring power:

```
[in AL-DMT/{ any-shelf any-slot 0 }:line-config]
max-aggr-power-level-up = 13
max-aggr-power-level-down = 20
max-power-spectral-density = 40
gain-default = 16-db
```

Parameter	Description
`max-aggr-power-level-up`	Specifies the maximum aggregate power level on the upstream channel. Valid range is from 0dBm to 13dBm.
`max-aggr-power-level-down`	Specifies the maximum aggregate power level on the downstream channel. Its valid range is from 0dBm to 20dBm.
`max-power-spectral-density`	Specifies the maximum PSD in both directions. Its valid range is from 34 to 52 in even-number increments. If you specify an odd number, the system uses the even-number setting below that number. The actual value used is the negative value of the number that is specified.
`gain-default`	Specifies the default gain value in dB (`16dB` or `20dB`) for automatic gain control (AGC). The optimum value for downstream transmission is `20dB`. The optimum value for upstream transmission is `16dB`.

Fast and interleaved bit-rate parameters

Bit-rate parameters specify minimum, maximum, and planned upstream and downstream bit rates for a rate-adaptive connection. Bit rates depend on the physical interface (the line to which the central office equipment (COE) and customer premises equipment (CPE) are connected) and the ADSL interleaved or fast channel.

The `line-latency-up` and `line-latency-down` settings in the Line-Config subprofile (`fast` or `interleave`) determine which channel is used in each direction. For more information, see “Line activation and DMT parameters” on page 1-4.

The Fast-Path-Config subprofile

The following configuration shows the default settings for the Fast-Path-Config subprofile. The bit-rate parameter settings indicate use of the fast channel for both upstream and downstream traffic. Note that in the current software version, both upstream and downstream traffic must use the same channel.

```
[in AL-DMT/{ any-shelf any-slot 0 }:fast-path-config]
min-bitrate-up = 128
min-bitrate-down = 128
max-bitrate-up = 1000
```

```
max-bitrate-down = 8000
planned-bitrate-up = 512
planned-bitrate-down = 1000
```

For optimum performance under most conditions when using the 48-port Annex A LIM, fast-path bit rates should be configured as shown in the following example, which shows how the bit rates are set for the first interface of a 48-port Annex A LIM in slot 2.

```
admin> read al-dmt {1 2 1}
AL-DMT/{ shelf-1 slot-2 1 } read
admin> set fast-path-config max-bitrate-up = 1280
admin> set fast-path-config max-bitrate-down = 12480
admin> set fast-path-config min-bitrate-up = 32
admin> set fast-path-config min-bitrate-down = 32
admin> write
```

The Interleave-Path-Config subprofile

The following default configuration of the Interleave-Path-Config subprofile, bit-rate parameter settings indicate the use of the interleave path channel for both upstream and downstream traffic.

```
[in AL-DMT/{ any-shelf any-slot 0 }:interleave-path-config]
min-bitrate-up = 128
min-bitrate-down = 128
max-bitrate-up = 1000
max-bitrate-down = 8000
planned-bitrate-up = 512
planned-bitrate-down = 1000
```

Parameter	Description
`min-bitrate-up`	Specifies the minimum bit rate for upstream traffic, from 0Kbps to 1024Kbps. When the automatic rate-adaptive mode is in use, the line initializes at this upstream rate or fails to initialize. The default value for the ADSL 48-port Annex A LIM is 128Kbps. **Note:** Not configured for operator-controlled rate adaptation.
`min-bitrate-down`	Specifies the minimum bit rate for downstream traffic, from 0Kbps to 8192Kbps. When the automatic rate-adaptive mode is in use, the line either initializes at this downstream rate or fails to initialize. The default value for the ADSL 48-port Annex A LIM is 128Kbps. **Note:** Not configured for operator-controlled rate adaptation.
`max-bitrate-up`	Specifies the maximum bit rate for upstream traffic, from 0Kbps to 2,000Kbps. The default value for the ADSL 48-port Annex A LIM is 1000Kbps. **Note:** Not configured for operator-controlled rate adaptation.

Parameter	Description
`max-bitrate-down`	Specifies the maximum bit rate for downstream traffic, from 0Kbps to 15,000Kbps. The default value for the ADSL 48-port Annex A LIM is 8000Kbps. **Note:** Not configured for operator-controlled rate adaptation.
`planned-bitrate-up`	Specifies the constant bit rate for upstream traffic when operator-controlled rate-adaptive mode is in use. Valid values are from 0Kbps to 2,000Kbps. The default value for the ADSL 48-port Annex A LIM is 512Kbps. **Note:** Not configured for automatic-at-startup rate adaptation.
`planned-bitrate-down`	Specifies the constant bit rate for downstream traffic when operator-controlled rate-adaptive mode is in use. Valid values are from 0Kbps to 15,000Kbps. The default value for the ADSL 48-port Annex A LIM is 1000Kbps. **Note:** Not configured for automatic-at-startup rate adaptation.

Interleaving delay parameters

Data interleaving increases the ability of the system to tolerate noise on the line. However, it also increases the latency (delay) of the data traffic. When using the interleave channel, determine the maximum amount of latency by considering the type of traffic sent on the line. The more tolerant of delay the traffic is, the higher these settings can be.

Following are the Interleave-Path-Config subprofile parameters shown with default values for specifying the maximum tolerable delay for interleaver/deinterleaver operations:

```
[in AL-DMT/{ any-shelf any-slot 0 }:interleave-path-config]
max-delay-up = 16
max-delay-down = 16
```

Parameter	Description
`max-delay-up`	Specifies the maximum milliseconds of delay allowed in the upstream direction as a result of interleaving data. The valid range is 0 to 64.
`max-delay-down`	Specifies the maximum milliseconds of delay allowed in the downstream direction as a result of interleaving data. The valid range is 0 to 64.

Setting the interleave bit-rate for optimum performance

For optimum performance when using the 48-port Annex A LIM, under most conditions interleave bit rates should be configured as shown in the following example. The example shows how the bit rates are set for the first interface of a 48-port Annex A LIM in slot 2.

```
admin> read al-dmt {1 2 1}
AL-DMT/{ shelf-1 slot-2 1 } read
admin> set interleave-path-config max-bitrate-up = 1280
admin> set interleave-path-config max-bitrate-down = 12480
admin> set interleave-path-config min-bitrate-up = 32
admin> set interleave-path-config min-bitrate-down = 32
admin> write
```

Margin-Config subprofile

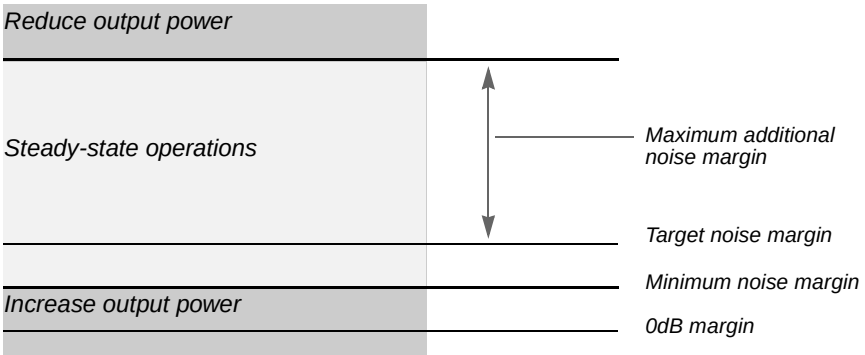
The Bit Error Rate (BER) is the percentage of erroneous bits in the total number of transmitted bits. The noise margins can be controlled to ensure that the line provides a BER of 10^{-7}or better, as required by DMT standards.

Noise margin parameters

The Margin-Config subprofile contains the parameters that configure noise margins. Noise margins are defined in decibels (dB). A BER of 10^{-7}represents 0dB. The line tolerates a certain level of random frequency voltage (noise) with respect to its received signal. If the maximum noise level is exceeded, the ADSL Transceiver Unit (ATU) attempts to reduce the far-end output power. If the noise drops below a minimum margin, the ATU attempts to increase the far-end power output until the noise level is at or above the configured minimum.

Although the noise-margin settings can be from 1dB to 31dB, the modem software limits the maximum noise margin to 15dB. If you specify a setting greater than 15dB, the modem software uses 15dB. Figure 1-2 illustrates the relationship of margin parameters to power adjustments.

Figure 1-2. Relationship between noise margin parameters and power adjustments



The target noise margin parameter is supported by the ADSL 48-port Annex A LIM. The minimum noise margin and maximum additional noise margin parameters are not used by ADSL 48-port Annex A LIMs and are not detailed here. Consult documentation for the ADSL G.lite LIM for additional information about setting the noise margin parameters.

Following are the Margin-Config subprofile parameters shown with default values for configuring the target noise margins on the ADSL-DMT line for the ADSL 48-port Annex A LIMs:

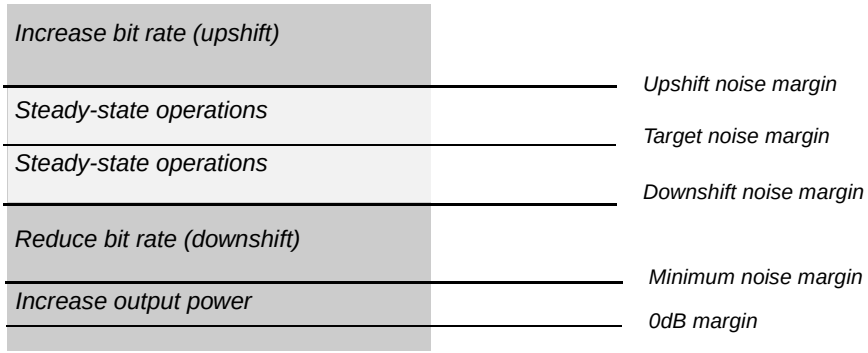
```
[in AL-DMT/{ any-shelf any-slot 0 }:margin-config]
target-noise-margin-up = 6
target-noise-margin-down = 6
```

Parameter	Description
`target-noise-margin-up`	Specifies the upstream noise margin, relative to 0dB, that must be present before the line can initialize successfully and rate adapt during normal operations. The valid range is 0dB to 31dB, with a practical limitation of 15dB set by the modem software. The default for the ADSL 48-port Annex A LIM is 6dB.
`target-noise-margin-down`	Specifies the downstream noise margin, relative to 0dB, that must be present before the line can initialize successfully and rate adapt during normal operations. The valid range is 0dB to 3dB, with a practical limitation of 15dB set by the modem software. The default for the ADSL 48-port Annex A LIM is 6dB.

Dynamic rate-adaptive noise margin parameters

Dynamic rate adaptation is not supported in the current software version, but will be soon. Therefore, if you set any of the parameters described in this section, the modem retrains with its previous behavior. When dynamic rate adaptation is in use, the line adjusts its bit rate dynamically (it *upshifts* to increase its bit rate or *downshifts* to reduce it) on the basis of specified noise margins and intervals for which a noise level is maintained, provided that the maximum or minimum bit rate has not been reached. Figure 1-3 illustrates the relationship between margins and dynamic rate adaptation.

Figure 1-3. Future support: Noise margins and dynamic rate adaptation relationship



When dynamic rate adaptation is supported, the following parameters will configure it:

```
[in AL-DMT/{ any-shelf any-slot 0 }:margin-config]
ra-downshift-margin-up = 0
ra-downshift-int-up = 0
ra-downshift-margin-down = 0
ra-downshift-int-down = 0
ra-upshift-margin-up = 0
ra-upshift-int-up = 0
```

```
ra-upshift-margin-down = 0
ra-upshift-int-down = 0
```

Parameter	Description
`ra-downshift-margin-up`	*Not currently supported.* Specifies the upstream noise margin relative to 0dB. If the noise level remains at this value for more than the specified time interval, the line reduces its upstream bit rate.The valid range is 1dB to 31dB.
`ra-downshift-int-up`	*Not currently supported.* Specifies the number of seconds (1 to 255) the downshift noise margin may be maintained before the line reduces its upstream bit rate.
`ra-downshift-margin-down`	*Not currently supported.* Specifies the downstream noise margin relative to 0dB. If the noise level remains at this value for more than the specified time interval, the line reduces its downstream bit rate. The valid range is 1dB to 31dB.
`ra-downshift-int-down`	*Not currently supported.* Specifies the number of seconds (1 to 255) the downshift noise margin may be maintained before the line reduces its downstream bit rate.
`ra-upshift-margin-up`	*Not currently supported.* Specifies the upstream noise margin relative to 0dB. If the noise level remains at this value for more than the specified time interval, the line increases its upstream bit rate.The valid range is 1dB to 31dB.
`ra-upshift-int-up`	*Not currently supported.* Specifies the number of seconds (1 to 255) the upshift noise margin can be maintained before the line increases its upstream bit rate.
`ra-upshift-margin-down`	*Not currently supported.* Specifies the downstream noise margin relative to 0dB. If the noise level remains at this value for more than the specified time interval, the line increases its downstream bit rate. The valid range is 1dB to 31dB.
`ra-upshift-int-down`	*Not currently supported.* Specifies the number of seconds (1 to 255) the upshift noise margin can be maintained before the line increases its downstream bit rate.

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 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 HDSL2 LIMs.

The call control mechanism enables the Stinger unit to establish and maintain soft PVCs (SPVCs) across port state changes. This allows xDSL subscribers to establish connections on LIM interfaces in the operating states before the interfaces are fully trained, as well as in the standard `port-up` state (in which the modem has successfully trained). 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 connected.

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	Description
`ignore-lineup`	In the System profile, enables or disables the Stinger system'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 disallow 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 to inherit the `ignore-lineup` value from the System profile. • `no`—Sets the Stinger call-control mechanism to ignore the system-wide setting and allows 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 system-wide 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 new call-control procedures systemwide:

```
admin> read system
SYSTEM read

admin> set ignore-lineup = yes

admin> write
SYSTEM written
```

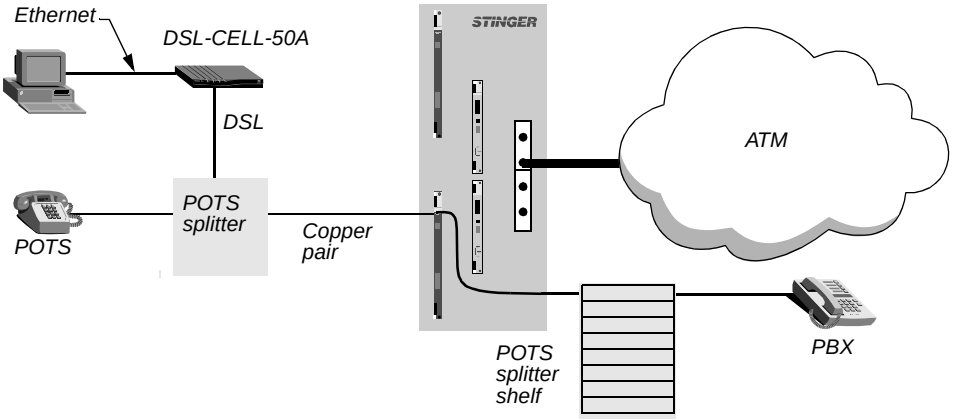
When call-control is enabled systemwide, you can disable it on specific interfaces by modifying the Line profile. The commands in the following example disable call-control procedures on port one of the SDSL 48-port Annex A LIM in slot 12:

```
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
```

Examples of ADSL-DMT interface configuration

In Figure 1-4, an ADSL-DMT interface in a Stinger unit is configured to support a rate-adaptive connection to a DSL-CELL-50A CPE.

Figure 1-4. ADSL ATM LIM configuration



The following commands configure the interface to use a constant, planned (operator-controlled) bit rate of 56Kbps upstream and 1.5Mbps downstream, using the fast channel in both directions:

```
admin> read al-dmt { 1 3 4 }
AL-DMT/{ shelf-1 slot-3 4 } read
admin> set enabled = yes
admin> set line-config line-latency-up = fast
admin> set line-config line-latency-down = fast
admin> set line-config rate-adapt-mode-up = operator-controlled
admin> set line-config rate-adapt-mode-down = operator-controlled
admin> set fast-path-config planned-bitrate-up = 56
admin> set interleave-path-config planned-bitrate-down = 1500
admin> write
AL-DMT/{ shelf-1 slot-3 4 } read
```

The following commands configure the interface to automatically select the best possible rate at startup time. They specify a possible upstream bit-rate range of 56Kbps to 256Kbps and a possible downstream bit-rate range of 512Kbps to 1.5Mbps. They also specify use of the interleaved channel in both directions.

```
admin> read al-dmt { 1 3 4 }
AL-DMT/{ shelf-1 slot-3 4 } read
admin> set enabled = yes
```

```
admin> set line-config rate-adapt-mode-up = automatic-at-startup
admin> set line-config rate-adapt-mode-down = automatic-at-startup
admin> set line-config line-latency-up = interleave
admin> set line-config line-latency-down = interleave
admin> set interleave-path-config min-bitrate-up = 56
admin> set interleave-path-config max-bitrate-up = 256
admin> set interleave-path-config min-bitrate-down = 512
admin> set interleave-path-config max-bitrate-up = 1500
admin> write
AL-DMT/{ shelf-1 slot-3 4 } read
```

The following commands reserve VPI 7 for VP switching on the interface:

```
admin> read al-dmt { 1 3 4 }
AL-DMT/{ shelf-1 slot-3 4 } read
admin> set line-config vp-switching-vpi = 7
admin> write
AL-DMT/{ shelf-1 slot-3 4 } read
```

Checking status of ADSL-DMT interface

The system creates a read-only Al-Dmt-Stat profile for each ADSL-DMT interface. The profiles provide statistics and connection status. Following are the relevant parameters, shown with sample settings for an active line:

```
[in AL-DMT-STAT/{ shelf-1 slot-3 4 }]
physical-address* = { shelf-1 slot-3 4 }
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 = { 0 coe port-up 128 2944 fast fast 1.4.1 2 0 1 init-+
physical-statistic = { { 1 1 1 } yes 3 passed 3 6 56 19 5 41 11 0 0 0 +}
```

Parameter	Description
`line-state`	Indicates the overall state of the line. Possible values are as follows: `does-not-exist`—Link is not physically present on board. `disabled`—Line is disabled. `active`—Multipoint is established.
`spare-physical-address`	Indicates the shelf, slot, and port number of the spare (redundant) LIM.

Parameter	Description
`sparing-state`	Indicates the state of the redundancy function. If redundancy is not enabled, `sparing-none` is the value. If sparing is enabled and the LIM slot is a primary LIM, the value can be `primary-active` or `primary-inactive`. If sparing is enabled and the LIM slot is the secondary (spare) LIM, the value can be `secondary-active` or `secondary-inactive`.
`sparing-change-reason`	Indicates how redundancy is activated. Valid values are `inactive`, `manual` and `automatic`.
`sparing-change-time`	Indicates the time that the last change in redundancy state occurred.
`sparing-change-counter`	Indicates each redundancy change, for example, primary to secondary, secondary to primary, increments the counter. The counter is reset when the Stinger starts or restarts.
`vpi-vci-range`	Indicates the valid range of VPI and VCI for the circuits established for the line. This range can change only after LIM reboot.
`vp-switching-vpi`	Indicates the VPI to be used for the VP switching. The rest of the VPIs are used for the VC switching.

Checking status of the physical interface

The Physical-Status subprofile provides information about the physical interface. The interface runs a continuous Bit Error Rate Test (BERT) over its unused bandwidth, so bit-error counts are always available without explicitly running a BERT and disrupting data transmission. Integrated BERT results are displayed by the `accum-bit-err`, `num-sec-valid`, and `num-sec-invalid` parameters.

Following are the Physical-Status subprofile parameters shown with sample settings for an active interface:

```
[in AL-DMT-STAT/{ shelf-1 slot-3 4 }:physical-status]
if-group-index = 0
unit-type = coe
dev-line-state = port-up
up-stream-rate-fast = 0
down-stream-rate-fast = 0
up-stream-rate-interleave = 128000
down-stream-rate-interleave = 2944000
up-stream-latency = interleave
down-stream-latency = interleave
firmware-ver = 1.4.1
ansi-adsl-ver = 2
initial-adsl-ver = 0
hardware-ver = 1
modem-hw-state = init-ok
accum-bit-err = 0
num-sec-valid = 91
```

```
num-sec-invalid = 0
operational-mode = g.lite
```

Parameter	Description
`if-group-index`	Indicates the SNMP interface group index of the line.
`unit-type`	Indicates the operating mode (should always be COE).
`dev-line-state`	Indicates the current state of the interface. Valid values are as follows: `down`—Either there is no connection or the interface is disabled. `activation`—Interface is trying to train but not detecting a modem on the other end. `training`—Training with a modem on the other end. `port-up`—Interface is successfully trained up. `failed`—Interface failed training (usually a log message gives the reason). `loopback`—Interface is in special loopback test mode.
`up-stream-rate-fast`	Indicates the upstream data rate in bps when `latency` is `fast`. Zero means that latency is set to `interleave` or the data rate is unknown.
`down-stream-rate-fast`	Indicates the downstream data rate in bps when `latency` is `fast`. Zero means that latency is set to `interleave` or the data rate is unknown.
`up-stream-rate-interleave`	Indicates the upstream data rate in bps when latency is `interleave`. Zero means that latency is set to `fast` or the data rate is unknown.
`down-stream-rate-interleave`	Indicates the downstream data rate in bps when latency is `interleave`. Zero means that latency is set to `fast` or the data rate is unknown.
`up-stream-latency`	Indicates the operational upstream latency (`none`, `fast`, or `interleave`). The `none` setting indicates that the line is not operational.
`down-stream-latency`	Indicates the operational downstream latency (`none`, `fast`, or `interleave`). The `none` setting indicates that the line is not operational.
`firmware-ver`	Indicates the version number of the ADSL modem firmware.
`ansi-adsl-ver`	Indicates the supported issue of the ANSI T1.413 standard (Issue 2).
`hardware-ver`	Indicates the hardware version of the ADSL modem.

Parameter	Description
`modem-hw-State`	Indicates the state of the interface after initialization. Valid values are `init-ok` (all is well), `bad-sdram`, `bad-cache`, or `bad-cache-sdram`. The last three values imply memory problems, probably associated with a self-test failure.
`accum-bit-err`	Indicates the number of actual bit errors detected during the continuous BERT.
`num-sec-valid`	Indicates how many seconds were error free during the continuous BERT.
`num-sec-invalid`	Indicates how many error seconds were detected during the continuous BERT.
`operational-mode`	Indicates ADSL coding protocol as automatically detected or set by user. Valid values are `ANSI dmt`, `g.lite`, or `g.dmt`.

Obtaining statistics about operations

The Physical-Statistic subprofile enables you to check interface operations. Following are the `physical-statistics` parameters shown with sample settings for an active interface:

```
[in AL-DMT-STAT/{ shelf-1 slot-3 4 }:physical-statistic]
line-up-timer = { 0 0 1 }
rx-signal-present = yes
up-dwn-cntr = 3
self-test = passed
noise-margin-down = 6
attenuation-down = 56
output-power-down = 19
noise-margin-up = 5
attenuation-up = 41
output-power-up = 11
near-end-fec = 0
near-end-crc = 0
near-end-hec = 0
far-end-fec = 10
far-end-crc = 0
far-end-hec = 0
received-rs-blcks = 104073
transmitted-rs-blocks = 416772
incoming-cells = 92
outgoing-cells = 100
```

Parameter	Description
`line-up-timer`	Indicates how long the interface has been up (days, hours, and minutes in {*dd hh mm*} format).

Parameter	Description
`rx-signal-present`	Indicates whether receiving (`yes`) or not receiving (`no`) signal from the CPE.
`up-down-cntr`	Indicates the number of times the link has changed from an `up` state to a `down` state since the module was last reset.
`self-test`	Indicates whether the port has passed the modem chipset self-test.
`noise-margin-down`	Indicates current downstream noise margin in dB.
`attenuation-down`	Indicates current downstream attenuation in dB.
`output-power-down`	Indicates current downstream aggregate power level in dBm.
`noise-margin-up`	Indicates current upstream noise margin in dB.
`attenuation-up`	Indicates current upstream attenuation in dB.
`output-power-up`	Indicates current upstream aggregate power level in dBm.
`near-end-fec`	Indicates forward Error Correction (FEC) errors detected by the COE ADSL Transceiver Unit (ATU).
`near-end-crc`	Indicates cyclic Redundancy Check (CRC) errors detected by the COE ATU.
`near-end-hec`	Indicates header Error Checksum (HEC) errors detected by the COE ATU.
`far-end-fec`	Indicates forward Error Correction (FEC) errors detected by the CPE ATU.
`far-end-crc`	Indicates cyclic Redundancy Check (CRC) errors detected by the CPE ATU.
`far-end-hec`	Indicates header Error Checksum (HEC) errors detected by the CPE ATU.
`received-rs-blcks`	Indicates the number of received Reed-Solomon blocks. Enabled on 24-port and 48-port LIMs only.
`transmitted-rs-blocks`	Indicates the number of transmitted Reed-Solomon blocks.
`incoming-cells`	Indicates the number of incoming cells.
`outgoing-cells`	Indicates the number of outgoing cells.

Displaying ADSL-DMT port status and nailed groups

To display the nailed-group numbers for ADSL-DMT lines, use the `dmtal` command. For example, the following command output shows the nailed-group numbers for an ADSL-DMT module in slot 4:

```
admin> dmtal -a

All ADSL lines:
(dvOp   dvUpSt  dvRq    sAdm    nailg)
Line    {    1  4  1 }       (Up      Idle    UP      UP     00151)
Line    {    1  4  2 }       (Up      Idle    UP      UP     00152)
```

```
Line    {    1  4  3 }        (Up      Idle    UP      UP     00153)
Line    {    1  4  4 }        (Up      Idle    UP      UP     00154)
Line    {    1  4  5 }        (Up      Idle    UP      UP     00155)
Line    {    1  4  6 }        (Up      Idle    UP      UP     00156)
Line    {    1  4  7 }        (Up      Idle    UP      UP     00157)
Line    {    1  4  8 }        (Up      Idle    UP      UP     00158)
Line    {    1  4  9 }        (Up      Idle    UP      UP     00159)
Line    {    1  4 10 }        (Up      Idle    UP      UP     00160)
Line    {    1  4 11 }        (Up      Idle    UP      UP     00161)
....
```

Configuring LIM and LIM Port Redundancy 2

All Stinger line interface modules (LIMs), except the T1 and E1 LIMs, support LIM and LIM port redundancy in both manual and automatic mode.

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-RP) for line protection.

Note: Some older Stinger systems 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 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 system can be set up with the following module pairs:

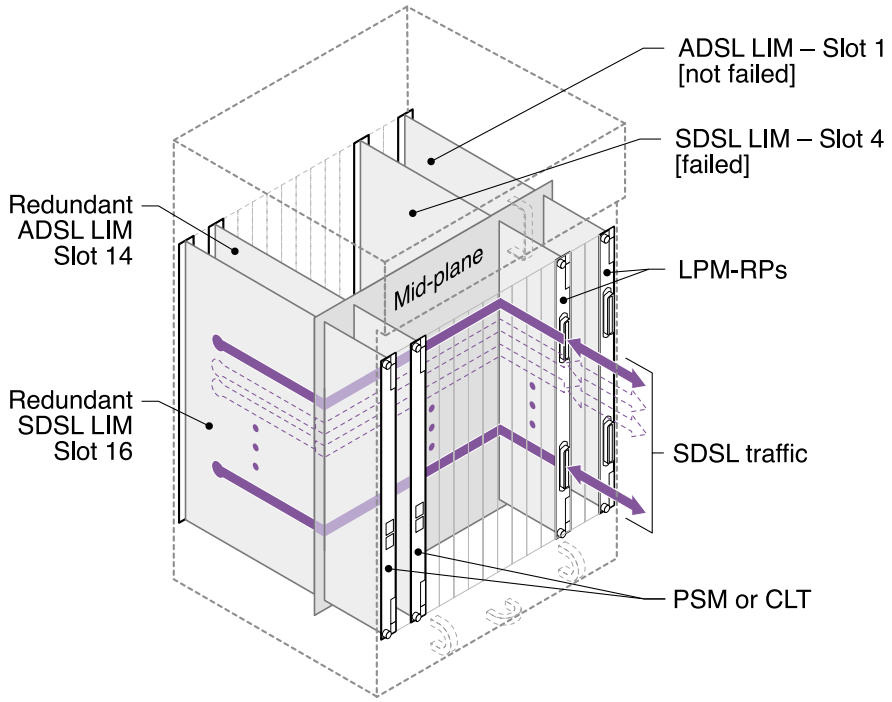
- 6 SDSL LIM–LPM-RP pairs
- 1 SDSL–PSM pair or SDSL–CLT module pair
- 6 ADSL LIM–LPM-RP pairs
- 1 ADSL–PSM pair or ADSL–CLT module pair

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.

Figure 2-1. LIM redundancy in a Stinger FS



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 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. The `inactive` setting disables the LIM redundancy function. The `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. The `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 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, suppose that the SDSL LIM in slot 4 fails (see Figure 2-1). 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 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 to 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. Use the `dir lim-sparing-config` command to verify that the profile has been created.

For example, suppose a Stinger FS 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 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 values:

```
[in LIM-SPARING-STATUS]
spare-slot-type = none
sparing-mode = 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 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.

```
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.

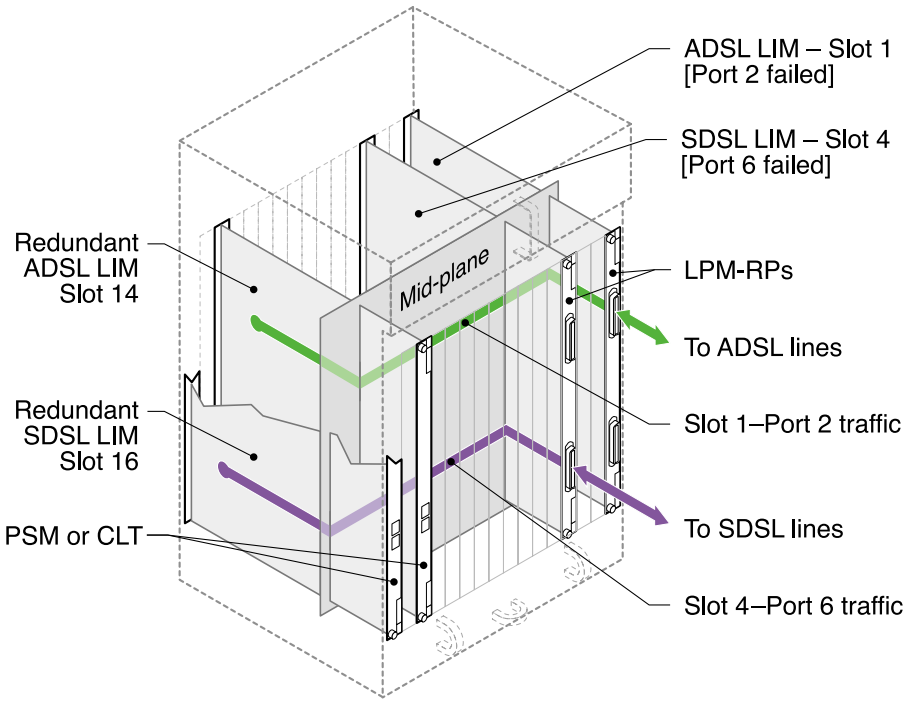
More than one kind of LIM port can be backed up. An additional LIM-PSM pair (or LIM-CLT module pair) of another type installed in a Stinger can be used to back up other LIMs of that type in the system. For example, a spare SDSL LIM in slot 16 can back up any failed port on any other SDSL LIMs in a Stinger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



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 enable two port-redundancy modes. The default value, `inactive`, disables LIM port redundancy. The `manual` setting deactivates the LIM port and then reestablishes the connection on the same port of the spare LIM. The `automatic` setting 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 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 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 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.

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`.
`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 is turned on.