Lucent Technologies
Bell Labs Innovations

Stinger®

SHDSL/HDSL2 32-Port Line Interface Module (LIM) Guide

For software version 9.3-170
March 2002

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About This Guide

What is in this guide

This guide describes how to configure and monitor the Stinger SHDSL/HDSL2 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. You should understand the fundamental concepts of digital subscriber line (DSL) technology and be familiar with the relationship between DSL interfaces and associated configuration profiles.

Documentation conventions

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

Convention	Meaning
`Monospace text`	Represents text that appears on your computer's screen, or that could appear on your computer's screen.
`Boldface monospace text`	Represents characters that you enter exactly as shown (unless the characters are also in ***`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.
[ ]	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.

Convention	Meaning
|	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 SHDSL/HDSL2 32-Port LIM

1

The Stinger SHDSL/HDSL2 line interface module (LIM) supports both single-pair high-speed digital subscriber line (SHDSL) mode and high-speed digital subscriber line 2 (HDSL2) mode. When the LIM is installed in a Stinger slot, the Stinger chassis connects the LIM to a line protection module (LPM), which provides the physical connections for incoming lines. The SHDSL/HDSL2 LIM provides 32 SHDSL or HDSL2 interfaces per LIM.

You select the mode of operation for the module by the `interface-type` parameter. (For details, see "Specifying HDSL2 or SHDSL mode" on page 1-4.) In SHDSL mode, a Stinger unit supports symmetric data transfer rates from 72Kbps through 2312Kbps. In HDSL2 mode, the Stinger unit supports symmetric data transfer at 1.544Mbps over a single twisted pair.

HDSL2 and SHDSL technologies are spectrally compatible with other loop technologies such as ISDN, T1, and HDSL.

Note: The SHDSL/HDSL2 32-port LIM (product code STGR-LIM-H2-32) for Stinger FS and Stinger LS units was previously known as the HDSL2 32-port LIM. The product code number and the hardware remain the same, but the SHDSL designation has been added to the module name to indicate the new SHDSL software capability.

Note: Unless noted otherwise, the configuration information and parameters described in this guide apply to both SHDSL and HDSL2 mode of operation.

Installing the SHDSL/HDSL2 LIM

Install the SHDSL/HDSL2 32-port module in the same manner as for any other LIM module. For details, see the Stinger *Getting Started Guide* for your unit. After installation, follow the instructions in this document to configure the module.

Module specifications

Table 1-1 shows the specifications for the SHDSL/HDSL2 32-port LIM.

Table 1-1. Specifications for the SHDSL/HDSL2 32-port LIM

Category	Specification	
Physical dimensions	Height: 15 inches (38.1cm). Width: 1.06 inches (2.69cm). Depth: 9 inches (22.8cm).	
Weight	3.8 pounds (1.7kg)	
Maximum power requirements	HDSL2: 70W	SHDSL: 80W
Temperature	FS/LS version: 32°F through 131°F (0°C through 55°C) RT version: -40°F through 149°F (-40°C through 65°C)	
Relative Humidity	10% through 95% (noncondensing)	
Operating Altitude	Up to 13,123 feet (4,000m)	
Interface standards	HDSL2: ANSI T1 418 Issue 1 T1E1.4/99-006R6	SHDSL: ITU G.991.2 (G.shdsl) Annex A (North America) Annex B (Europe) ETSI TS 101 524 (similar to ITU G.991.2 Annex B implementation) ITU G.994.1 (G.hs) ITU G.997.1 (physical layer management)
Range	HDSL2: Maximum 12,000 feet with 24 AWG wire at 1.544Mbps Maximum 9,000 feet with 26 AWG wire at 1.544Mbps	SHDSL: Maximum 24,000 feet with 24 AWG wire at 192Kbps Maximum 12,000 feet with 24 AWG wire at 2.312Mbps

Status indicators

Several status lights on the front panel of the SHDSL/HDSL2 32-port LIM indicate the status of the module and its ports. Figure 1-1 shows the front panel and status lights of the SHDSL/HDSL2 32-port LIM.

Figure 1-1. SHDSL/HDSL2 32-port LIM

Interpreting SHDSL/HDSL2 32-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 its POST and becomes operational, the ACTIVE light illuminates. Table 1-2 explains the SHDSL/HDSL2 32-port LIM status lights.

Table 1-2. SHDSL/HDSL2 32-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.

Table 1-2. SHDSL/HDSL2 32-port LIM status lights

Light	Color	Indication
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.

Embedded Operations Channel (EOC) protocol compliance

Embedded Operations Channel (EOC) protocol compliance is defined within the T1E1.4/99-006R6 HDSL2 Draft Standard specification. The EOC protocol provides identification and statistical information about the HDSL2 interface and its remote repeaters and associated customer premises equipment (CPE) and central office equipment nodes.

To display basic statistics, view the `hdsl2-stat` profile. You can display additional information by using the `hdsl2dumpeoc` debug command, which is run directly from the SHDSL/HDSL2 LIM.

MIBs

An HDSL2 Management Information Base (MIB) provides status and statistical information.

Specifying HDSL2 or SHDSL mode

You set the `interface-type` parameter to specify whether the SHDSL/HDSL2 32-port LIM operates in HDSL2 or SHDSL mode at the slot level. Because HDSL2 and SHDSL technologies are not interoperable between the customer premises equipment (CPE) and the central office equipment (COE), the `interface-type` parameter setting on the COE must match that of the CPE.

The following example configures the COE for SHDSL mode:

```
admin> read slot-static-config { 1 3 0}
SLOT-STATIC-CONFIG/{ shelf-1 slot-3 0 } read
admin >list
[in SLOT-STATIC-CONFIG/{ shelf-1 slot-3 0 }]
admin> set interface-type = g-shdsl
admin> write
```

Parameter	Setting
`interface-type`	HDSL2 or SHDSL mode. Specify one of the following values: • `g-shdsl` (default)—The LIM operates in SHDSL mode. **Note:** You must also set the `g-shdsl`, the `rate-mode`, `min-rate`, and `max-rate` parameters, which do not apply if you set one of the other modes. • `hdsl2`—The LIM operates in HDSL2 mode. • `default`—The slot contains a module other than the SHDSL/HDSL2 32-port LIM.

Configuring SHDSL/HDSL2 interfaces

The SHDSL/HDSL2 32-port LIM supplies up to 32 interfaces per LIM. A Stinger unit creates an `hdsl2` profile for each SHDSL/HDSL2 interface in the system.

For example, for an SHDSL/HDSL2 32-port LIM installed in slot 1, the system creates profiles such as the following:

```
admin> dir hdsl2
    18  06/20/1999 23:18:51  { shelf-1 slot-1 1 }  1:1:1
    18  06/20/1999 23:18:51  { shelf-1 slot-1 2 }  1:1:2
    18  06/20/1999 23:18:51  { shelf-1 slot-1 3 }  1:1:3
    18  06/20/1999 23:18:51  { shelf-1 slot-1 4 }  1:1:4
    18  06/20/1999 23:18:51  { shelf-1 slot-1 5 }  1:1:5
    18  06/20/1999 23:18:51  { shelf-1 slot-1 6 }  1:1:6
    18  06/20/1999 23:18:51  { shelf-1 slot-1 7 }  1:1:7
    18  06/20/1999 23:18:51  { shelf-1 slot-1 8 }  1:1:8
```

Configuring port settings for SHDSL and HDSL2

SHDSL/HDSL2 ports are configured in each port's `hdsl2` profile. For example, the `hdsl2` profile for port 1 of a LIM in slot 2 might be configured as follows:

```
admin> read hdsl2 { 1 2 1 }
HDSL2/{ shelf-1 slot-2 1 } read
admin> list
[in HDSL2/{ shelf-1 slot-2 1 }]
name = 1:2:1
physical-address* = { shelf-1 slot-2 1 }
enabled = no
sparing-mode = inactive
line-config = { 0 51 15 static { any-shelf any-slot 0 } coe }

admin> list line
[in SHDSL/{ any-shelf any-slot 0 }:line-config]
trunk-group = 0
nailed-group = 1
vp-switching-vpi = 15
```

```
activation = static
call-route-info = { any-shelf any-slot 0 }
unit-type = coe
ntr-enabled = no
clock-source = not-eligible
clock-priority = middle-priority
loop-back = none
margin = 2db
snext-margin = disable
rate-mode = auto
min-rate = 72000
max-rate = 2312000
gshdsl-standard-network-type = north-american-annex-a
annexb-anfp-enabled = no
gshdsl-psd-type = symmetric
master-binding-port = no
```

Parameter	Setting
`name`	Name of the interface. The default value is the interface address in *`shelf:slot:item`* format (for example, `1:2:1`), but you can assign a text string of up to 16 characters.
`physical-address`	Physical address of the interface in the Stinger unit.
`enabled`	Enable or disable the interface. Specify one of the following values: • `no` (the default)—Line is disabled until you activate it in the `hdsl2` profile. • `yes`—Line is enabled.
`trunk-group`	*Not currently used.* Use the default value (zero).
`nailed-group`	Nailed-group number for the SHDSL or HDSL2 physical interface. A Connection or RADIUS profile specifies this number to make use of the interface. Each interface is assigned a unique default number, so you need not modify this parameter. If you assign a new value, it must be a number from 1 through 1024 that is unique within the system.
`VP-switching-VPI`	The virtual path identifier (VPI) to use for virtual path (VP) switching on the LIM port. The default is `15`. All other VPIs are used for virtual circuit (VC) switching.
`activation`	*Not currently used.* Leave the default value (`static`).
`call-route-info`	*Not currently used.* Leave the default value (the zero address).
`unit-type`	Type of unit. Remote equipment must have opposite setting. Specify one of the following values: • `coe` (the default)—The unit is central office equipment (COE). • `cpe`—The unit is customer premises equipment (CPE).

Parameter	Setting
`NTR-enabled`	Enable or disable network time reference (NTR) capability. Specify one of the following values: • `no` (the default)—NTR capability is disabled. • `yes`—NTR capability is enabled. If the `unit-type` parameter is set to `coe`, the system clock is taken as the input and the CPE, if equipped to do so, can recover the clock. If the `unit-type` parameter is set to `cpe`, the port outputs the recovered clock as the system clock if the `clock-source` parameter is set to `eligible` and the `clock-priority` parameter is set to allow the clock to be selected.
`clock-source`	Eligibility of the 8kHz clock from the SHDSL/HDSL2 line to be used as the 8kHz system clock. Specify one of the following values: • `eligible`—The line can be used as the master clock source. (The `unit-type` parameter must be set to `cpe`). • `not-eligible`—The line can not be used as the master clock source.
`clock-priority`	Clock priority assigned to the SHDSL/HDSL2 line. Used to select a particular HDSL2 line as the 8kHz system clock source. Specify one of the following values: • `high-priority`—A line with this priority is selected over lines with lower priorities. If more than one line has the highest priority, the first one to become available is the source. • `middle-priority`—Second-highest clock priority. • `low-priority`—Last clock priority.
`loop-back`	Whether the line passes normal data or is in loopback mode. Specify one of the following values: • `none` (default)—The line is not being used for loopback testing. • `analog`—The line is enabled for analog loopback testing. (You might need to terminate the DSL line with a 150-ohm resistor). • `digital`—The line is enabled for digital loopback testing.

Parameter	Setting
`margin`	Noise margin value (in decibels). This parameter applies only if the `interface-type` parameter is set to `g-shdsl`. Specifying a value that is more than 6 decibels causes modems to train at higher rates, but on noisy loops, also causes them to become unstable and retrain. If this parameter is set to a value that is less than 6 decibels, the modems train at lower rates, but are more stable and are less likely to retrain on noisy loops. Specify one of the following values: • `0db` • `1db` • `2db (the default)` • `3db` • `4db` • `5db` • `6db` • `7db` • `8db` • `9db` • `10db` • `disable`

Parameter	Setting
`snext-margin`	Selects an Snext margin range that allows compensation for self-noise generated by adjacent SHDSL lines in the same bundle. A value other than disable reduces the maximum rate at which the loop trains. Specify one of the following values: • `0db` • `1db` • `2db` • `3db` • `4db` • `5db` • `6db` • `7db` • `8db` • `9db` • `10db` • `-10db` • `-9db` • `-8db` • `-7db` • `-6db` • `-5db` • `-4db` • `-3db` • `-2db` • `-1db` • `disable (the default)`
`rate-mode`	Whether the line rate is fixed or adaptive (also called automatic). This parameter applies only if the `interface-type` parameter is set to `g-shdsl`. Specify one of the following values: • `fixed`—A modem attempts to train only at the rate specified by the `max-rate` parameter. • `auto` (default)—A modem attempts to train at a rate within the range specified by the `min-rate` and `max-rate` parameters.

Parameter	Setting
`min-rate`	Minimum rate in kilobits per second at which a modem trains when the `rate-mode` parameter is set to `auto`. This parameter applies only if the `interface-type` parameter is set to `g-shdsl`. Specify one of the following values: • `72000` (the default) • `136000` • `200000` • `264000` • `328000` • `392000` • `520000` • `776000` • `1032000` • `1160000` • `1288000` • `1544000` • `2056000` • `2312000`
`max-rate`	Maximum rate at which the modem trains when `rate-mode` is set to `auto`. When `rate-mode` is set to `fixed`, the modem attempts to train only to the rate specified by this parameter. You need only configure the central office equipment (COE) for the maximum rate value. The modem uses G.994.1 handshake protocol to communicate the maximum rate value to the customer premises equipment (CPE). This parameter applies only if the `interface-type` parameter is set to `g-shdsl`. • `72000` • `136000` • `200000` • `264000` • `328000` • `392000` • `520000` • `776000` • `1032000` • `1160000` • `1288000` • `1544000` • `2056000` • `2312000` (the default)

Parameter	Setting
`gshdsl-standard-network-type`	The G.991.2 standard network type for the network that is connected to the SHDSL port. This setting specifies the modem output characteristics for either a North American or European network. This parameter applies only if the `interface-type` parameter is set to `g-shdsl`. Specify one of the following values: • `north-american-annex-a`—North American Annex A network • `european-annex-b`—European Annex B network • `auto-detect`—Select network type automatically. This value is valid only if unit-type is CPE.
`annexb-anfp-enabled`	Special test parameter for internal test purposes. Leave at default value of `no`.
`gshdsl-psd-type`	The modem outputs a symmetric power spectral density (PSD), based on the G.shdsl standard G.991.2. Specify one of the following values: • `symmetric`—The modem outputs a symmetric power spectral density for all rates. • `asymmetric-776k-psd`—The modem outputs an asymmetric power spectral density at 776Kbps only. This setting applies only if the `rate-mode` parameter is set to `fixed`, the `max-rate` parameter is set to is `776000`, and the `network-type` parameter is set to `north-american-annex-a`. • `asymmetric-1544k-psd`—The modem outputs an asymmetric power spectral density at 1544Kbps only. This setting applies only if the `rate-mode` parameter is set to `fixed`, the `max-rate` parameter is set to is `1544000`, and the `network-type` parameter is set to `north-american-annex-a`. • `asymmetric-2056k-psd`—The modem outputs an asymmetric power spectral density at 2056Kbps only. This setting applies only if the `rate-mode` parameter is set to `fixed`, the `max-rate` parameter is set to is `2056000`, and the `network-type` parameter is set to `european-annex-b`. • `asymmetric-2312k-psd`—The modem outputs an asymmetric power spectral density at 2312Kbps only. This setting applies only if the `rate-mode` parameter is set to `fixed`, the `max-rate` parameter is set to is `2312000`, and the `network-type` parameter is set to `european-annex-b`. • `automatic`—Select network type automatically. This value is valid only if `unit-type` is CPE
`master-binding-port`	Not used for this LIM.

Sample HDSL2 mode configuration

To configure the SHDSL/HDSL2 32-port line interface module for HDSL2 operation, you must first set the `interface-type` parameter to `hdsl2` as described in "Specifying HDSL2 or SHDSL mode" on page 1-4. Following is an example of a profile for one of the lines of an SHDSL/HDSL2 32-port module that is operating in HDSL2 mode:

```
admin> read hdsl2 { 1 2 1 }
HDSL2/{ shelf-1 slot-2 1 } read
admin> list
[in HDSL2/{ shelf-1 slot-2 1 }]
name = 1:2:1
physical-address* = { shelf-1 slot-2 1 }
enabled = no
sparing-mode = inactive
line-config = { 0 51 15 static { any-shelf any-slot 0 } coe }

admin> list line
[in HDSL2/{ shelf-1 slot-2 1 }:line-config]

nailed-group = 51
vp-switching-vpi = 15
unit-type = coe
ntr-enable = no
clock-source = not-eligible
clock-priority = middle-priority
loop-back = n
```

Sample SHDSL mode configuration

To configure the SHDSL/HDSL2 32-port line interface module for SHDSL operation, you must first set the `interface-type` parameter to `g-shdsl` as described in "Specifying HDSL2 or SHDSL mode" on page 1-4. Following is an example of an `hdsl2` profile configured for an SHDSL/HDSL2 line that operates in SHDSL mode:

```
admin> read hdsl2 { 1 3 1}

HDSL2/{ shelf-1 slot-3 1 } read

admin >list

[in HDSL2/{ shelf-1 slot-3 1 }]

name = 1:3:1
physical-address* = { shelf-1 slot-3 1 }
enabled = yes
sparing-mode = inactive
line-config = { 0 101 15 static { any-shelf any-slot 0 } coe no
not-eligible mi+

admin> list line

[in HDSL2/{ shelf-1 slot-3 1 }:line-config]
nailed-group = 101
vp-switching-vpi = 15
unit-type = coe
ntr-enabled = no
clock-source = not-eligible
```

```
clock-priority = middle-priority
loop-back = none
margin = 6dbrate-mode = auto
min-rate = 72000
max-rate = 2312000
gshdsl-standard-network-type = north-american-annex-a
gshdsl-psd-type = symmetric
```

Displaying SHDSL/HDSL2 port status

To display the port status and nailed group for each SHDSL/HDSL2 port, use the `hdsl2Lines` command. For a description of the command's syntax, enter the command name, as in the following example:

```
admin> hdsl2Lines
usage: Hdsl2Lines -[ a | d | f | u | t ]
-a  show (a)ll HDSL2 lines
-d  show (d)isabled lines
-f  show all (f)ree lines
-u  show in-(u)se lines
-t  toggle debug flag
```

The following example (which is truncated) shows status of the first 16 ports on an SHDSL/HDSL2 LIM in slot 4:

```
admin> hdsl2 -a
All HDSL2 lines:                (dvOp   dvUpSt  dvRq    sAdm   nailg)
  Line    {   1  4  1 }       (Down    Idle   DOWN    DOWN   00151)
  Line    {    1  4  2 }       (Down    Idle    DOWN    DOWN   00152)
  Line    {    1  4  3 }       (Up      Idle    UP      UP     00153)
  Line    {    1  4  4 }       (Down    Idle    DOWN    DOWN   00154)
  Line    {    1  4  5 }       (Down    Idle    DOWN    DOWN   00155)
  Line    {    1  4  6 }       (Down    Idle    DOWN    DOWN   00156)
  Line    {    1  4  7 }       (Up      Idle    UP      UP     00157)
  Line    {    1  4  8 }       (Down    Idle    DOWN    DOWN   00158)
  Line    {    1  4  9 }       (Up      Idle    UP      UP     00159)
  Line    {    1  4 10 }       (Up      Idle    UP      UP     00160)
  Line    {    1  4 11 }       (Down    Idle    DOWN    DOWN   00161)
  Line    {    1  4 12 }       (Down    Idle    DOWN    DOWN   00162)
  Line    {    1  4 13 }       (Up      Idle    UP      UP     00163)
  Line    {    1  4 14 }       (Down    Idle    DOWN    DOWN   00164)
  Line    {    1  4 15 }       (Down    Idle    DOWN    DOWN   00165)
  Line    {   1  4 16 }       (Down    Idle DOWN    DOWN 00166)
```

Configuring call control

By default, a Stinger unit monitors the physical line states of its interfaces and allows connections to be established only when the line state is fully up. Using the call-control procedures, you can configure a Stinger unit to allow connections to be established even when the line state is not fully up. You can configure the unit to use these procedures systemwide or on a per-port basis on the SHDSL/HDSL2 32-port LIM.

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

Following are examples of the call-control parameters, shown with their 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	Setting
In the system profile: `ignore-lineup`	Enable or disable the Stinger system's ability to ignore line status when determining whether calls are established or not. Specify one of the following values: • `no` (the default)—The Stinger call-control mechanism allows calls to be established if the line state is up and disallows calls if the line state is down. • `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.
In a line profile: `ignore-lineup`	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)—The Stinger unit inherits the `Ignore-Lineup` value from the `system` profile. • `no`—The Stinger call-control mechanism ignores the systemwide setting, allows calls to be established if the line state is operational, and disallows calls on the port if the line state is `down`. • `yes`—The Stinger call-control mechanism ignores the line state and the systemwide setting and allows calls to be established on the specified port as long as the specified slot is operational and the specified port is enabled.

The commands in the following example configure the unit to use the 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. For example, the following commands 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
```

Checking the status of an SHDSL/HDSL2 interface

A Stinger unit creates an `hdsl2-stat` profile for each SHDSL/HDSL2 interface in the system. Following is an example for an active line (line 1 in this case) connected to a LIM in slot 6:

```
[in HDSL2-STAT/{ shelf-1 slot-6 1 }]

physical-address* = { shelf-1 slot-6 1 }
line-state = active
spare-physical-address = { any-shelf any-slot 0 }
sparing-state = sparing-none
sparing-change-reason = unknown
sparing-change-time = 0
sparing-change-counter = 0
vpi-vci-range = vpi-0-7-vci-32-255
vp-switching-vpi = 7
physical-status = { 95 coe g-shdsl port-up 2312000 "R110 " 0 }
physical-statistic = { { 0 0 55 } yes 42 2 passed 7 in-sync 0 0 0 0 0 0
}
```

Checking the status of the physical interface

An `hdsl2` profile's `physical-status` subprofile provides information about the physical interface. For example:

```
admin> list physical-status
[in HDSL2-STAT/{ shelf-1 slot-2 10 }:physical-status]
if-group-index = 0
unit-type = cpe
dev-line-state = port-up
operational-rate = 1544000
firmware-ver = A100
```

```
hardware-ver = 1
network-type = annex a
```

Parameter	Indicates
`if-group-index`	SNMP interface group index of the line.
`unit-type`	Operating mode specified by the `unit-type` parameter in the `hdsl2` profile.
`interface-type`	Whether the module is operating in SHDSL mode (`g-shdsl`), HDSL2 mode (`hdsl2`), or if the module is not an SHDSL/HDSL2 LIM (`default`).
`dev-line-state`	Current state of the interface, which can be one of the following: • `port-up`–Connected to CPE and data can be transferred. • `test`–Line is in test mode. • `start-up-handshake`—Startup handshake is occurring. • `start-up-training`—Startup training is occurring. • `start-up-download`–Startup download is occurring. • `idle`—Line is idle. • `down`—Line is not currently operational. • `out-of-service`—Line is out of service. • `unknown`—Line status is unknown. • `analog-loopback`—Line is in analog loopback mode. • `digital-loopback`—Line is in digital loopback mode.
`operational rate`	Data rate for this symmetric interface. The data rate is currently fixed at 1.544Mbps.
`firmware-ver`	Version number of the SHDSL/HDSL2 firmware.
`hardware-ver`	Hardware version of the SHDSL/HDSL2 modem.
`network-type`	Current network type. Possible values are one of the following: • `annex-a` • `annex-b` • `annex-b-anfp`

Obtaining statistics about operations

An `hdsl2-stat` profile's `physical-statistic` subprofile enables administrators to check interface operations, as in the following example :

```
admin> list physical-statistic
[in HDSL2-STAT/{ shelf-1 slot-2 10 }:physical-statistic]
line-up-timer = { 0 0 3 }
rx-signal-present = yes
line-quality = 36
up-dwn-cntr = 3
```

```
self-test = passed
transmit-power = 10
framer-sync-status = in-sync
code-violations = 17
errored-second = 2
severely-errored-second = 1
losw-second = 1
unavailable-second = 0
loop-attenuation = 10
snr = 40
stur-loop-attenuation = 2
stur-snr = 40
```

Parameter	Indicates
`line-up-timer`	How long the line has been up (days, hours, and minutes in {*dd hh mm*} format).
`rx-signal-present`	Whether a receiving signal is present (`yes` or `no`).
`line-quality`	Line quality in decibels. A value of -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.
`transmit-power`	Current transmission power that the transceiver is using, reported in dBm.
`framer-sync-status`	State of the HDSL2 framer. Provides troubleshooting information and can assist in determining loss of signal (LOS). This parameter reports one of the following values: • `in-sync`—Framer is in sync. The HDSL2 framers are successfully transmitting HDSL2 frames. • `out-of-sync`—HDSL2 framer is out of sync and is not trying to gain sync.
`code-violations`	Number of HDSL2 cyclic redundancy check (CRC) anomalies occurring during the accumulation period.
`errored-second`	Number of 1-second intervals during which one or more CRC anomalies are declared and/or one or more loss of synchronous word (LOSW) defects are declared.
`severely-errored-second`	Number of 1-second intervals during which at least 50 CRC anomalies are declared or one or more LOSW defects are declared.
`losw-second`	Number of 1-second intervals during which one or more HDSL2 LOSW defects are declared.

Parameter	Indicates
`unavailable-second`	Number of 1-second intervals for which the HDSL2 line is unavailable. The HDSL2 line becomes unavailable at the onset of 10 contiguous severely errored seconds (SES)-Ls. Once unavailable, the HDSL2 line becomes available at the onset of 10 contiguous seconds with no SES-Ls.
`loop-attenuation`	Current loop attenuation in decibels.
`snr`	Signal-to-noise ratio on the line, in decibels. The signal-to-noise ratio defines a relationship between the noise floor and the signal. For an SHDSL/HDSL2 interface, a reading of 24dB or higher is required for reliable data transfer.
`stur-loop-attenuation`	Indicates the current signal reduction in the loop, in decibels. The `stur-loop-attenuation` parameter value is received by the central office equipment (COE) from the customer premises equipment (CPE), and thus characterizes how the loop attenuation looks from the CPE's perspective.
`stur-snr`	Signal-to-noise ratio on the line (in decibels). For an SHDSL/HDSL2 interface, a reading of 24dB or higher is required for reliable data transfer. The `stur-snr` parameter value is received by reported message from the customer premises equipment (CPE) as a direct request from the central office equipment (COE), and thus is the CPE's `snr` reading.

Internal, external, and bit-error-rate diagnostic tests

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

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

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

```
[in LINE-DIAG/{ shelf-1 slot-2 1 }]

physical-address* = { shelf-1 slot-2 1 }
bert-timer = 1 minute
bert-enable = no
```

```
idt-enable = no
idt-num-of-msg = 1000
```

Parameter	Setting
`bert-timer`	Duration of the bit-error-rate test (BERT). Specify one of the following values: • `1 minute (the default)` • `2 minutes` • `3 minutes` • `4 minutes` • `5 minutes` • `10 minutes` • `15 minutes` • `20 minutes` • `30 minutes`
`bert-enable`	Enable or disable BERT. (Note that a BERT disrupts data transmission.) Specify one of the following values: • `no` (default)—Line is disabled for BERT. • `yes`—Line is enabled for BERT.
`idt-enable`	Whether internal diagnostic testing is enabled on the line. • `no` (default)—Line is disabled for loopback testing. • `yes`—Enables internal diagnostic testing on the line.
`idt-num-of-msg`	Number of messages that the control module sends to the line. Each message corresponds to four ATM cells. The data payload of each message consists of sequential numeric data. By default, the value of this parameter is set to `1000`. Enter a value from 0 to 10000.

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

```
[in LINE-DIAG-STAT/{ shelf-1 slot-2 1 }]

physical-address* = { shelf-1 slot-2 1 }
bert-operation-state = stopped
idt-operation-state = stopped
bert-error-counter = 0
idt-send-count = 0
```

```
idt-recv-count = 0
idt-error-counter = 0
```

Parameter	Setting
`bert-operation-state`	State of the bit-error-rate test (BERT) when it is enabled and the BERT timer has not expired. This parameter reports one of the following states: • `waiting-for-511-sync`—Waiting for remote synchronization before starting the BERT. • `local-loop-active`—The interface is in local analog loopback and is running the test. No remote device is involved. • `active`—BERT is running with remote device. • `stopped`—BERT was disabled. • `loop-back-setup`—The interface is being put into analog loopback. • `start-up`—BERT is starting up.
`bert-error-counter`	Number of bit errors counted by BERT.
`idt-operation-state`	Whether an internal diagnostic test is active on the line. (This parameter is read-only.) • `stopped` (default)—The test is inactive. • `active`—The line is undergoing internal diagnostic testing.
`idt-send-count`	Number of messages sent from the LIM to the control module. (This parameter is read-only.)
`idt-recv-count`	Number of messages received by the control module. (This parameter is read- only.)
`idt-error-counter`	Number of erroneous messages received by the control module. (This parameter is read-only.)

Configuring an internal diagnostic test (IDT)

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

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

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

```
admin> read line-diag-stat {1 2 1}
LINE-DIAG-STAT/{ shelf-1 slot-2 1 } read

admin> list

[in LINE-DIAG-STAT/{ shelf-1 slot-2 1 }]

physical-address* = { shelf-1 slot-2 1 }
bert-operation-state = stopped
idt-operation-state = stopped
bert-error-counter = 0
idt-send-count = 1000
idt-recv-count = 1000
idt-error-counter = 0
```

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

```
admin> set idt-enable = no

admin> write

LOG warning, Shelf 1, Controller-1, Time: 20:12:30--
IDT Test for {1 3 1} is running !
LINE-DIAG/{ shelf-1 slot-3 1 } written
```

Configuring a bit-error-rate test (BERT)

To run a bit-error-rate test (BERT), set the `bert-enable` parameter to `yes`. The test counts bit errors continuously for the interval specified by the `bert-timer` parameter. If both the CPE and COE are connected and have BERT enabled, the test runs between the two systems. If the two ends are not connected, the test runs within the SHDSL/HDSL2 interface in the Stinger unit.

Following is an example of setting up a BERT:

```
[in LINE-DIAG/{ shelf-1 slot-4 1 }]

admin> set bert-timer = 5

admin> set bert-enable = yes

admin> write

LINE-DIAG/{ shelf-1 slot-4 1 } written
```

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

Configuring an external diagnostic test (EDT)

The external diagnostic test (EDT) feature puts the DSL modem into loopback mode. If a complete circuit is established, you can then send a data stream from an external device (such as a network traffic generator) through the trunk to the modem. The modem loops back the data stream to the external device, where it can be analyzed. The `loop-back` parameter is described in “Configuring port settings for SHDSL and HDSL2” on page 1-5.

```
[in HDSL2/{ shelf-1 slot-2 1 }:line-config]
loop-back = none
```

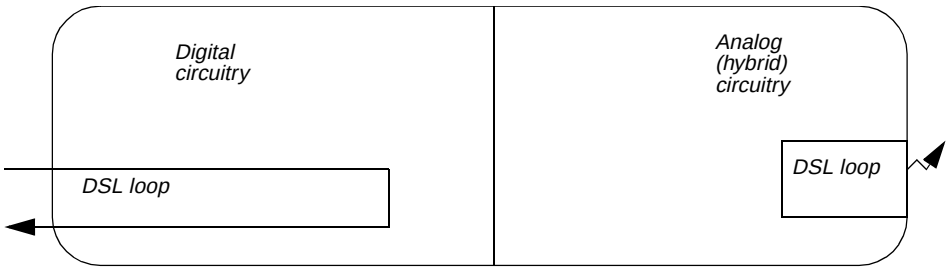
You configure a line for external diagnostic testing by putting it into loopback mode, as shown in the following example:

```
admin> read hdsl2 {1 1 1}
HDSL2/{ shelf-1 slot-1 1 } read
admin> set loop-back = analog
admin> write
```

Digital loopback

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

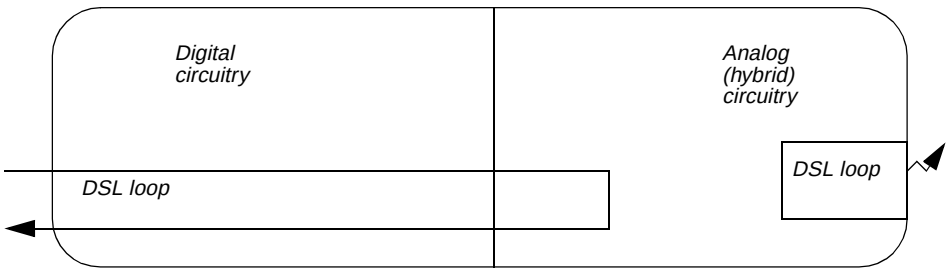
Figure 1-2. Data passes through a modem's digital circuitry (digital loopback)



Analog loopback

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

Figure 1-3. Data passes through a modem's digital circuitry and analog circuitry (analog loopback)



The following example puts a line into analog loopback mode:

```
admin> read hdsl2 {1 1 1}
HDSL2/{ shelf-1 slot-1 1 } read
admin> set loop-back = analog
admin> write
```

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-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:

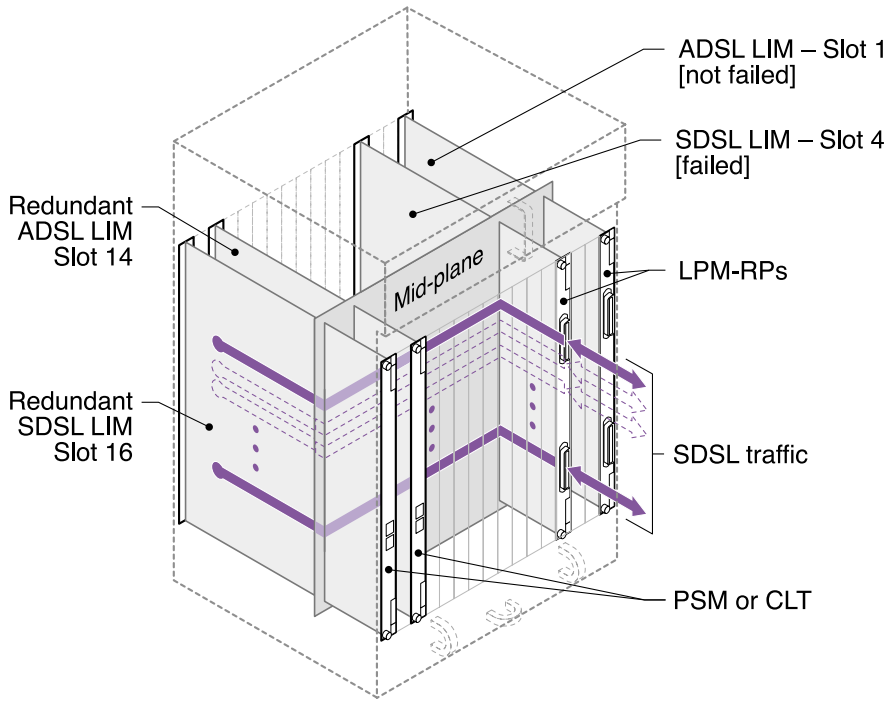
- 6 SDSL LIM–LPM-RP pairs
- 1 SDSL–PSM pair or SDSL–CLT module pair
- 6 ADSL LIM–LPM-RP pairs
- 1 ADSL–PSM pair or ADSL–CLT module pair

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

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

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

Figure 2-1. LIM redundancy on 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	Setting
`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	Setting
`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	Setting
`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 from releases earlier than TAOS 7.11.4, 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.

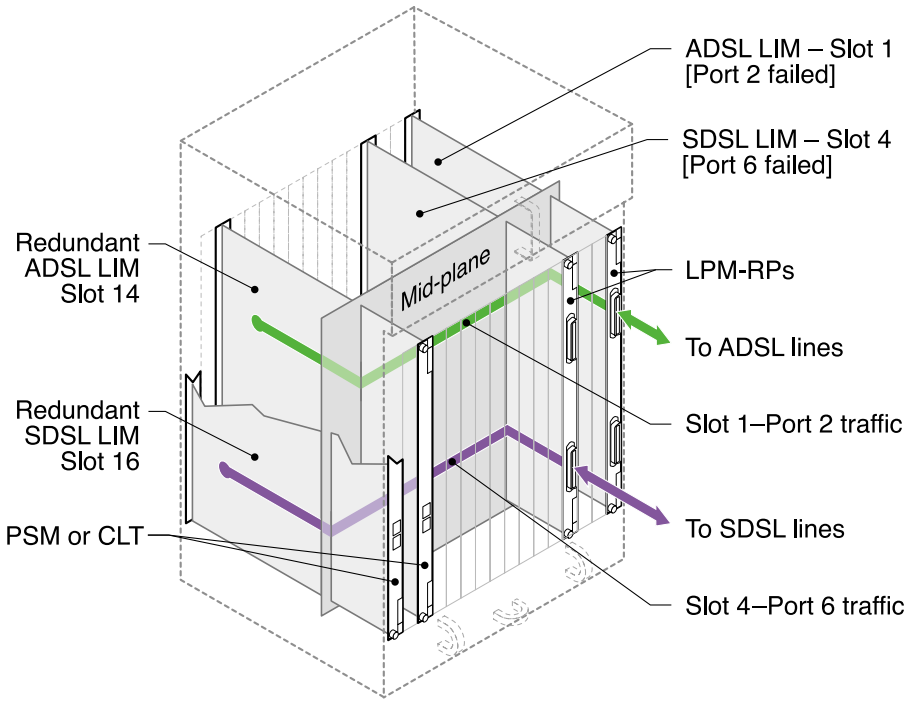
More than one kind of LIM port can be backed up. An additional LIM-PSM pair (or LIM-CLT module pair) of another type installed in a Stinger can be used to back up other LIMs of that type in the system. For example, a spare SDSL LIM in slot 16 can back up any failed port on any other SDSL LIMs in a Stinger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