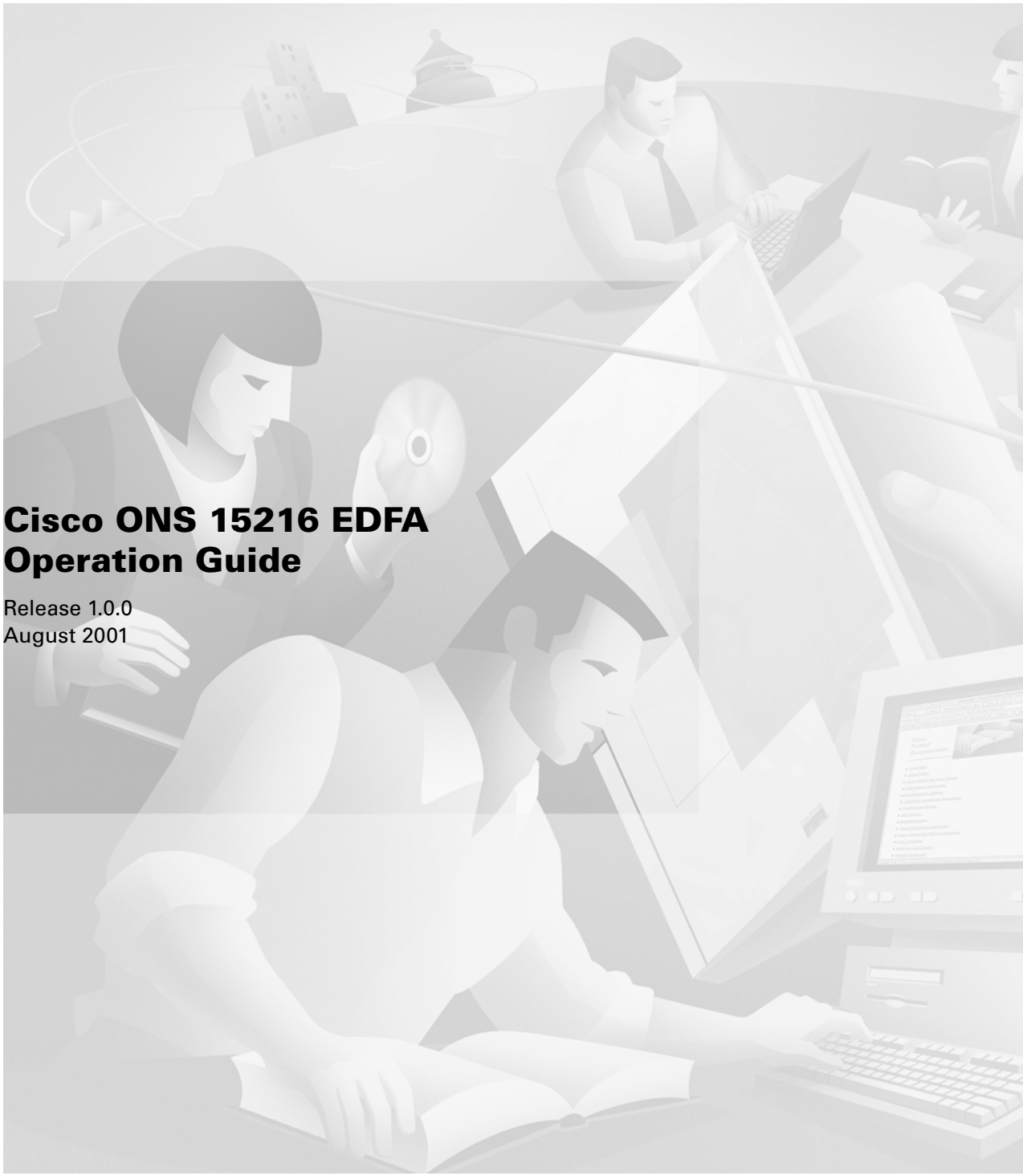

Cisco ONS 15216 EDFA Operation Guide

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Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

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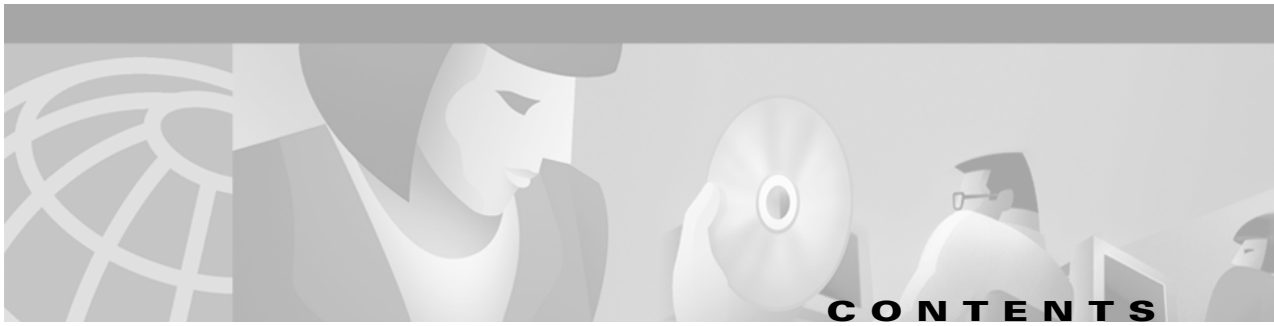
Cisco ONS 15216 OPM Operations Guide



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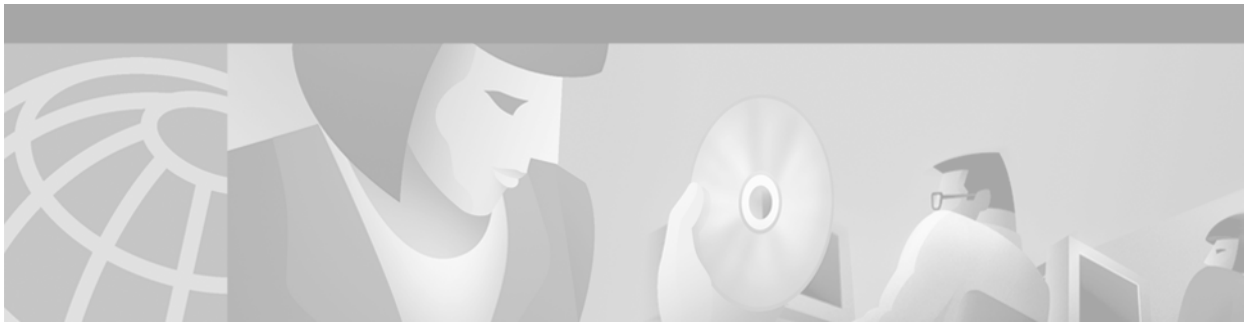

Preface

Obtaining Documentation

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- http://www-china.cisco.com
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- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

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If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

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- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

CHAPTER 1

Applications

The Cisco ONS 15216 EDFA1 provides bandwidth-on-demand to extend DWDM links by hundreds of kilometers. This manual describes how to install and operate the ONS 15216 EDFA1, which is a DWDM-enabling technology for multiservice ring DWDM networks. The ONS 15216 EDFA1 is part of the Cisco ONS 15216 metro regional DWDM product line that includes red and blue terminal filters, a one-channel and two-channel optical add/drop multiplexer (OADM), and an optical performance manager (OPM).

The ONS 15216 EDFA1 is a C-band EDFA that has constant gain control, gain-flatness, transient suppression, and low-noise figure optimized for metro DWDM applications. These features enable the ONS 15216 EDFA1 to add/drop optical signals from a span in a DWDM network without degrading of the other optical signals in the same span.

Bandwidth-On-Demand

The ONS 15216 EDFA1 uses gain-control technology, which is the ability to keep the amplification per wavelength constant at all times as wavelengths are added/dropped from an optical fiber. Every wavelength in an ONS 15216 EDFA1, regardless of number, is guaranteed to be amplified by 23 dB. Any number of wavelengths can be amplified, as long as the total input power of all wavelengths is between -29 dBm and -6 dBm. Unlike previous generations of EDFAs, the ONS 15216 reconfigures itself rapidly to ensure constant gain and gain flatness.

Metro Regional Multi-Service Ring DWDM

Using the Cisco ONS 15216 product family you can build ring-based, multiservice DWDM systems using the Cisco ONS 15454 platform. DWDM systems that incorporate these two product families enable you to scale rings of up to 400 km in circumference. At each of the add/drop sites, a service provider can drop wavelengths to provide a variety of IP/data and TDM services. The Cisco ONS 15216/ONS 15454 solution provides not only a cost-effective method to create the multiservice environment, but also aggregates and grooms that traffic onto efficiently-packed wavelengths which are then carried around the DWDM ring.

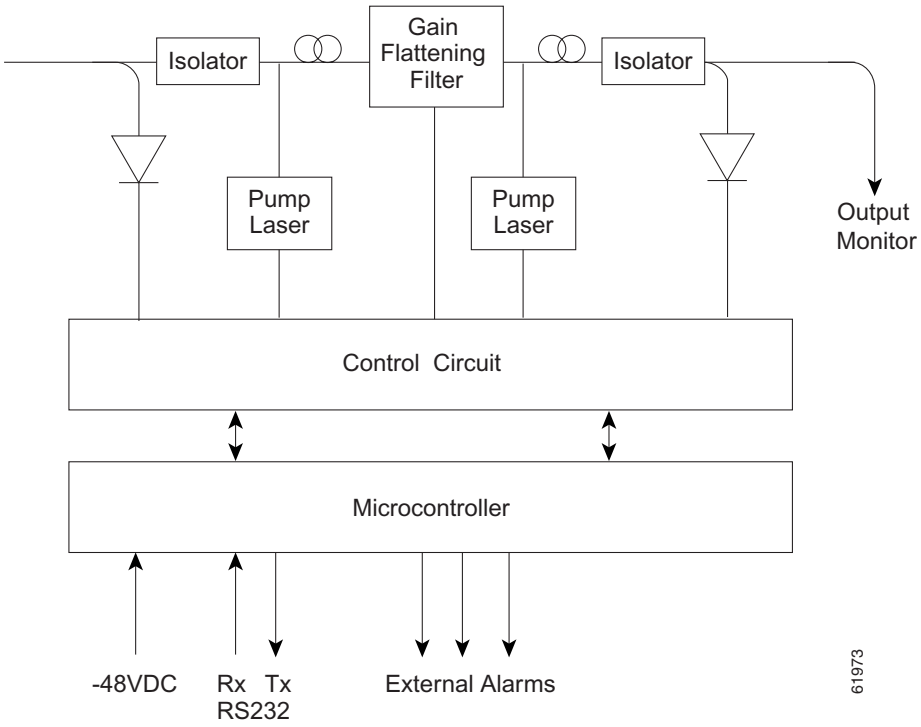
Extending ONS 15454 Reach Distance

The Cisco ONS 15216 EDFA1 can be used in conjunction with the ONS 15454 to increase reach distance if the link loss between nodes in a metro network is greater than 15 dB. The ONS 15216 EDFA1 can be used as a booster amplifier immediately following the transmitter, as an in-line amplifier at an intermediate site, or as a pre amplifier just before the receiver.

ONS 15216 EDFA1 Operation

The ONS 15216 EDFA1 consists of a few meters of coiled erbium-doped fiber pumped by a high-power semiconductor laser operating at 980 nm. Amplification occurs when energy from the pump laser is transferred via the erbium-doped fiber to incoming optical signals in the 1550 nm window. Each optical signal leaves the ONS 15216 EDFA1 two hundred times brighter than when it arrived. Figure 1-1 is a block diagram of the ONS 15216 EDFA1.

Figure 1-1 ONS 15216 EDFA1 Block Diagram



Key Features

The ONS 15216 EDFA1 has the following key features:

- Constant gain of 23 dBm ± 1.25 dBm
- Gain flatness ±1.0 dB (over input range and temperature range)
- Typical transient suppression in less than 200 µs

- Low-noise figure of < 6.0 dB

Constant Gain Mode

Constant amplification per wavelength is important for bandwidth-on-demand wavelength services. As wavelengths are added/dropped from an optical fiber, small variations in gain between channels in a span can cause large variations in the power difference between channels at the receivers. The ONS 15216 EDFA1 enables bandwidth-on-demand services by guaranteeing that every wavelength is amplified by 23 dB, regardless of the number of wavelengths being amplified.

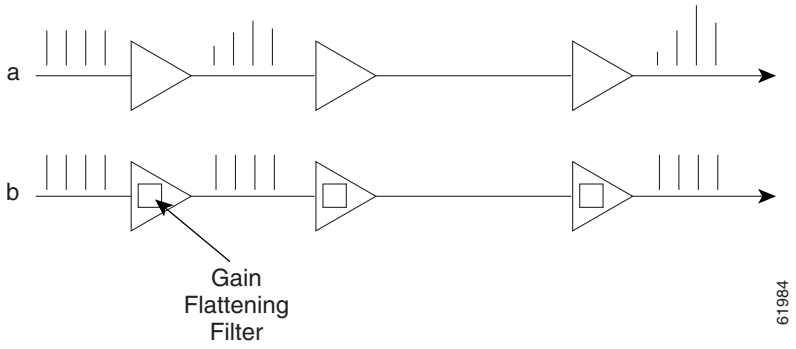
Constant gain mode is achieved using an automatic control circuit that adjusts pump power when changes in input power are detected. The ONS 15216 EDFA1 operates in constant gain mode by default, but because other operating modes can be required, the EDFA can also be set to operate in any one the following modes:

- Constant-pump current mode
- Constant-pump power mode
- Constant-output power mode

Gain Flatness

Figure 1-2 illustrates the importance of the ONS 15216 EDFA1's gain-flattening filter. With the first fiber (a), channels having equal power going into a cascaded network of amplifiers have vastly different powers and optical signal-to-noise ratio (SNR) at the output—without a gain flattening filter. In contrast, with the second fiber (b), the EDFAs reduce this effect by introducing a gain-flattening filter within each amplifier

Figure 1-2 Gain Flattening Filter



Transient Suppression

Transients in the performance of EDFAs are inevitable whenever the number of signals or the relative power of signals change. The amount of time required by an amplifier to recover from a change indicates the suitability of the amplifier for add/drop applications.

Low Noise

Noise increases whenever a gain occurs in an optical system. The predominant source of noise in EDFAs is Amplified Spontaneous Emission (ASE). The ONS 15216 EDFA1 has a low-noise figure of < 6.0 dB.

CHAPTER 2

Technical Specifications

This chapter discusses the technical specifications of the ONS 15216 EDFA1.

See Chapter 3, "Installation" to set up and install the ONS 15216 EDFA1. See Chapter 4, "Provisioning and Monitoring" for information about a local serial port or remote connection.

ONS 15216 EDFA1 Optical Specifications

Table 2-1 lists the ONS 15216 optical specifications.

Table 2-1 ONS 15216 Optical Specifications

Requirement	Specifications
Input Signal Wavelength in a vacuum	1530 nm to 1563 nm
Input Power (channel total)	-29 dBm to -6 dBm (total all channels) See the "Maximum Input Power" section on page 2-2 and the "Upgrading to a Larger Number of Wavelengths" section on page 2-2 for additional information.
Mode of Operation	Unidirectional (two common fibers: one for transmit and one for receive)
Maximum Output Power	17 dBm
Signal Gain per channel	23 dB (+/- 1.25 dB)
Gain Flatness	< 2 dB (Peak to Valley)
Noise Figure	< 6.0 dB
Pump Wavelength	980 nm
Polarization Mode Dispersion (PMD)	< 0.6 ps
Input/Output Optical Return Loss	> 27 dB

Table 2-1 ONS 15216 Optical Specifications (continued)

Requirement	Specifications
Backward amplified spontaneous emission (ASE) power	< -20 dBm
Polarization Sensitivity	<0.5 dB
Automatic Gain Control (AGC)	The ONS 15216 EDFA1 contains active-gain block with automatic-gain control loop to minimize the effects of output power variations per wavelength when adding/deleting wavelengths on the same DWDM ring.

Maximum Input Power

Caution In the constant-gain mode of operation, the ONS 15216 amplifier is designed to operate up to a maximum input power of -6 dBm. Optical specifications cannot be maintained with an input power greater than -6 dBm. Operating at higher powers causes the pumps to be overdriven. Prolonged periods of operation in this condition can shorten the life time of the ONS 15216 EDFA1.

In this mode, optical attenuators are required to bring total input power to less than -6 dBm.

Upgrading to a Larger Number of Wavelengths

You can ensure a smooth upgrade path from a single channel to the maximum number of channels with a minimum disruption of service if the per-channel power of the single channel is properly set from the start. Set the per-channel power so that at full channel loading the total input power is less than –6 dBm (0.25 mW).

For example, if the maximum number of channels at full loading is 18, then you can calculate the power per channel by dividing .25 mW by 18, which equals .0138 mW. This number (.0138 mW) in logarithmic scale is -18.6 dBm.

Use Table 2-2 to calculate per-channel power as a function of the maximum total number of channels at full loading.

Table 2-2 Maximum Power Per Channel

Full Loading-Number of Channels	Maximum per Channel Power (mW)	Maximum per Channel Power (dBm)
1	0.2500	-6.0
2	0.1250	-9.0
3	0.0833	-10.8
4	0.0625	-12.0
5	0.0500	-13.0

Table 2-2 Maximum Power Per Channel (continued)

Full Loading- Number of Channels	Maximum per Channel Power (mW)	Maximum per Channel Power (dBm)
6	0.0416	-13.8
7	0.0357	-14.5
8	0.0312	-15.1
9	0.0277	-15.6
10	0.0250	-16.0
11	0.0227	-16.4
12	0.0208	-16.8
13	0.0192	-17.2
14	0.0178	-17.5
15	0.0166	-17.8
16	0.0156	-18.1
17	0.0147	-18.3
18	0.0138	-18.6
19	0.0131	-18.8
20	0.0125	-19.0
21	0.0119	-19.3
22	0.0113	-19.5
23	0.0108	-19.7
24	0.0104	-19.8
25	0.0100	-20.0
26	0.0096	-20.2
27	0.0092	-20.4
28	0.0089	-20.5
29	0.0086	-20.7
30	0.0083	-20.8
31	0.0080	-21.0
32	0.0078	-21.1
33	0.0075	-21.2
34	0.0073	-21.4
35	0.0071	-21.5
36	0.0069	-21.6
37	0.0067	-21.7
38	0.0065	-21.8
39	0.0064	-22.0
40	0.0062	-22.1

Contact Cisco's Technical Assistance Center (TAC) with any questions or concerns regarding maximum input power or setting the upgrade path.

ONS 15216 EDFA1 Electrical Specifications

The ONS 15216 EDFA1 uses a power supply that meets the electrical specifications listed in Table 2-3.

Table 2-3 ONS 15216 Electrical Specifications

Requirement	Specifications
Input Voltage	-48 VDC
Maximum Power Consumption	< 25 W @ 65°c End of LIfe
Minimum Supply Voltage	-30 VDC
Maximum Supply Voltage	-62 VDC
Maximum Current	0.52 Amps

ONS 15216 EDFA1 Mechanical Specifications

Table 2-4 lists the mechanical specifications for the ONS 15216 EDFA1.

Table 2-4 ONS 15216 EDFA1 Mechanical Specifications

Specification	Description
Dimensions (H x W x D)	1.75" (Height) x 17 3/16" (Width) x 12" (Depth)
Weight	5.45 lbs.
Ambient Operating Temperature	0 to 65° C
Storage Temperature	-40 to 70° C
Humidity Operation	Relative humidities of 5% to 95%, non-condensing. With ambient temperatures above 29 degrees Celsius, the relative humidity may be limited to a specific humidity of 0.024 pounds of water per pound of dry air.
Humidity Storage	Relative humidities of 5% to 95%, non-condensing. With ambient temperatures above 29 degrees Celsius, the relative humidity may be limited to a specific humidity of 0.024 pounds of water per pound of dry air.
Connector Types	SC/UPC bulkhead connectors

ONS 15216 EDFA1 External Features

The ONS 15216 EDFA1 has the following external features:

- Front panel LEDs, graphics, and warning displays
- Brackets for rack mounting (including reversible ears that permit front, mid, and rear mounting)
- Rear and side cooling vents
- Access door for fiber cleaning
- Fiber routing and retaining feature
- Two threaded grounding studs on rear and two threaded grounding holes on front
- Terminal block for power connection
- RJ-45 connector for external alarm connection
- SC/UPC connectors for optical interface
- DB-9 female connector for craft serial interface connection

Figure 2-1 shows a mechanical outline of the external features and dimensions of the ONS 15216 EDFA1.

Figure 2-1 ONS 15216 EDFA1 Side View

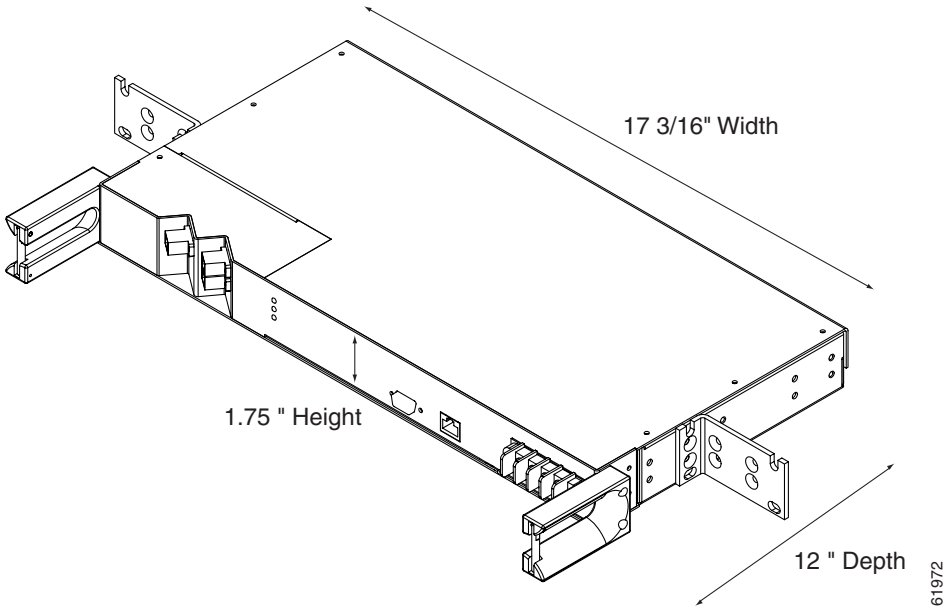
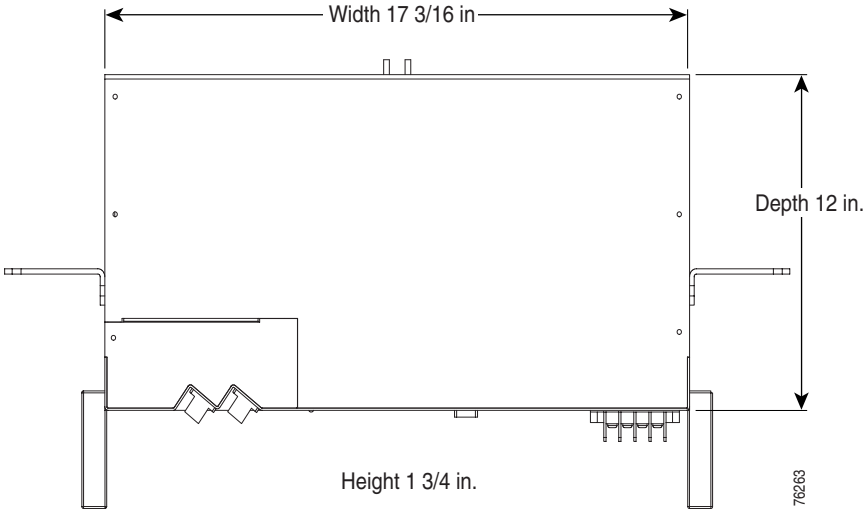


Figure 2-2 shows the ONS 15216 EDFA1 top view.

Figure 2-2 ONS 15216 EDFA1 Top View



ONS 15216 Front Panel

Figure 2-3 displays the ONS 15216 EDFA1 front panel in detail. The front panel provides an all-front access (fibers, power, alarm contact, and management interface) that complies with international standards. Refer to Table 2-5 on page 2-7 for information about the front panel features.

Figure 2-3 ONS 15216 EDFA1 Front Panel

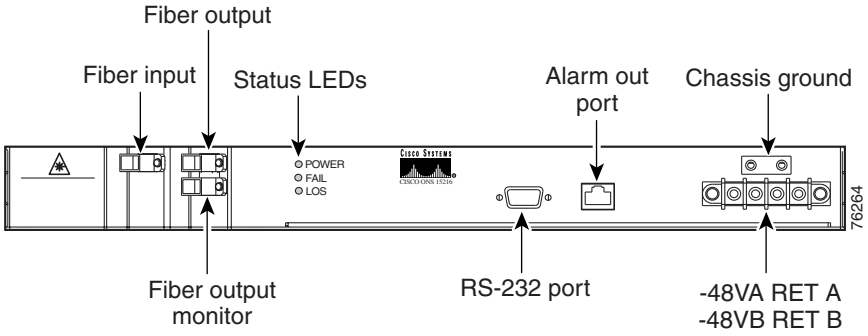


Table 2-5 describes the ONS 15216 EDFA1 front panel features.

Table 2-5 ONS 15216 Front Panel Features

Feature	Description
Terminal Strip	Terminal strip for supply power to ONS 15216 EDFA1: attach AWG 14 stranded power wires to appropriate terminals
Grounding Threaded Holes	Grounding threaded holes to ground ONS 15216 EDFA1 (#8/32).
Alarm Out	RJ-45 connector used for alarm system connection (see the "Alarm Contact Closures" section on page 4-8 for additional information)
RS-232 Serial Port Connection	Serial Port for local or remote (modem) data communication connection (see Chapter 4, "Provisioning and Monitoring" for additional information)
Label	Laser warning and designation labels.
Status LEDs	LEDS indicating status of power, fail, loss of signal (see ONS 15216 LED Alarm Definitions section below)
Fiber Input	SC/UPC fiber input port
Fiber Output	SC/UPC fiber output port
Monitor Output	SC/UPC port for fiber that taps off 1% of output signal for monitoring purposes.
Chassis Ground Lugs	Rear panel grounding post to attach chassis ground wire using #8/32 nut

ONS 15216 LED Alarm Definitions

The ONS 15216 EDFA1 front panel has three LEDs:

- POWER LED

  The green POWER LED will turn on and off to reflect the following conditions:

  – ON: when an internal power supply is within tolerance (the ONS 15216 EDFA1 is powered normally)

  – OFF: when an internal power supply is not present or is out of tolerance

  In the OFF condition, the first pair of alarm relay contacts in the RJ-45 connector will change from a normally open condition to a closed condition. The LED and alarm will automatically reset when the condition clears (see the "Alarm Contact Closures" section on page 4-8 for additional alarm contact closure information).

- FAIL LED

  The red FAIL LED will turn on and off to reflect the following conditions:

  – ON: when either the pump laser bias or pump laser temperature is out of tolerance. This indicator illuminates when a major internal failure occurs, for example, an overtemperature condition or a failure in the pump laser

  - OFF: when either the pump laser bias or the pump laser temperature is in the specified range or no +5 VDC is present

  In the ON condition, the second pair of alarm relay contacts in the RJ-45 connector will change from normally open to closed. The LED and alarm will automatically reset when the condition clears (see the "Alarm Contact Closures" section on page 4-8 for additional alarm contact closure information).

- LOS LED

  The yellow LED will turn on and off to reflect the following conditions:

  - ON: when optical-input power to the ONS 15216 EDFA1 is below the loss-of-input threshold (a LOS threshold decision occurs)
  - OFF: when optical-input power is within the input threshold

In the ON condition, the third pair of alarm relay contacts in the RJ-45 connector changes from a normally-open condition to a closed condition. The LED and alarm automatically reset when the condition clears (see the "Alarm Contact Closures" section on page 4-8 for additional alarm contact closure information).

CHAPTER 3

Installation

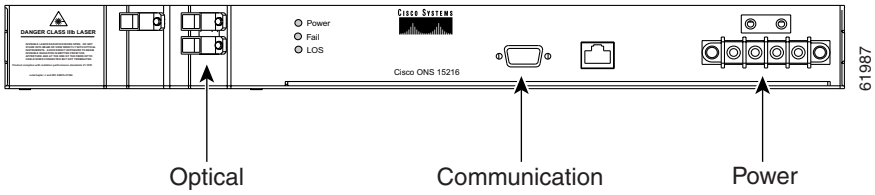
This chapter discusses the ONS 15216 EDFA1 installation procedure, which includes power installation, optical cabling, alarm contacts, and installation commands.

The ONS 15216 EDFA1 is logically divided into the following three sections:

- Power section (-48V A, RET A, -48V A, RET B, and chassis ground)
- Optical section (fiber input and output ports)
- Communication section (RS-232 and Alarm Out)

Each section (Figure 3-1) has an installation procedure in this chapter.

Figure 3-1 Logical Division of the ONS 15216 EDFA1



Power Installation

Warning **Basic electrical precautions should be taken before powering up the EDFA.**

Caution Standard fiber handling and cleaning procedures should be followed. Fiber optic handling and cleaning procedures are critical when installing optical networking equipment.

Warning **Eye safety precautions should be observed when handling fiber optic patch cords.**

Procedure: Install the ONS 15216 in a Rack

Step 1 Mount the ONS 15216 EDFA1 in the rack (19" and 23" reversible ears). Empty rack space is not required above or below the EDFA.

Step 2 Connect the –48VDC cable to the office fuse panel. Note that 1.0A fusing is required and that 18AWG stranded wire or larger must be used. Connect wire lugs as appropriate to ends of wire (not provided).

Step 3 Connect power buss A from the fuse panel to the ONS 15216 EDFA1 power terminals.

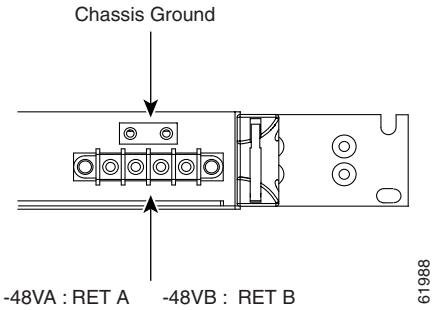
Step 4 Repeat steps 2 and 3 for power buss B.

Step 5 Connect the facility ground to the ONS 15216 EDFA1 front panel ground using #8/32 star washer and 3/4" screws (not provided).

Step 6 Insert the fuses into the fuse panel.

LEDs should now be illuminated on the ONS 15216 EDFA1.

Figure 3-2 Power Connections



Optical Connections

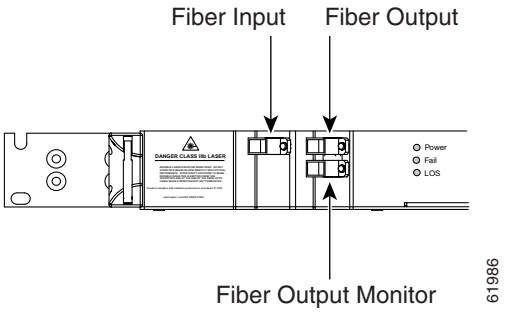
Procedure: Connect the customer-supplied fiber patch cords to the SC/UPC optical ports

Step 1 Connect the fiber carrying the optical-input signal to be amplified (INPUT) to the fiber input port of the ONS 15216 EDFA1 (not provided).

Step 2 Connect the fiber carrying the optically-amplified output (OUTPUT) to the fiber output port of the ONS 15216 EDFA1 (not provided).

Step 3 If applicable, connect the fiber carrying the optical monitored output signal (MON OUT) to the fiber output monitor port (for 1% tap of output

Figure 3-3 ONS 15216 EDFA1 Optical Connections



Communication Connections

The ONS 15216 EDFA1 communicates in two ways: alarm contacts (RJ-45) and the serial interface (RS-232).

See the "Local Serial Communication Setup" section on page 4-1 for detailed information about the RS-232 serial interface.

Procedure: Set Up Alarm Contacts

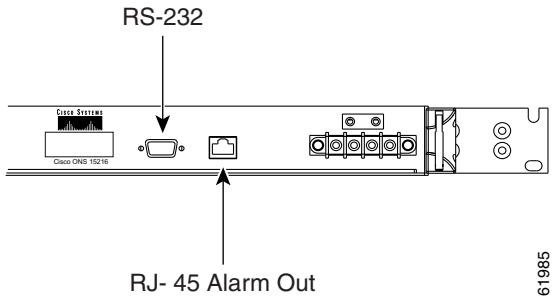
Step 1 Obtain an 8-conductor, 22 AWG solid-wire cable and terminate one end with an RJ-45 connector.

Step 2 Connect the stub end of the alarm cable to the alarm system contacts, either as miscellaneous discrete inputs on terminal equipment or to a central office alarm panel.

Step 3 Connect the RJ-45 end to the ONS 15216 EDFA1.

See the "Alarm Contact Closures" section on page 4-8 and the "ONS 15216 LED Alarm Definitions" section on page 2-7 for further information.

Figure 3-4 ONS 15216 EDFA1 Alarm LEDs



Installation Commands

You can connect to an ONS 15216 locally using a serial connection or remotely using a modem.

See the "Local Serial Communication Setup" section on page 4-1 and the "Remote Communication Component Requirements" section on page 4-5 for information.

After you establish connection, use the following commands to complete the hardware installation. See Chapter 5, "Command Line Reference" for detailed information about each of these commands. Table 5-17 on page 5-26 summarizes all of the ONS 15216 EDFA1 commands.

Installation-Introductory Commands

You can use the following commands to first establish communication with the ONS 15216 EDFA1 and gain access to additional information about the amplifier.

- **@00**– Use this command to log in and establish a connection to the EDFA1. The default address for the EDFA is "00".
- **HELP**– Use this command to review all of the available commands.
- **PASS**– This command enables you to use password-protected commands. All commands which affect system operation or alarm-threshold parameters are password protected. Prior to using any password-protected commands, you must first enter the PASS command with the correct password. The factory-set password is "CISCO". See the "PASS" section on page 5-17 for information about changing the password.
- **VER**– This command accesses information about the ONS 15216 EDFA1 software and hardware. After entering this command, record the identification and inventory information.

Installation-Review and Operational Commands

You can use the following commands to review the overall status of the EDFA and to make basic configuration changes.

- **STAT**– Review the operational status of the EDFA
- **SETADDR**– Changes the numerical address of the 15216 EDFA1; use this command to change the default address, "00"
- **ALMENBL**– Enables alarm checking for a specified alarm
- **ALMDSBL**– Disables an alarm
- **ALARM C–** Clears alarm count
- **SET_LOSTH–** Set, enable, disable, or display the loss-of-input signal threshold; the factory default is set to -30 dBm
- **SET**– Set operational modes of the ONS 15216 EDFA1; for example,
  - SETGT command- sets EDFA to constant gain mode temperature compensated (the factory default)
  - SETI command- sets the specified pump laser to constant current mode
  - SETOUT command- sets EDFA to constant output power mode
  - SETP command- sets specified pump laser to constant output power

- **CONFIG S**- Saves configuration changes in active memory; you must save configuration changes or they will be lost by a power reset, inactivity, or the LOGOUT command
- **LOGOUT-** Terminates the active session

CHAPTER 4

Provisioning and Monitoring

Each ONS 15216 EDFA1 is equipped with a microcontroller that allows you to provision and monitor several operating parameters. The microcontroller generates an alarm in event of failure. For example, if the performance of one of several operating parameters is out of range, an alarm is generated. Alarms are recorded and stored in the microcontroller's memory and can be retrieved for review.

You provision and monitor the ONS 15216 EDFA1 using an RS-232 serial port located in the front panel. You can connect locally or remotely using a modem. A DB-9 female pinout is required to connect to the serial port.

This chapter describes how to set up communications with an ONS 15216 EDFA1 using the following methods:

- Local serial interface
- Remotely (using a modem)
- Alarm contact closures

Local Serial Communication Setup

To establish a serial communications link with an ONS 15216 EDFA1 you need the equipment listed in Table 4-1. To set up an RS-232 serial connection, follow the steps in Table 4-2.

Table 4-1 Equipment Checklist

Hardware	Comments
Laptop, or VT100, running HyperTerminal	User supplied; HyperTerminal can be found in the Microsoft Windows Accessories menu
RS-232 cable with DB-9F connectors wired per EDFA pinout specification	Provides RS-232 link to ONS 15216 EDFA1

Table 4-2 RS-232 Configuration

Step	Description
1	Connect the DB9(R) end of the RS-232 data cable to the COM port on your laptop.
2	Connect the other end of the RS-232 data cable to the RS-232 serial port connection on the 15216 EDFA1 front access panel (Figure 2-3).

Table 4-2 RS-232 Configuration (continued)

Step	Description
3	Open HyperTerminal.
4	Type `Optical Amplifier`, select an icon, and click **OK**. In the **Connect To** dialog box (Figure 4-1), Direct to Com1 must be selected in the **Connect using** field. Click **OK** when done.
5	Configure the Port Settings in the **COM1 Properties** dialog box as shown in Figure 4-2.
6	From the HyperTerminal menu bar, select File>Properties to display the Properties dialog box. Click the **Connect to** tab (Figure 4-3). Make sure that Direct to Com1 is selected in the **Connect using** field.
7	Click the **Settings** tab shown in Figure 4-4 and click the **ASCII Setup** button. Configure the ASCII Setup window as shown in Figure 4-5.
8	Click **OK** to return to the HyperTerminal main screen.
9	Set the address using the !xx syntax, where xx can be any value from 00 to 99. At the prompt, login using the @xx syntax, where xx can be any value from 00 to 99.
10	Click **Enter** once.

Figure 4-1 HyperTerminal Connect To Dialog Box

Figure 4-2 HyperTerminal COM1 Dialog Box

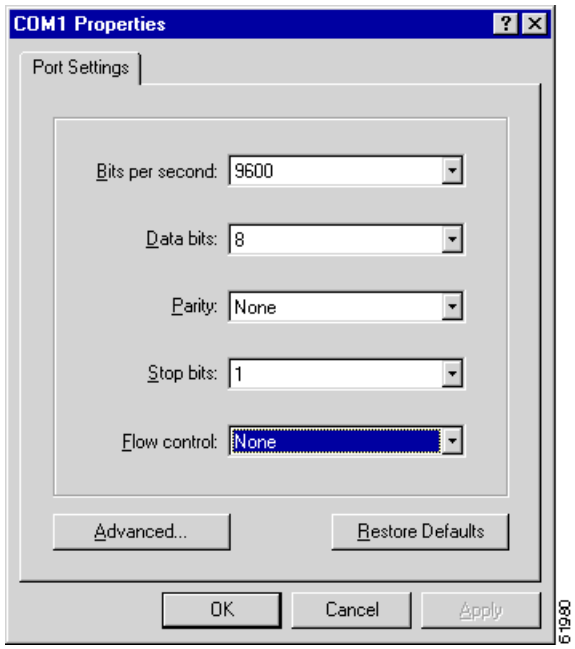


Figure 4-3 HyperTeminal Connect To Tab

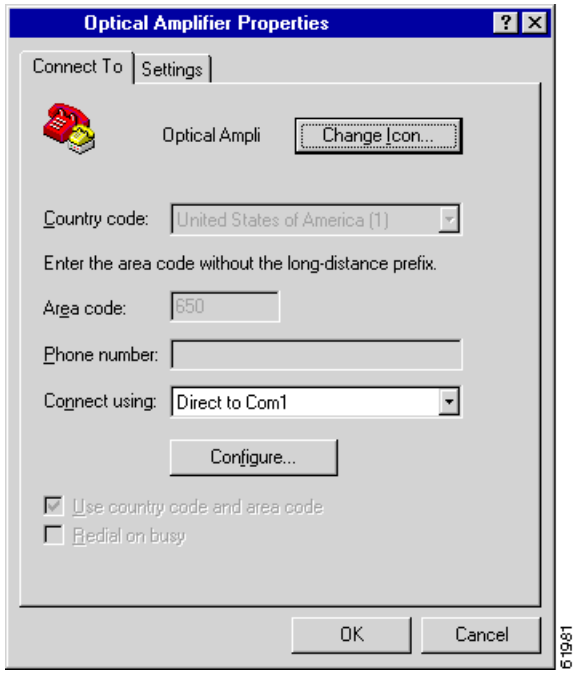


Figure 4-4 Hyperterminal Settings Tab

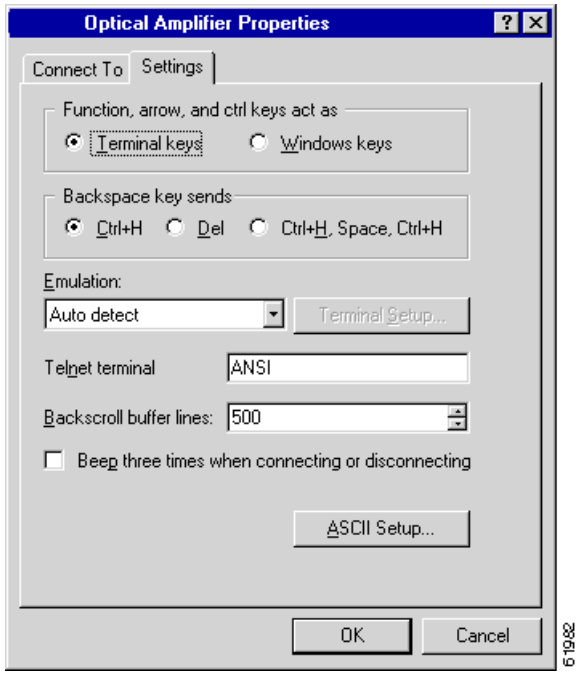
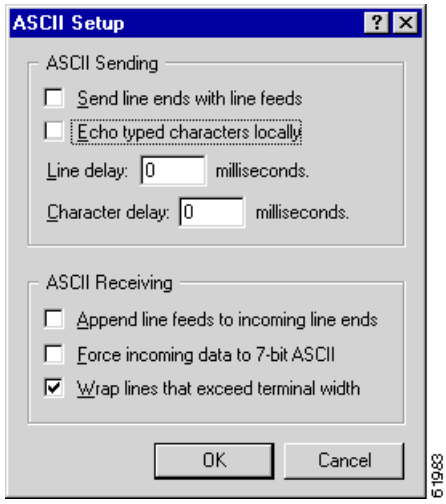
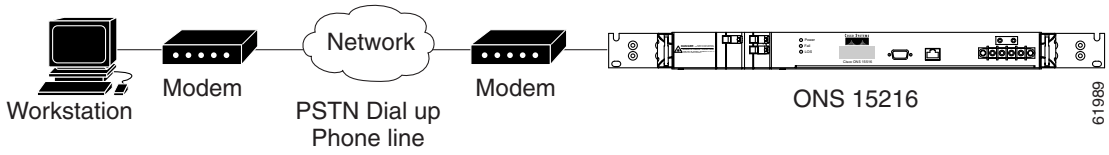


Figure 4-5 HyperTerminal ASCII Setup Dialog Box



Note This section assumes you are using the US Robotics 56K Fax modem V.90 modem. Other modem types may require different settings to establish a remote dial-up connection. Review your modem documentation to ensure compatibility between US Robotics and other vendor modem types.

Figure 4-6 Remote Communication



Remote Communication Component Requirements

Table 4-3 lists the components required to communicate remotely with an ONS 15216 EDFA1. Table 4-3 is divided into two sections: first the Remote Site and then the Local Site. The Remote Site section lists components needed at the site that contains the ONS 15216 EDFA1 and the Local Site section lists components needed at the user site.

Table 4-3 ONS 15216EDFA1 Communication Components

Component	Notes
Remote Site	Site where the ONS 15216 EDFA1 is located (other than the local site).
1 ONS 15216 EDFA1	
1 US Robotics 56K Fax modem V.90	The modem-to-ONS 15216 EDFA1 connection must be set for 9600 N-8-1. The modem-to-modem connection must be set for 14400
1 DB25-M to DB9-F cable-10	For connection between ONS 15216 EDFA1 and modem
1 RJ-11 to RJ-11 telephone cable	For connection between the modem and PSTN dial-up telephone line
1 PSTN dial-up telephone line	
User Site (local)	Site where user, PC, and terminal program is located
1 PC running HyperTerminal	
US Robotics 56K Fax modem V.90	The modem-to-PC connection must be set for 9600 N-8-1; the modem-to-modem connection must be set for 14400.
1 DB-25M to DB-9F cable-10	For connection between PC COM port and modem
1 RJ-11 to RJ-11 telephone cable	For connection between the modem and PSTN dial-up telephone line
1 PSTN dial-up telephone line	

Modem Signals

The only signals required for communication are TXD (transmit), RXD (receive), and SIGNAL GROUND. By adjusting the modem manufacturers' settings, the other signals can be ignored.

Modem Power Up

The modem has a dip switch that will override certain NVRAM settings during a power up. For consistent operation throughout the power cycles, you must set the dip switches as follows.

Table 4-4 Dip Switch Settings

Dip Switch Setting	Up (U) or Down (D)	Description
1	D	Data terminal ready override
2	U	Verbal result codes
3	U	Suppress result codes
4	D	No echo, offline commands
5	U	Auto answer on first ring, or higher if specified in NVRAM
6	U	Carrier detect normal
7	U	Load NVRAM defaults
8	D	Smart mode

Configuration Settings

After configuring the dip switch settings, you must set up each modem configuration using a terminal program such as Microsoft Windows HyperTerminal.

Using the manufacturer's recommendations, connect the modem to the serial port on your PC using a DB9-25 modem cable.

Set the terminal communication parameters as follows:

- 9600 baud
- No parity
- 8 bits per character
- 1 stop bit, and no flow control

Table 4-5 gives a brief description of the modem settings that can be stored in NVRAM. These settings will survive power supply interruptions. Use these settings to configure each modem.

Table 4-5 Modem Settings

Modem Setting	Description
b0	ITU-T answer sequence
e0	Echo off
f1	Local echo off
m1	Speaker on until CONNECT
q1	Quiet mode; no results code
v1	Verbal codes
x1	Select result codes displayed

Table 4-5 Modem Settings (continued)

Modem Setting	Description
y0	Use profile 0 setting in NVRAM
&a3	Enable extra result codes
&b1	Fixed DTE speed
&c1	Normal CD operation
&d0	DTR override
&g0	No guard tone, U.S. and Canada
&h0	Flow control disabled
&i0	Software flow control disabled
&k0	Data compression disabled
&m5	ARQ mode
&n8	Fix highest connect speed to 14,400 bps
&p1	Pulse dialing option
&r1	Ignore RTS
&s1	Modem controls DSR
&t5	Prohibits remote digital loopback
&u8	Fix lowest connect speed to 14,400 bps
&y1	Break handling; destructive/expeditec
&w0	Store configuration 0
s0=1	Auto answer on first ring
s2=128	Disable escape to command mode

Setting and Saving Modem Settings

To set and save modem settings, enter the following command to the terminal program and to each modem:

```
atb0e0f1m1q1v1x1y0
at&a3&b1&c1&d0&g0&h0&i0&k0s0=1
at&m5&n8&p1&r1&s1&t5&u8&y1s2=128
at&w0
```

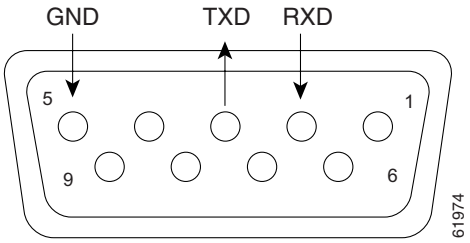
Connecting to the ONS 15216 EDFA1

At this point, the modems, PC, and ONS 15216 EDFA1 should be physically setup as displayed in Figure 4-6 on page 4-5.

The ONS 15216 EDFA1 and modem are connected through an RS-232 port using a DB-9 connector. Use Figure 4-7 to properly connect the ONS 15216 EDFA1 to the modem. Normally, a craftsperson connects only pins 2, 3, and 5.

Note Pins 1,4, and 6 are internally connected to each other and are not connected to any other component of the ONS 15216 EDFA1. Pins 7 and 8 are internally connected to each other and are not connected to any other components of the ONS 15216 EDFA1. These pins can also be used to simplify future cabling requirements.

Figure 4-7 DB-9 pinouts



Using the terminal program from the PC, enter the ATDT command with the appropriate telephone number to call the remote ONS 15216 EDFA1 modem. After the modems synchronize, log into the ONS 15216 EDFA1 using the @ command. See Chapter 5, "Command Line Reference," for additional information about commands.

Alarm Contact Closures

The ONS 15216 EDFA1 provides a front panel single Form C discrete external alarm output. The external alarm output is through the eight wires of an RJ-45 connector.

The following events are reported by the discrete external alarms through individual alarm contacts:

- Loss of power supply–Alarm 0
- Pump laser overheating (temperature) or out of bias threshold condition (temperature)–Alarm 1
- Loss of optical input signal–Alarm 2

Note The default state of the alarm contacts are Normally Open. Depending on which fault condition occurs, specific alarm contacts will close and cause the corresponding ONS 15216 EDFA1 LEDs to light (see the "ONS 15216 LED Alarm Definitions" section on page 2-7 for additional information).

Table 4-6 lists the RJ-45 pinout for the alarms.

Table 4-6 RJ-45 Pinout

Pinout	Alarm
1	Alarm 0+ (Power)
2	Alarm 0-
3	Alarm 1 +(Major)
4	Alarm 1 -
5	Alarm 2 +(Minor)
6	Alarm 2 -

Table 4-6 RJ-45 Pinout (continued)

Pinout	Alarm
7	Alarm 3 + (No Connection)
8	Alarm 3

CHAPTER 5

Command Line Reference

This chapter describes the ONS 15216 EDFA1 software command set and includes information about each command's syntax, function, and password protection status.

Note To obtain the syntax for any command, enter the command followed by a space and the question mark character (?). To obtain a complete list of all commands, type the **HELP** command.

ONS 15216 EDFA1 Operation

There are two types of ONS 15216 EDFA1 operations: special and normal.

Special ONS 15216 EDFA1 operations are described in Table 5-1.

Commands for operating the ONS 15216 EDFA1 under normal conditions are discussed in detail beginning in the "User Commands" section on page 5-3. Under normal operation, the unit behaves according to the specifications outlined in Chapter 1, "Applications."

Table 5-1 Special Operations

Special Operation	Duration	Alarm Impact	Control Loop Impact
Download	2 minutes	All alarm checking, except loss of input power, is stopped. If the loss of signal alarm is set, it cannot be cleared until after the download. Alarm states are retained.	None
Cutover	12 seconds	All alarm checking, except loss of input power, is stopped. If the loss of signal alarm is set, it cannot be cleared until after the download. Alarm states are retained.	Loop control suspended while software restarts.

Table 5-1 Special Operations

Special Operation	Duration	Alarm Impact	Control Loop Impact
Software Reset	12 seconds	All alarm checking, except loss of input power, is stopped. Alarm states are retained.	Loop control suspended while software restarts.
Power Reset	12 seconds	Alarms set to voltage LOW (VLO) within 1 second after power is applied and 5V supply stable.	Loop control not yet initialized.

Note With the exception of a power reset, Special Operations commands will not interrupt service.

User Commands

Each command in this chapter is described in the following format:

Command:	Command Name
Syntax:	Help information associated with a given command is displayed by issuing **COMMAND ?**
Password:	Password protection status
Configuration:	Command affects configuration data; the data must be saved using the **CONFIG** command to retain it through a reset, power down, or cutover operation
Brief Description:	Simple description of command
Explanation:	Demonstration, relevant parameters, parsing rules, and warnings

If you need additional information about a specific command or its syntax, enter the command followed by a question mark (?).

The following example displays the **HELP** command screen. See the"HELP" section on page 5-7 for more specific information.

Example 5-1 HELP Command:

```
0-0>HELP
System Status     System Commands   Setup Commands    Maintenance
------------------------------------------------------------------------
   ALARM            ALMDSBL          SET_LOSTH        CUTOVER
   HELP             ALMENBL          SETGT            LOAD
   LD               CONFIG           SETI             SETADDR
   PRM              LOGOUT           SETOUT           SRESET
   STAT             PASS             SETP
   VER
------------------------------------------------------------------------
Enter 'Command ?' for syntax

0-0>
```

Measurement Parameters

The format for measurement parameters is as follows:

% [width].[precision]type,

Additional parameters include:

- Width-total field width
- Precision-number of decimals

- Type- float (f) or signed decimals (d)

Additional information regarding measurement parameters can be found in the "PRM" section on page 5-9.

Login Session

@XY

Command: **@XY**

Syntax: None given

Password: N/A

Configuration: N/A

Brief Description: Login to unit with address XY

Explanation:

To begin a command session, you need to log in to the ONS 15216 EDFA1. Typing the '@' character while logged into a unit immediately terminates the command session. Table 5-2 displays the ONS 15216 EDFA1 address parameters.

Example 5-2 @XY Command:

@xy

x-y>

Table 5-2 EDFA Address Parameters

Parameter	Format	Description
x	0-9	First half of EDFA address
y	0-9	Second half of EDFA address

Note The Default Address for the ONS 15216 EDFA1 is 00.

To begin a session, enter @xy followed by a carriage return (where xy is the address of the module). The address of the ONS 15216 EDFA1 is a two-digit number from 00 to 99. In this document, the default address 00 is used for the ONS 15216 EDFA1.

The ONS 15216 EDFA1 ends every command by returning the following prompt: a-b> (where ab is the address of the ONS 15216 EDFA1). The prompt does not appear with the following commands:

- CONFIG

- SRESET
- STAT
- CUTOVER
- LOAD

The LOGOUT command should always be used to terminate a session.

Password Protection

Password protection is applied to commands that can change the mode of the ONS 15216 EDFA1 operation. You are required to enter the password at login to gain access to these commands.

CISCO is the default password. See the "PASS" section on page 5-17 for information about changing passwords

Error Handling

Unaccepted commands result in an error message. Table 5-3 lists and describes error messages.

Example 5-3 Error Message:

```
0-0>COMMAND
Error message
0-0>
```

Table 5-3 Error Messages

Error Message	Description
No such command	Command does not exist
Syntax:xxxxx	The syntax for the given command is wrong; generally this error message appears if a command argument is invalid or out of range
Ser in full	Serial input fifo is full, caused by overflowing the command input
Cmd fifo empty	Command fifo is empty, caused by serial errors
Cmd trunc 1	Command line is truncated, caused by serial errors
Cmd trunc 2	Command line is truncated, caused by serial errors
Cmd trunc 3	Command line is truncated, caused by serial errors
Cmd too long	Command name is too long
NO termin space	No terminating white space is found, caused by serial errors
Cmd line too long	Command line is too long

System Status Commands

This section describes system status commands.

Command: **ALARM**

Syntax: **ALARM D|C**

Password: N/A

Configuration: N/A

Brief Description: Displays alarm status or clears alarm counts

ALARM

Explanation:

Table 5-4 lists the alarms tracked by the ONS 15216 EDFA1.

Table 5-4 Alarms Tracked by the ONS 15216 EDFA1

Name	Description	Threshold
LCRNT	Excessive pump current	Drive current is greater than 95% of end-of-life value. Current must drop to 90% of end-of-life value for alarm to clear.
LTMP	Laser chip temp out-of-range	Chip temperature is deviating more than 10°C from setpoint.
LPOUT	Loss of output power	EDFA output power is deviating more than 2 dB from the setpoint. Tracking of this alarm is disabled when the EDFA is operating in constant gain mode.
LPIN	Loss of input power	EDFA input power is below the loss of input threshold. Input power must rise greater than 1 dB over the loss of input threshold for alarm to clear.
GAIN	Gain out-of-range	Gain has deviated more than 2 dB from the setpoint. Tracking of this alarm is disabled when the EDFA is not operating in constant gain mode.
CTMP	Case temperature out-of-range	Case temperature is less than -5°C or greater than 65°C.

To display the current status of alarms, type the ALARM D command.

Example 5-4 ALARM D command:

```
0-0>ALARM D

                 Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor    xxxxx yyy    xxxxx yyy   Excessive pump crnt/pump bias
LTMP  Minor    xxxxx yyy    xxxxx yyy   LD temp out-of-range

                 EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    xxxxx yyy   Loss outp pwr
LPIN  Major    xxxxx yyy   Loss inp pwr
GAIN  Major    xxxxx yyy   Gain out-of-range
CTMP  Major    xxxxx yyy   Case temp out-of-range
0-0>
```

Table 5-5 provides information for interpreting the results of an **ALARM D** command.

Table 5-5 Alarms

Parameter	Value	Description
XXXXX	Alarm	Alarm is set
	Dsbl	Alarm is disabled
	OK	Alarm is cleared
YYY	0..255	Count of alarm activations.

To clear all alarm counts, type the **ALARM C** command.

Example 5-5 Alarm C Command:

```
0-0>ALARM C
Alarms cleared
0-0>
```

HELP

Command: **HELP**

Syntax: **HELP**

Password: N/A

Configuration: N/A

Brief Description: Lists available commands

Detailed: Displays list of available user commands.

Example 5-6 HELP command results:

```
0-0>HELP
System Status     System Commands   Setup Commands    Maintenance
------------------------------------------------------------------------
   ALARM             ALMDSBL           SET_LOSTH         CUTOVER
   HELP              ALMENBL           SETGT             LOAD
   LD                CONFIG            SETI              SETADDR
   PRM               LOGOUT            SETOUT            SRESET
   STAT              PASS              SETP
   VER
------------------------------------------------------------------------
Enter 'Command ?' for syntax

0-0>
```

LD

Command: **LD**

Syntax: **LD**

Password: N/A

Configuration: N/A

Brief Description: Display the control mode of each laser diode pump.

Explanation: Displays the current laser status (see Example 5-7). Laser modes of operation are listed in Table 5-6.

Example 5-7 LD Command:

```
0-0>LD
LD n: mmmmmmmmmmmmmmmmmmmmmmmmmmmmmm
LD n: mmmmmmmmmmmmmmmmmmmmmmmmmmmmmm
0-0>
```

Table 5-6 Laser Diode Pump Parameters

Parameter	Value	Description
n	1.2	Laser diode pump number
mmmm...	Const Pump Crnt xxx(mA)	Constant current mode
	Const Pump Power yyy(mW)	Constant pump power mode
	Const Outp Power zz(mW)	Constant output power mode. Only Pump laser 2 may be in this mode.

Table 5-6 Laser Diode Pump Parameters

Parameter	Value	Description
	Temp Compensated	Temperature compensated constant gain mode
	Idle	Control is off. Pump current set to zero.
xxx	0..300	Pump bias current range for constant pump current mode
yyy	0..100	Pump power range for constant pump power mode
zz	0..65	EDFA power range for constant EDFA output power mode

PRM

Command: **PRM**

Syntax: **PRM 1|2**

Password: N/A

Configuration: N/A

Brief Description: Displays the latest measurements for the specified laser pump and EDFA

Explanation: When the **PRM 1|2** command is entered, the parameters for pump 1 and 2 are displayed. (see Example 5-8). This command displays the same line of parameters as the **STAT** command without the header and one line at a time.

Example 5-8 PRM Command:

```
0-0>PRM 1

1  aaa.a/bb.b  ccccc ddd.dd  eeee.ee   ff.ff ggg.g  hhhh.h/iiii.ii jjjj.jj/kkk.kk  lll.l
0-0>PRM 2

2  aaa.a/bb.b  ccccc ddd.dd  eeee.ee   ff.ff ggg.g  hhhh.h/iiii.ii jjjj.jj/kkk.kk  lll.l
0-0>
```

Note **Note**: White space, asterisks, and forward slashes are required field delimiters.

Use the following formats to specify displayed parameters such as width, precision, and type:

- %[width].[precision]type,
- Width -total field width

- Precision -number of decimals
- Type -float (f) or signed decimal (d)

Table 5-7 lists the measurement parameters used to interpret the results of a **PRM 1|2** command.

Table 5-7 PRM Measurement Parameters

Parameter	Format	Description
aaa.a	%5.1f	Laser chip temperature
bb.b	%4.1f	Laser chip temperature setpoint
ccccc	%5d	Laser TEC current
ddd.dd	%6.2f	Laser power
eeee.ee	%7.2f	Laser current
ff.ff	%5.2f	EDFA Ambient temperature
ggg.gg	%5.1f	EDFA DC voltage
hhhh.h	%6.1f	EDFA input power in µW
iiii.ii	%7.2f	EDFA input power in dBm
jjjj.jj	%7.2f	EDFA output power in mW
kkk.kk	%6.2f	EDFA output power in dBm
lll.l	%5.1f	EDFA Gain

STAT

Command: **STAT**

Syntax: **STAT** [interval], 1-255 sec

Password: N/A

Configuration: N/A

Brief Description: Print the control mode of each pump and then periodically print the pump and EDFA status.

Explanation: Displays EDFA status (Example 5-9).

The period between updates ranges from 1 to 255 seconds and is specified as an argument to the **STAT** command. The default update rate is one time per second. To end the status-update printing and return to the prompt, press **<Ctrl-X>**.

While in **STAT** mode, line feeds are suppressed, and only carriage returns can achieve the effect of a continuously updated status line under a stationary header. This mode is intended for a craftsperson, whereas the **PRM** command is intended for a computer controlling the EDFA.

Laser diode pump control modes are displayed in the same format as the **LD** command. The only exception is that the note **<<< Ctrl-X to Stop >>> which** is printed on the same line as the first laser diode pump's control mode.

Format fields are identical to the **PRM** command.

Example 5-9 STAT Command:

```
0-0>STAT 1
LD 1: Const Pump Crnt   10(mA)                      <<<  Ctrl-X to Stop   >>>
LD 2: Const Pump Crnt   10(mA)
LD     T/To     TEC    LDPwr    LDCrnt   Amb    DC        In             Out         Gain
        (C)    (mA)    (mW)      (mA)    (C)    (V)    (uW/dBm)       (mW/dBm)      (dBm)
1   25.5/25.5     39   0.49     9.92   30.25   5.2     0.0/-120.00    0.00/-90.00   30.0
```

VER

Command: **VER**

Syntax: **VER**

Password: N/A

Configuration: N/A

Brief Description: Displays general information about the EDFA

Explanation: Displays module details.

Example 5-10 VER Command:

```
0-0>VER
CISCO Optical Amplifier, ver.4.20,  May 05, 00
Ser.# Q17DA1100003    Rev. B
Active Plane: 1
Inactive ver. 4.16
ALARM D  to see alarms
0-0>
0-0>VER
aaaaaaaaaaaaaaaaaaaaaaa, ver.bbbb,  ccccccccc
Ser.# ddddddddddd    Rev. eeeeeeeee
Active Plane: f
Inactive ver. gggg
hhhhhhhhhhhhhhhhhhhhh
0-0>
```

Fixed widths are variable unless specified. Delimiters include the comma, period, pound, colon, space, carriage return, and line feed. Use Table 5-8 to interpret the **VER** command details.

Table 5-8 VER Parameters

Parameter	Format	Description
aaa...	up to 50 characters	Product name
bbbb	%4.2f	Product version number. *This must be allowed to grow to %5.2f in the future.
ccc...	xxx yy,zz	Firmwave build date
ddd...	up to 12 characters	Serial number
eee...	up to 9 characters	Hardware version number
f	0 o 1.	Active firmware plane
gggg	%4.2f	Product version number. *This must be allowed to grow to %5.2f in the future
hhh...	**ALARM D** to see alarms	String is displayed if one or more alarms are active
xxx	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	Month of active firmware build
yy	%02d	Day of firmware build
zz	%02d	Year of active firmware build

System Commands

The following section describes system commands.

ALMDSBL

Command: **ALMDSBL**

Syntax: **ALMDSBL <name> 1|2**

Password: Yes

Configuration: Yes

Brief Description: Disables an alarm

Explanation:

When an alarm is linked exclusively to a pin, that alarm can be disabled and its output pin set to V_{LO} (Voltage Low). The exceptions are the loss of output alarm and the gain alarms.

For example, to disable the laser-chip temperature alarm of the second pump, type **ALMDSBL LTMP 2**. The alarms display. If the alarm is active, pin 10 on the DB-25 connector changes states from V_{HI} (Voltage High) to V_{LO}.

```
0-0>ALMDSBL LTMP 2
0-0>ALARM D

                 Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor     OK     0     OK     0   Excessive pump crnt/pump bias
LTMP  Minor     OK     0    Dsbl    0   LD temp out-of-range

                 EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    Dsbl    0   Loss outp pwr
LPIN  Major    Dsbl    0   Loss inp pwr
GAIN  Major    Dsbl    0   Gain out-of-range
CTMP  Major     OK     1   Case temp out-of-range
```

Note When operating the EDFA in the default constant gain mode, the LPOUT alarm is disabled and the alarms are not reported.

ALMENBL

Command: **ALMENBL**

Syntax: **ALMENBL <name> 1|2**

Password: Yes

Configuration: Yes

Brief Description: Enables alarm checking for the specified alarm

Explanation:

The following example displays a disabled alarm (the second laser pump's chip temperature alarm), enabled by the **ALMENBL LTMP 2** command:

Example 5-11 ALMENBL Command:

```
0-0>ALARM D
                 Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor     OK     0     OK     0   Excessive pump crnt/pump bias
LTMP  Minor     OK     0    Dsbl    0   LD temp out-of-range

                 EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    Dsbl    0   Loss outp pwr
LPIN  Major    Dsbl    0   Loss inp pwr
GAIN  Major    Dsbl    0   Gain out-of-range
CTMP  Major     OK     1   Case temp out-of-range
0-0>ALMENBL LTMP 2
0-0>ALARM D
```

```
                  Pump 1        Pump 2
Name  Type      Crnt  Cnt     Crnt  Cnt    Descr
LCRNT Minor      OK     0      OK     0    Excessive pump crnt/pump bias
LTMP  Minor      OK     0      OK     0    LD temp out-of-range

                  EDFA 1
Name  Type      Crnt  Cnt    Descr
LPOUT Major     Dsbl    0    Loss outp pwr
LPIN  Major     Dsbl    0    Loss inp pwr
GAIN  Major     Dsbl    0    Gain out-of-range
CTMP  Major      OK     1    Case temp out-of-range
0-0>
```

CONFIG

Command: **CONFIG**

Syntax: **CONFIG S**

Password: Yes

Configuration: Yes

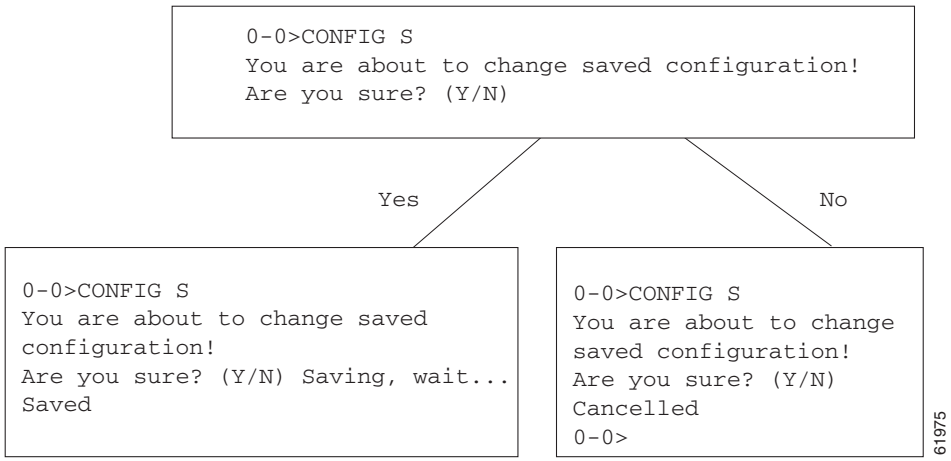
Brief Description: Saves the current EDFA configuration

Explanation:

Configuration data consists of the control mode for each laser, all alarm enable/disable states, and loss of input threshold. After reset, the EDFA will use the saved configuration as the starting point for EDFA control.

As shown in Figure 5-1, entering the **CONFIG S** command followed by the letter **Y** saves the configuration. If you enter **CONFIG S** followed by the letter **N**, the save operation will be cancelled.

Figure 5-1 CONFIG S Command Path Diagram



Note Following the **Y** path above, only "Saved" will be returned, followed by a new line. Following the **N** path above, "Cancelled" is returned with a prompt.

LOGOUT

Command: **LOGOUT**

Syntax: **LOGOUT**

Password: N/A

Configuration: N/A

Brief Description: Logout of current session

Explanation:

The **LOGOUT** command returns the current prompt and terminates the command line interface serial session. The ONS 15216 EDFA1 will not respond to any further commands unless you perform a login or address bootstrap.

Example 5-12 LOGOUT Command:

```
0-0>LOGOUT
0-0>
```

Warning **Configuration changes are lost at LOGOUT unless these changes are saved using the CONFIG S command (CONFIG, page 5-14).**

Setup Commands

The following section describes setup commands.

SET_LOSTH

Command: **SET_LOSTH**

Syntax: **SET_LOSTH [D|<value, -15 to -31dBm>]**

Password: Yes

Configuration: Yes

Brief Description: Set, get, or disable the loss-of-signal threshold

Explanation:

This command performs the following three functions:

- Sets and enables the loss-of-optical-input signal threshold
- Obtains and displays the current loss-of-optical-input signal threshold
- Disables the loss-of-optical-input signal alarm

Figure 5-1 The following example displays the **SET_LOSTH** command.

Example 5-13 SET LOSTH Command:

```
0-0>SET_LOSTH aaa.aa
OK
0-0>SET_LOSTH
bbb.bbdBm
0-0>SET_LOSTH D
OK
0-0>
```

Use Table 5-9 to interpret the results of a **SET_LOSTH** command

Table 5-9 LOS Threshold Parameters

Parameter	Format	Description
aaa.aa	%6.2f	Setpoint LOS Threshold
bbb.bb	%6.2f	Current LOS Threshold The value returned by SET_LOSTH. This accounts for rounding and table look-up accuracy.

Note The default loss-of-optical-input signal threshold is -30 dBm.

PASS

Command: **PASS**

Syntax: **PASS <password> [<new password>]**

Password: N/A

Configuration: Yes

Brief Description: Gains access to password protected commands and can change password

Explanation:

Before using any password protected commands, you must first enter the correct password. For example, you must enter the correct password before switching the ONS 15216 EDFA1 operating mode to temperature-compensated constant gain mode (**SETGT** command, see Figure 5-1).

The system returns a "wrong password" for any incorrect passwords entered. When you enter the correct password, all password protected commands become accessible.

To change the password, use the **PASS** command followed by the old password and then the new password. In Example 5-14, after you enter the correct password (ENTER) the password is changed with the new **PASS ENTER OPEN** command.

Note To retain the new password, you need to save the configuration.

Example 5-14 PASS Command:

```
0-0>SETGT
Password required
0-0>PASS ABCD
Wrong password
0-0>PASS ENTER
 Pass OK
0-0>PASS ENTER OPEN
Password changed
0-0>SETGT
LD 1: Temp Compensated
LD 2: Temp Compensated
0-0>
```

Note CISCO is the default password.

SETGT

Command: **SETGT**

Syntax: **SETGT**

Password: Yes

Configuration: Yes

Brief Description: Sets the laser diode pump control mode to constant gain with possible temperature compensation

Explanation:

The **SETGT** command switches the module operation to constant gain mode Figure 5-1. When the command switches laser diode pump control modes to constant gain, the LPOUT alarm (loss of output) is disabled and the GAIN alarm is enabled.

Example 5-15 SETGT Command:

```
0-0>SETGT
LD 1: Temp Compensated
LD 2: Temp Compensated
0-0>SETG
LD 1: Const Gain
LD 2: Const Gain
0-0>
```

Note Constant gain mode is the default mode of operation.

SETI

Command: **SETI**

Syntax: **SETI 1|2 <value, decimal (0-300mA)>**

Password: Yes

Configuration: Yes

Brief Description: Sets specified laser diode pump control to constant current mode

Explanation:

The **SETI** command is used to change the laser diode pump current (Figure 5-1).

When setting a laser in constant current mode, the GAIN alarm is automatically disabled. The output power alarm continues to function, testing for a 2 dB deviation of output power from the last output power setpoint.

If necessary, the **ALMDSBL** command (see the"ALMDSBL" section on page 5-12) can be used to disable the LPOUT alarm.

Note A value of zero will place the specified laser in idle mode.

Example 5-16 SETI Command:

```
0-0>SETI n xxx
LD n: Const Pump Crnt  xxx(mA)
0-0>
0-0>SETI 1 0
0-0>
```

Use Table 5-10 to interpret the SETI commands.

Table 5-10 Laser Diode Pump Parameters

Parameter	Format	Description
n	1 or 2	Laser diode pump number
xxx	0..300	Laser diode pump current setpoint in mA. A value of zero will place the laser in IDLE mode and will cause the control mode line not to display.

SETOUT

Command: **SETOUT**

Syntax: **SETOUT <value, decimal (0-65mW)>**

Password: Yes

Configuration: Yes

Brief Description: Set EDFA in constant output power mode

Explanation:

Constant EDFA output power mode has a configuration of 75 mW constant pump power for the first-stage pump laser and the second-stage laser controlling the overall EDFA output power. Use the **SETOUT** command to set the control point for the second-stage laser. The LPOUT alarm is automatically enabled and the GAIN alarm is automatically disabled when the **SETOUT** command is successfully issued.

A value of zero for the EDFA output power setpoint puts both pumps into IDLE mode. In this case, no control mode line is displayed after you enter the **SETOUT** command.

Example 5-17 SETOUT Command:

```
0-0>SETOUT aa.a
LD 1: Const Pump Power  75(mW)
LD 2: Const Outp Power  bb(mW)
0-0>SETOUT 0
0-0>LD
LD 1: Idle
LD 2: Idle
0-0>
```

Use Table 5-11 to interpret **SETOUT** command details.

Table 5-11 EDFA Power Parameters

Parameter	Format	Description
aa.a	0..65.0	Set EDFA output power setpoint with 0.1mW
bb	0..65	Current output power setpoint is rounded to nearest whole number

SETP

Command: **SETP**

Syntax: **SETP 1|2 <value, decimal (0-100mW)>**

Password: Yes

Configuration: Yes

Brief Description: Sets specified laser to constant pump power mode

Explanation:

The **SETP** command sets Laser diode "1" or "2" to constant pump laser power mode (Example 5-18). The GAIN alarm is automatically disabled when the **SETP** command is successfully issued.

A value of zero for the pump power setpoint places the pump in IDLE mode. In this case, no control mode line is displayed after the **SETP** command.

Example 5-18 SETP Command:

```
0-0>SETP n xxx
LD n: Const Pump Power xxx(mW)
0-0>SETP n 0
0-0>
```

Table 5-12 can be used to interpret the **SETP** command details.

Table 5-12 Laser Diode Pump Parameters

Parameter	Format	Description
n	1 or 2	Laser diode pump number
xxx	0..100	Set laser diode pump power in mW

Maintenance Commands

The following are maintenance commands.

CUTOVER

Command: **CUTOVER**

Syntax: **CUTOVER**

Password: Yes

Configuration: Yes

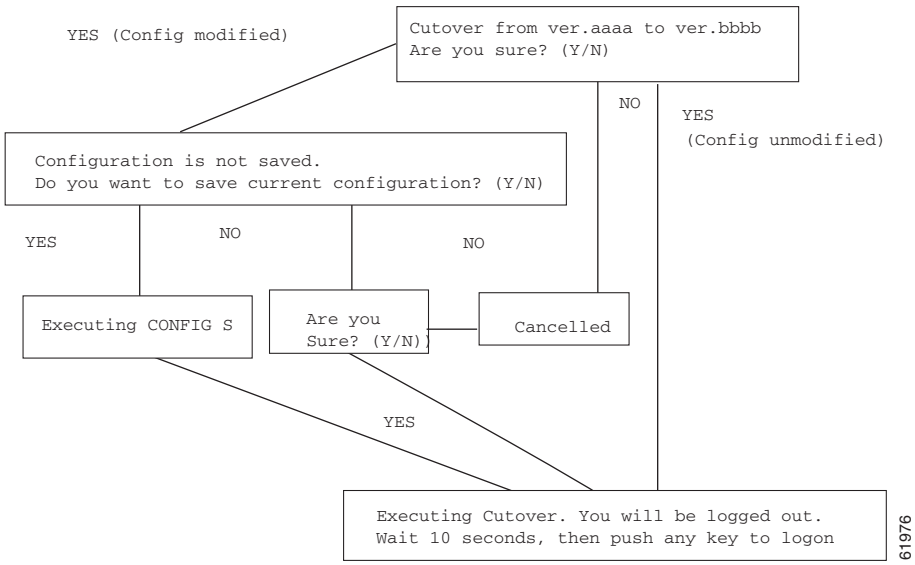
Brief Description: Executes firmware from the inactive plane and changes inactive plane status to the default active plane

Explanation:

After a new firmware version is downloaded to the EDFA's inactive plane, the **CUTOVER** command begins executing the new firmware. The cutover process is similar to a cold restart, except that information about control loops is stored and recovered after booting so that the EDFA can resume control where it left off. Alarm reporting can be incorrect during a cutover. Cutoveris approximately 12 seconds.

If any unsaved configuration parameters are present when the cutover command is issued, a prompt appears that permits you to save the modified parameters. All unsaved modified parameters will be lost during the cutover process.

Figure 5-2 CUTOVER Command Diagram



Use Table 5-13 to interpret the **CUTOVER** command details.

Table 5-13 Active/Inactice Plane Parameters

Parameter	Format	Description
aaaa	%4.2f	Active plane firmware version. This must be allowed to grow %5.2f in the future.
bbbb	%4.2f	Inactive plane firmware version. This must be allowed to grow %5.2f in the future.

LOAD

Command: **LOAD**

Syntax: **LOAD Start|Abort|Report**

Password: Yes

Configuration: N/A

Brief Description: Download firmware to the EDFA

Explanation:

Enter the **LOAD START** command to download new firmware. During the download process, feedback consisting of an increasing page count appears every second on the terminal screen (Example 5-19). Each page represents one loaded 128 byte flash page; there are two cyclic redundancy checks (CRCs)at the end of the load procedure. For a successful load, the CRC will match the Cisco-provided CRC (Cisco provides the CRC with its firmware upgrade).

If during download the rate of updates halts and no CRC is displayed within 10 seconds of the halt, the download has failed.

Note In the figure below at the "0 pages loaded line" , CR/LF (carriage return/line feed) pairs have been substituted for LFs to enhance readability. The actual download procedure only uses LFs.

Example 5-19 LOAD START Command:

```
0-0>LOAD START
Ready for loading
0-0>@LLF

   0 pages loaded
   1
   2
   3
   4
   5
   .
   .
   .
nnnn
xxxx xxxx
```

Use Table 5-13 to interpret the **LOAD START** command results.

Table 5-14 Load Parameters

Parameter	Format	Description
nnnn	0-9999	Pages loaded; 1 page = 128 bytes
xxxx	CRC	16-bit hex CRC of flash plane, repeated twice

A LOAD ABORT command reverts an EDFA that is waiting for a firmware upload to normal mode. Any firmware file sent to the EDFA is rejected. You must reissue the **LOAD START** command for the EDFA to take action on a firmware file (Example 5-19).

Example 5-20 LOAD ABORT Command

```
0-0>LOAD ABORT
Aborted
0-0>
```

Note The **LOAD REPORT** command is used only for diagnostic purposes.

SETADDR

Command: **SETADDR**

Syntax: **SETADDR xx, where xx is decimal number**

Password: N/A

Configuration: Yes

Brief Description: Sets the address of the ONS 15216 EDFA1. This command enables a unique address to be assigned to each EDFA in systems where two or more ONS 15216 EDFA1s are used within one networking platform.

Explanation:

Enter **SETADDR<xx>** to assign an address to the EDFA module (Example 5-21).

Example 5-21 SET ADDR Command:

```
0-0>SETADDR xy
x-y>
```

Use Table 5-14 to interpret and issue **SETADDR** commands.

Table 5-15 EDFA Address Parameters

Parameter	Format	Description
x	0-9	First half of EDFA address
y	0-9	Second half of EDFA address

SRESET

Command: **SRESET**

Syntax: **SRESET**

Password: N/A

Configuration: N/A

Brief Description: Software reset for EDFA

Explanation:

The **SRESET** command reboots the EDFA.

Example 5-22 SRESET Command:

```
0-0>SRESET
LD 1: Temp Compensated
LD 2: Temp Compensated
```

Caution Only use this command if the EDFA has entered an inconsistent state.

After bootup, the current control mode of the EDFA is broadcast. In Example 5-22, the EDFA has the temperature-compensated constant gain mode as the default mode of operation.

Note Alarms are not valid during the booting period (12 seconds). This command does not affect service.

!SETADDR

Command: **!SETADDR**

Syntax: **!SETADDR xx, where xx is decimal number**

Password: N/A

Configuration: Yes

Brief Description: Bootstraps the EDFA address

Explanation:

An exclamation point placed at the beginning of the **SETADDR** command overrides the logon requirement of the EDFA. This allows a new address to be assigned without knowledge of the EDFA's current address. After the confirmation prompt is returned, the user is logged out. In practice, the exclamation point shown in the following example is not echoed back (Example 5-23).

Example 5-23 !SETADDR Command:

```
!SETADDR xy
x-y>
```

Use Table 5-16 to interpret and issue the **!SETADDR** command.

Table 5-16 EDFA Address Parameters

Parameter	Format	Description
x	0-9	First half of EDFA address
y	0-9	Second half of EDFA address

Command Summary

Table 5-17 summarizes all the user commands presented in this chapter. Commands are listed in alphabetical order.

Table 5-17 Command Summary

Command Syntax	Function	Description
@XY	Login to unit with XY address	To begin a command session, first log into the EDFA module. Typing the @ character while already logged into a unit immediately terminates the command session.
ALARM D	Alarm Status Display	This command displays the alarm status.
ALARM C	Alarm Status Clear	This command clears all of the alarm counts.
ALMDSBL<name> 1|2	Alarm Enable /Disable	This command disables alarm number n.
ALMENBL<name> 1|2		This command enables alarm number n. Unless saved with the **CONFIG S** command, the alarm remains disabled/ enabled until the next reset.
CONFIG S	Configuration Save Command	This command saves the current settings.
CUTOVER	Firmware Cutover	This command switches operation from the active plane to the inactive plane to install a new version of firmware.
HELP	Command Display	This command displays a list of commands available to the user.

Table 5-17 Command Summary (continued)

Command Syntax	Function	Description
INACTIMER <minutes>	Inactivity Command	This command sets the inactivity timeout. If no keyboard activity is detected during this timeout, the EDFA automatically logs out. (Minutes = 1 to 255)
LD	Laser Status Display	This command displays the control mode of each laser diode pump..
LOAD Start | Abort | Report	Firmware Download to EDFA	This command initializes the module to accept remote downloads of new firmware.
LOGOUT	Logout Command	This command logs out of the current unit. The command will return to the current prompt and then terminate the command line interface serial session with the EDFA.
PASS <password.> [<new password>]	Password	This command enables password-protected commands and can change passwords.
PRM 1|2	Parameter Display	This command enables the parameters for pumps one and two.
SETADDR xx (where xx is a decimal number)	Sets address of EDFA	This command assigns a two-digit address value (range 0 to 99) to an EDFA.
!SETADDR xx (where xx is a decimal number)	Bootstraps the EDFA address	An exclamation point placed at the beginning of the **SETADDR** command overrides the EDFA's logon requirement. This allows a new address to be assigned without knowledge of the EDFA's current address. After the confirmation prompt is returned, the user is logged out.
SET_LOSTH [D] <value,-15 to -31 dBm>]	Set, get, or disable the loss of signal threshold	This command performs three functions: set and enable the loss-of-input signal threshold, get the current loss-of-input signal threshold, or disable the loss-of-input signal alarm.

Table 5-17 Command Summary (continued)

Command Syntax	Function	Description
SETGT	Sets laser diode pump control modes to constant gain	This command sets the laser pump control modes to constant gain with possible temperature compensation. When switching laser diode pump control modes to constant gain, the loss of output alarm, LPOUT, is disabled and the GAIN alarm is enabled.
SETI 1|2 <value, decimal (0-300) mA)>	Sets specified laser diode pump control to constant current mode	This command sets Laser 1 or 2 to Constant Pump Laser Current at set <value> in mA.
SETOUT <value, decimal (0-65 mW)>	Sets EDFA in constant output power mode	Constant EDFA output power mode has the first-stage pump laser configured for 75mW of constant pump power and the second-stage laser controlling the overall EDFA output power. The **SETOUT** command is used to set the control point for the second-stage laser. The LPOUT alarm is automatically enabled and the GAIN alarm is automatically disabled when you successfully issue the **SETOUT** command. A value of zero for the EDFA output power setpoint puts both pumps into IDLE mode. In this case, no control mode line displays after you issue the **SETOUT** command.
SETP 1|2 <value, decimal (0-100 mW)>	Sets specified laser in constant pump power mode	The GAIN alarm is automatically disabled when the **SETP** command is successfully issued. A value of zero for the pump power setpoint places the pump in IDLE mode. In this case, no control mode line displays after the **SETP** command.

Table 5-17 Command Summary (continued)

Command Syntax	Function	Description
SRESET	Software Reset	This command initiates a reboot of the EDFA. This command should only be used if the EDFA has entered an inconsistent state.
STAT [interval], 1-255 sec	Displays the control mode of each pump and then periodically displays pump and EDFA status.	This command provides a continuous display of all monitored parameters. You can set the period between updates from 1 to 255 seconds. It is specified as an argument to the **STAT** command. Type Ctrl-X to return to the prompt from the status display.
VER	Version Display	This command displays general information about the EDFA.

CHAPTER 6

Troubleshooting

This chapter discusses basic fault investigation and diagnosis (troubleshooting) procedures for the ONS 15216 EDFA1.

Tools and Equipment

Troubleshooting the ONS 15216 EDFA1 requires the following test equipment and tools:

Troubleshooting Test Equipment:

- Optical power meter
- Optical spectrum analyzer (as needed)
- 1550 nm optical source (as needed)
- DVOM (digital volt Ohm meter)

The Optical Spectrum Analyzer is necessary when individual wavelength levels need to be adjusted. You can use this tool to equalize the amplitudes of all the wavelengths so that the DWDM multiplexer output (the input point of the ONS 15216 EDFA1) has all the wavelengths flat across the spectrum. For example, you can add attenuation to stronger signals to equalize amplitudes. Once the amplitudes were equalized, you can then test the amplifier.

An external 1550 nm optical source is necessary in the absence of an active channel so that the ONS 15216 EDFA1 can be energized with an appropriate known input. This enables you to activate and test both the gain and output power of the amplifier.

Troubleshooting Tools:

- Standard hand tools
- Optical connector cleaner
- A Windows PC running the HyperTerminal program; see Chapter 4, “Provisioning and Monitoring” for detailed information about HyperTerminal and setting up local serial or remote communication between a PC and the ONS 15216 EDFA1

Basic Diagnosis

When a problem occurs over the network, the following three basic diagnostic procedures are designed to help you determine if the ONS 15216 EDFA1 is the source of the problem. If the ONS 15216 EDFA1 is the source of the problem, follow the directions in the "Troubleshooting Commands" section on page 6-3 to clear the alarms and if necessary reprovision the ONS 15216 EDFA1 for proper operation.

Verify Optical Input Power

First, measure the optical input power using the following command or test equipment:

- **STAT** Command (Troubleshooting Commands, page 6-3)
- Optical Power Meter (if necessary)
- Optical Spectrum Analyzer (if necessary)

When the ONS 15216 EDFA1 is operating in constant gain mode, the total optical input power must be less than or equal to -6dBm.

If optical input power is out of the specified range for proper ONS 15216 EDFA1 operation, the craftsperson must investigate and diagnose the fault.

Verify Optical Output Power

Second, measure the ONS 15216 EDFA1 optical output power using the following command or test equipment:

- **STAT** Command (Troubleshooting Commands, page 6-3)
- Optical power meter, connected to the ONS 15216 EDFA1 output port (if necessary)
- Optical spectrum analyzer, connected to the ONS 15216 EDFA1 output port (if necessary)

When operating in constant gain mode, the ONS 15216 EDFA1 delivers 23 ± 1.25dB gain above the input signal at the output port. If this is not the case, see the "Troubleshooting Commands" section on page 6-3.

Verify Alarm Settings

Measure, clear, and/or revise alarm settings using the following three commands:

- **ALARM D** Command - this command displays the current alarm status
- **ALARM C** Command- this command clears the alarm count
- **SET_LOSTH** Command - this command can set, enable, disable, or display the loss-of-signal threshold

For more details. see the "Troubleshooting Commands" section on page 6-3.

Contact Technical Support if the fault condition is not cleared after you have reviewed and cleared the alrms and/or reprovisioned the loss-of-input signal threshold.

Troubleshooting Commands

Use the following troubleshooting commands to review alarms and the overall status of the ONS 15216 EDFA1 and, if necessary, to reprovision the amplifier.

For additional detailed information regarding each of the following commands, see Chapter 5, "Command Line Reference."

STAT Command

You can view the following information using the **STAT** command:

- Amplifier mode of operation
- Individual pump laser statistics
- Electrical statistics
- Environmental statistics
- Input and output optical signals level
- Amplifier gain

As seen in the following example, you can use this information to quickly isolate any possible problem with the ONS 15216 EDFA1.

Example 6-1 STAT Command Results

```
0-0>STAT 1
LD 1: Const Pump Crnt   10(mA)                        <<<  Ctrl-X to Stop   >>>
LD 2: Const Pump Crnt   10(mA)
LD     T/To     TEC    LDPwr    LDCrnt   Amb    DC        In              Out         Gain
        (C)    (mA)    (mW)      (mA)    (C)    (V)    (uW/dBm)        (mW/dBm)      (dBm)
1   25.5/25.5     39   0.49     9.92   30.25   5.2     0.0/-120.00     0.00/-90.00   30.0
```

Alarm Display/Clear Commands

Use the **ALARM D** command to view active ONS 15216 EDFA1 alarms. These alarms are also helpful in determining the location and type of problem with the ONS 15216 EDFA1.

See the "ALARM" section on page 5-6 for additional information about this command.

Example 6-2 Alarm D Command

```
0-0>ALARM D

                  Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor    xxxxx yyy    xxxxx yyy   Excessive pump crnt/pump bias
LTMP  Minor    xxxxx yyy    xxxxx yyy   LD temp out-of-range

                  EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    xxxxx yyy   Loss outp pwr
LPIN  Major    xxxxx yyy   Loss inp pwr
GAIN  Major    xxxxx yyy   Gain out-of-range
```

```
CTMP  Major    xxxxx yyy   Case temp out-of-range
0-0>
```

The **ALARM C** command cleas the alarm after you determine and correct the problem, or you can use it to test a solution to a problem with the ONS 15216 EDFA1. Clearing active alarms resets alarm-monitoring circuitry within the ONS 15216 EDFA1 and is useful in verifying whether alarm conditions are present.

Alarm Enable/Disable Commands

Use the **ALMDSBL** command to disable a specific alarm. Use the **ALMENBL** command to enable the specific alarm. Both commands are useful in determining the source of a problem, masking specific alarms, or testing the ONS 15216 EDFA1.

See the "ALMENBL" section on page 5-13 for additional information about this command.

Example 6-3 Using the ALMENBL Command:

```
0-0>ALARM D

                 Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor     OK     0     OK     0   Excessive pump crnt/pump bias
LTMP  Minor     OK     0    Dsbl    0   LD temp out-of-range

                 EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    Dsbl    0   Loss outp pwr
LPIN  Major    Dsbl    0   Loss inp pwr
GAIN  Major    Dsbl    0   Gain out-of-range
CTMP  Major     OK     1   Case temp out-of-range
0-0>ALMENBL LTMP 2
0-0>ALARM D

                 Pump 1       Pump 2
Name  Type     Crnt  Cnt    Crnt  Cnt   Descr
LCRNT Minor     OK     0     OK     0   Excessive pump crnt/pump bias
LTMP  Minor     OK     0     OK     0   LD temp out-of-range

                 EDFA 1
Name  Type     Crnt  Cnt   Descr
LPOUT Major    Dsbl    0   Loss outp pwr
LPIN  Major    Dsbl    0   Loss inp pwr
GAIN  Major    Dsbl    0   Gain out-of-range
CTMP  Major     OK     1   Case temp out-of-range
0-0>
```

LOS Alarm Threshold Commands

Use the **SET_LOS** command to set, enable, disable, or display loss-of-input signal threshold. The factory default is set to -30 dBm. Use this command to review the loss-of-signal threshold and (if necessary) reset this value.

Note Changing the LOS alarm threshold requires a password.

See SET_LOSTH, page 5-16 for additional information about this command.

Example 6-4 Using the SET_LOSTH Command

```
0-0>SET_LOSTH aaa.aa
OK
0-0>SET_LOSTH
bbb.bbdBm
0-0>SET_LOSTH D
OK
0-0>
```

Reprovisioning the ONS 15216 EDFA1

See the "Installation Commands" section on page 3-4 for information about commands available to reprovision the ONS 15216 EDFA1.

Technical Support

If the problem exists after you review the ONS 15216 EDFA1 status and attempt to reprovision the amplifier, contact the Cisco Technical Assistance Center (TAC) at 1-877-323-7368.

Power Conversion Graph

This appendix includes two power/decibels conversion charts. For each chart, the vertical scales on the right are read with the bottom scales, and the vertical scales on the left are read with the top scales.

Figure A-1 Decibel Chart

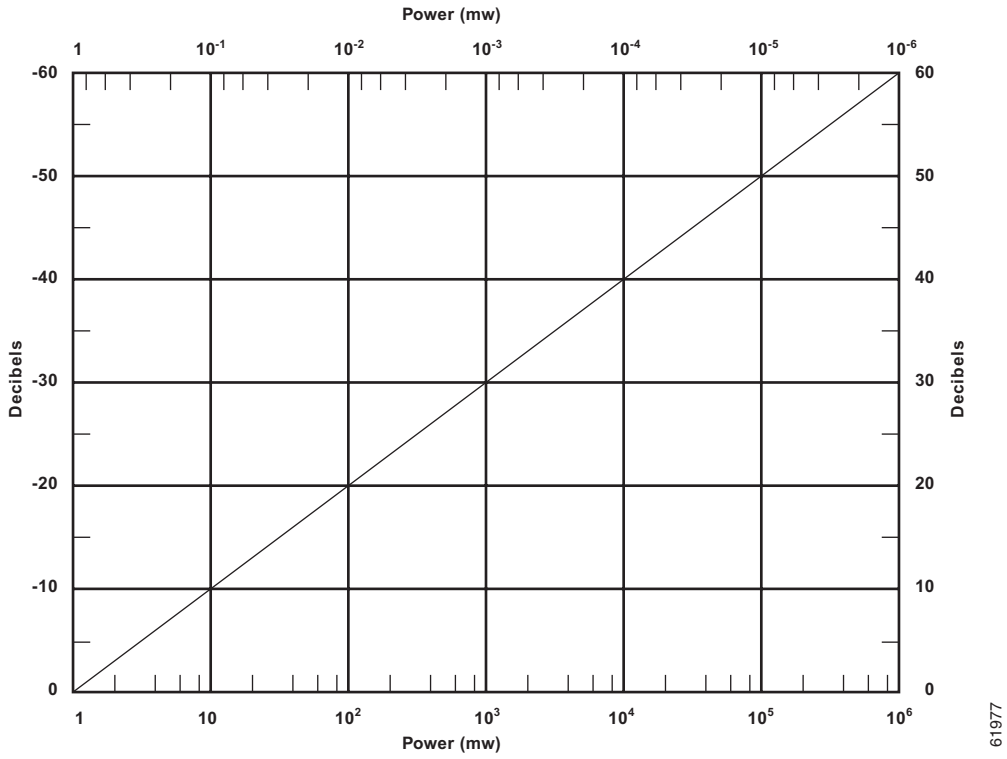
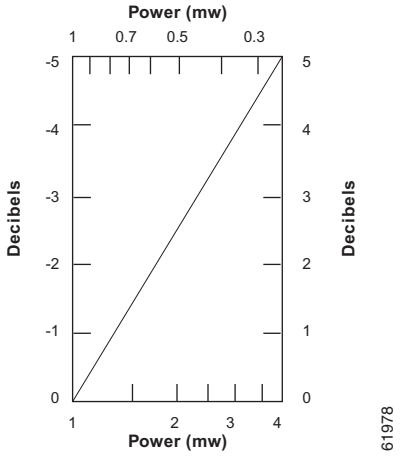
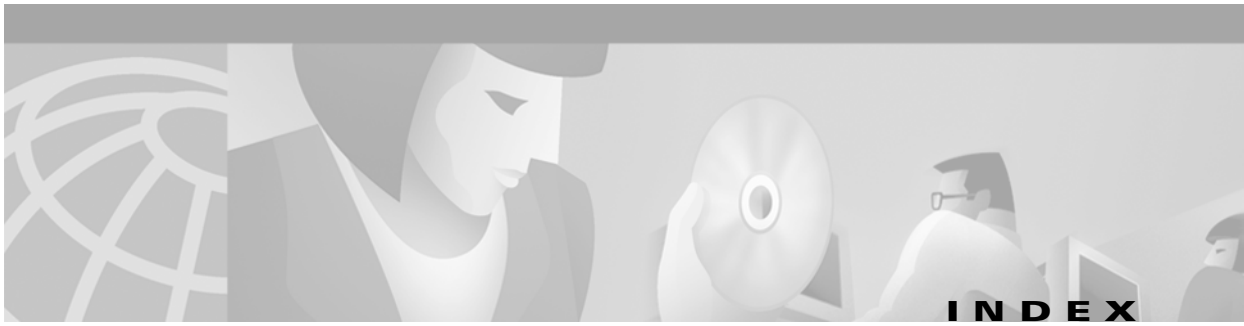


Figure A-2 is an expanded scale for power/decibel conversion.

Figure A-2 Expanded Decibel Scale





A

C

D

E

H

L

M

P

R

S