

# Installing and Operating the Cisco ONS 15216 50 GHz/100GHz Optical Interleaver and De-interleaver Module

---

## Introduction

This document explains how to install and operate the Cisco ONS 15216 50 GHz/100 GHz Optical Interleaver and De-Interleaver module used in the Cisco ONS 15216 FlexLayer four-slot shelf assembly. The FlexLayer product provides 50 GHz of channel spacing in Dense Wavelength Division Multiplexing (DWDM) systems.

## Safety Information

Before you install, operate, or service the Cisco ONS 15216 50 GHz/100 GHz Optical Interleaver and De-interleaver module (hereafter referred to as the ONS 15216-ID-50), read the *Cisco Optical Products Regulatory Safety and Compliance Information* document for important safety information you should know before working with the system.

The ONS 15216-ID-50 is compliant with GR 1089, UL60950 /CSA 22.2 No. 60950-00, and IEC 60950.

## Laser Radiation Emission Restrictions

The Class 1M Laser safety and warning label is affixed to the ONS 15216-ID-50 module and indicates that the product should never be used or installed in an optical network with emissions higher than Class 1M.



Warning

---

**Class 1M laser radiation when open. Do not view directly with optical instruments.** Statement 1053

---



---

Corporate Headquarters:  
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

© 2006 Cisco Systems, Inc. All rights reserved.

## Laser Safety During Operation

**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

## Electrical Safety

**Note**

The ONS 15216-ID-50 module is optically and electrically passive and requires no electrical connections. No electrostatic discharge (ESD) or other electrical safety considerations apply.

## Product Description

The ONS 15216-ID-50 is a C-band 50 GHz/100 GHz module that operates in the Cisco ONS 15216 FlexLayer four-slot shelf assembly in 50-GHz channel spacing DWDM systems. The ONS 15216-ID-50 module can interleave and de-interleave signals and extract a fraction of the signals for monitoring purposes. These are some of the module's applications and uses:

- Extends existing network capacity
- Provides low cost future proofing of network capacity
- Allows for non-traffic affecting capacity upgrade

## Features

The ONS 15216-ID-50 is a modular component that provides signal interleaving and de-interleaving in 50-GHz channel spacing DWDM systems. It is optically and electrically passive and requires no temperature control. It uses fused fiber coupler technologies and a birefringent crystal technology platform. The module's ultra-low dispersion coupled with the wide bandwidth (Wideband 100 GHz) reduces the concerns of dispersion accumulation and bandwidth narrowing, making the ONS 15216-ID-50 ideal for Multi-OADM Metro ring or mesh-based architectures.

Some of the ONS 15216-ID-50 module's operating features include:

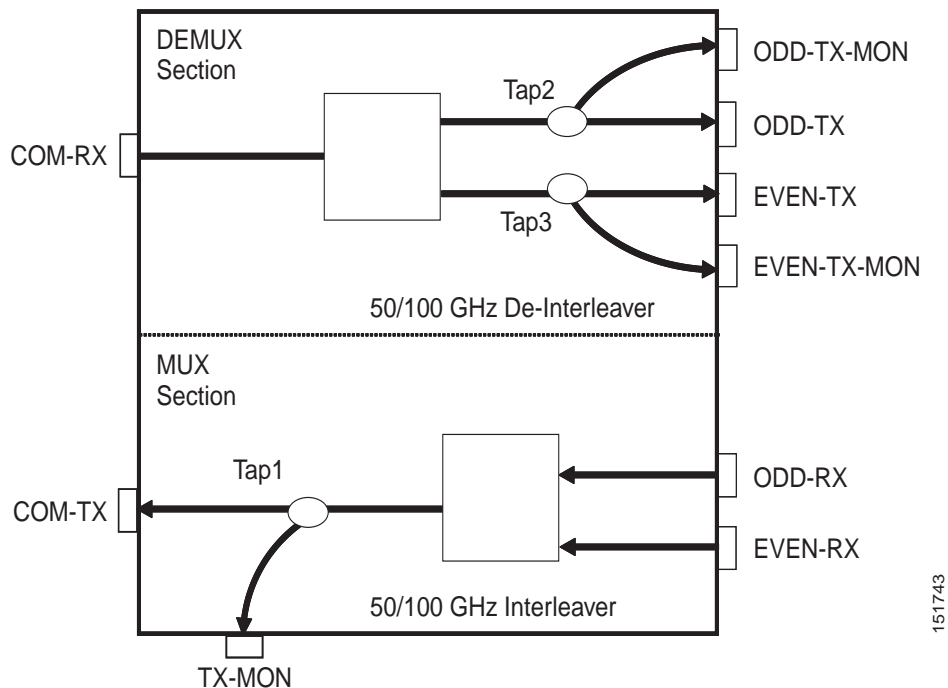
- Low dispersion
- Low insertion loss
- High channel isolation
- Wide clear bandwidth
- Full C-band coverage
- Athermal design

## Functional Description

The ONS 15216-ID-50 module increases capacity by combining two optical data streams into a single, more densely spaced stream. The module can be used in Mux mode to combine two 100-GHz optical signal streams into one 50-GHz stream, or in Demux mode to separate the 50-GHz stream into two 100-GHz streams.

The 15216-ID-50 is a bidirectional module in which the Mux and Demux functions are implemented in two different sections to enable signals flowing in opposite directions to be managed separately. This design is illustrated in Figure 1.

Figure 1 Module Design



The interleaver in the Mux section combines the even and odd channel signals at 100 GHz spacing (EVEN-RX and ODD-RX ports, respectively) into the 50 GHz channel spacing signal. The tap coupler enables aggregate 50-GHz-spaced transmitted optical channel spectrum monitoring at the output (TX-MON port).

The de-interleaver in the Demux section separates the 50-GHz channel spacing signal into even and odd channel signals of 100-GHz spacing (EVEN-TX and ODD-TX ports, respectively). The tap coupler on each of the two Demux paths enables even (EVEN-MON port) and odd (ODD-MON port) channel signal spectrum monitoring.

## Channel Wavelength Allocation

The ONS 15216-ID-50 channel plan is shown in .

Table 1 C-Band Channel Wavelength Plan

Channel Wavelength Odd_C Band			Channel Wavelength Even_C Band		
Channel Label	Frequency (THz)	Wavelength (nm)	Channel Label	Frequency (THz)	Wavelength (nm)
1	195.9	1530.33	2	195.85	1530.72
3	195.8	1531.12	4	195.75	1531.51
5	195.7	1531.90	6	195.65	1532.29

**Table 1** C-Band Channel Wavelength Plan

Channel Wavelength Odd_C Band (continued)			Channel Wavelength Even_C Band		
Channel Label	Frequency (THz)	Wavelength (nm)	Channel Label	Frequency (THz)	Wavelength (nm)
7	195.6	1532.68	8	195.55	1533.07
9	195.5	1533.47	10	195.45	1533.86
11	195.4	1534.25	12	195.35	1534.64
13	195.3	1535.04	14	195.25	1535.43
15	195.2	1535.82	16	195.15	1536.22
17	195.1	1536.61	18	195.05	1537.00
19	195	1537.40	20	194.95	1537.79
21	194.9	1538.19	22	194.85	1538.58
23	194.8	1538.98	24	194.75	1539.37
25	194.7	1539.77	26	194.65	1540.16
27	194.6	1540.56	28	194.55	1540.95
29	194.5	1541.35	30	194.45	1541.75
31	194.4	1542.14	32	194.35	1542.54
33	194.3	1542.94	34	194.25	1543.33
35	194.2	1543.73	36	194.15	1544.13
37	194.1	1544.53	38	194.05	1544.92
39	194	1545.32	40	193.95	1545.72
41	193.9	1546.12	42	193.85	1546.52
43	193.8	1546.92	44	193.75	1547.32
45	193.7	1547.72	46	193.65	1548.11
47	193.6	1548.51	48	193.55	1548.91
49	193.5	1549.32	50	193.45	1549.72
51	193.4	1550.12	52	193.35	1550.52
53	193.3	1550.92	54	193.25	1551.32
55	193.2	1551.72	56	193.15	1552.12
57	193.1	1552.52	58	193.05	1552.93
59	193	1553.33	60	192.95	1553.73
61	192.9	1554.13	62	192.85	1554.54
63	192.8	1554.94	64	192.75	1555.34
65	192.7	1555.75	66	192.65	1556.15
67	192.6	1556.55	68	192.55	1556.96
69	192.5	1557.36	70	192.45	1557.77
71	192.4	1558.17	72	192.35	1558.58
73	192.3	1558.98	74	192.25	1559.39

**Table 1** C-Band Channel Wavelength Plan

Channel Wavelength Odd_C Band (continued)			Channel Wavelength Even_C Band		
Channel Label	Frequency (THz)	Wavelength (nm)	Channel Label	Frequency (THz)	Wavelength (nm)
75	192.2	1559.79	76	192.15	1560.20
77	192.1	1560.61	78	192.05	1561.01
79	192	1561.42	80	191.95	1561.83

## Installation

This section explains how to unpack, verify, and install the ONS 15216-ID-50 module; clean and maintain the fiber-optic connectors; and install and route fiber-optic cable.

### Unpack and Verify the Equipment

- 
- Step 1** Unpack and inspect the module. The package should include these components:
- ONS 15216-ID-50 module
  - Production Test Report form showing the manufacturer's part number and serial number, Cisco part number, date, and device description
  - Packing slip
- Step 2** Compare the equipment received with the packing slip and the equipment list that customer service provided. If there are any discrepancies, notify the Customer Service Center.
- Step 3** Check for external damage. Visually check all components and immediately report any shipping damage to your customer service representative. Have this information ready:
- Invoice number of shipper (see packing slip)
  - Model and serial number of the damaged unit
  - Description of damage
  - Effect of damage on the installation

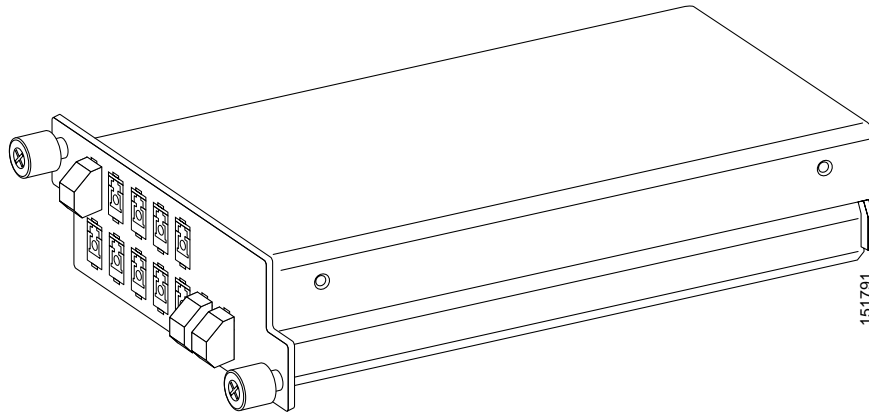
### Install the ONS 15216-ID-50 Module

The ONS 15216-ID-50 module operates in the Cisco ONS 15216 FlexLayer four-slot shelf assembly. The FlexLayer shelf can be installed anywhere in the rack (in other words, above or below the DWDM generating equipment), according to local site practice.

The 15216-ID-50 module is passive and requires no power cabling or connections. All connectors are on the front panel, which is equipped with LC/UPC bulkhead adapters. Fiber-optic cables equipped with the corresponding (LC/UPC) connector type are used. The module port numbers are labelled on the front panel, and port assignments are provided in [Figure 2](#).

For more information about the FlexLayer product, see the *Cisco ONS 15216 FlexLayer User Guide*.

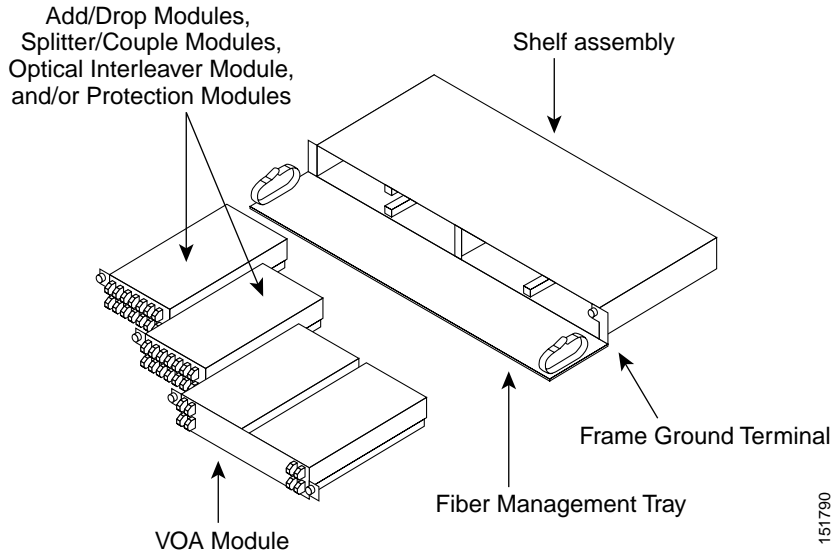
Figure 2 ONS 15216-ID-50 Module



### Install the 15216-ID-50 Module in the ONS 15216 FlexLayer Shelf

The FlexLayer shelf assembly is 1 RU high and can be mounted in a 19- or 23-inch rack (2-way mounting brackets). The shelf assembly houses four Add/Drop, Splitter/Combiner FlexLayer, or Interleaver/De-Interleaver modules, or two VOA FlexLayer modules. Figure 3 shows the FlexLayer shelf assembly and FlexLayer modules, including the ONS 15216-ID-50.

Figure 3 ONS 15216-ID-50 Installation in a Cisco ONS 15216 FlexLayer Shelf Assembly



- Step 1 Insert the 15216-ID-50 module into the FlexLayer slot.
- Step 2 Connect the fibers as appropriate.

- Step 3** Refer to the port assignments listed in [Table 2](#) and the port layout diagrams in [Figure 4](#) and [Figure 5](#). For fibering instructions, see the “[Fiber Optic Connector Cleaning and Maintenance](#)” section on page 9 and the “[Install and Route Fiber-Optic Cables](#)” section on page 11.

**Caution**

The ONS 15216-ID-50 front panel features LC/UPC bulkhead adapters. It uses fiber-optic cables equipped with the corresponding (LC/UPC) connector type with no fiber pigtail leading out. Using any other type of connector damages the connector and/or adapter.

## Port Assignments

[Table 2](#) lists the connector position and the type of connector used for each optical port. All connectors are on the front panel, which is equipped with LC adapters.

**Table 2** *Port Assignments and Descriptions*

Port Number	Port Label	Description	Type of connector
3	TX-MON	Output Monitor	LC-UPC II
4	ODD-TX-MON	Odd Channels Output Monitor	LC-UPC II
5	EVEN-TX-MON	Even Channels Output Monitor	LC-UPC II
6	ODD-RX	Odd Channels Input	LC-UPC II
7	EVEN-RX	Even Channels Input	LC-UPC II
8	COM-TX	Common Output	LC-UPC II
9	ODD-TX	Odd Channels Output	LC-UPC II
10	EVEN-TX	Even Channels Output	LC-UPC II
11	COM-RX	Common Input	LC-UPC II

[Figure 4](#) shows the module port numbers and labels.

Figure 4 Port Numbers and Labels

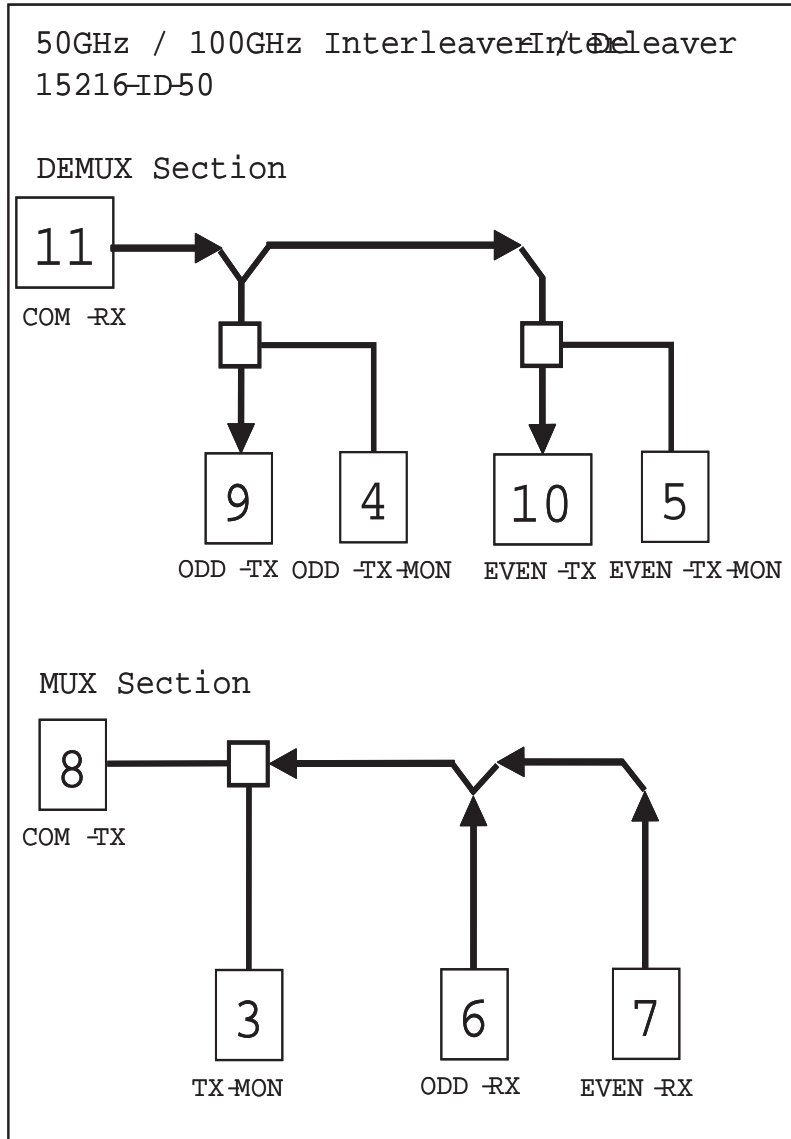
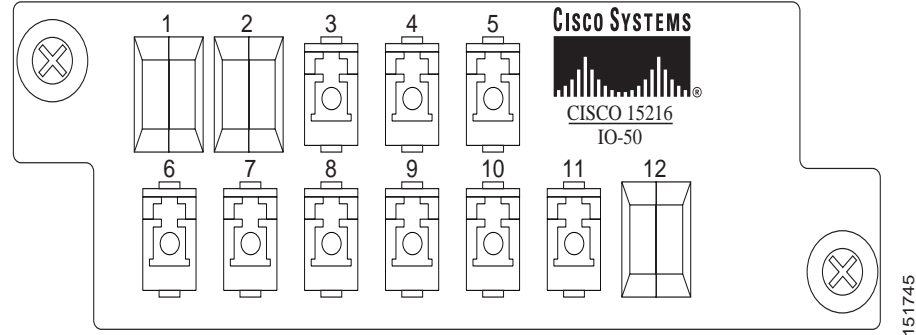


Figure 5 shows the corresponding optical ports on the front panel.



Figure 5 Front Panel Optical Ports



## Fiber Optic Connector Cleaning and Maintenance

Connector cleaning is required to maintain the performance of fiber-optic circuits. It is important that both the LC/UPC connector at the end of the fiber-optic cable and the mating bulkhead adapter on the front panel of the ONS 15216-ID-50 are clean before the connection is made.



Warning

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The following warning applies to disposal of chemicals and other materials used to clean connectors and adapters.



Warning

**Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040



Note

Before installing the fiber-optic cable, always perform the cleaning procedure for cable connectors described in the following section. Whenever possible, inspect each connector before connecting it to the mating bulkhead adapter on the ONS 15216-ID-50 front panel.



Note

The LC bulkhead adapters on the ONS 15216-ID-50 front panel are less likely to get dirty if they are capped when not in use. Because the procedure for a thorough cleaning of these adapters is complicated and involves opening the ONS 15216-ID-50 module, Cisco recommends that you use a commercially available cleaning kit and closely follow the instructions included with the kit. Only a simple, routine cleaning procedure for these adapters that can be easily performed by the customer is described here.

## Customer Supplied Cleaning Materials

These cleaning materials are recommended but are not supplied with the ONS 15216-ID-50 module:

- Reagent grade ethyl alcohol in an alcohol dispenser
- Lint free laboratory wipes

- Clean, dry, oil-free compressed air

When cleaning a paired cable connector (bulkhead mating adapter), always clean the mating adapter first.

If properly maintained (only used with clean, defect-free fiber connectors and capped when not in use), the mating adapter should not require cleaning. However, if you suspect the adapter is dirty, clean it by blowing with clean, dry, oil-free compressed air.

## Clean the Bulkhead Mating Adapters

---

**Step 1** Read the manufacturer instructions to properly use the compressed air can.



**Note** Improper use of compressed air may cause more contamination to the part being cleaned and defeat the purpose of cleaning the bulkhead mating adapters.

---

**Step 2** Before blowing the adapter clean, release a short blast of compressed air to remove any dust inside the nozzle of the compressed air can.

**Step 3** Blow three to four short blasts of air into the adapter housing to remove any dust.



**Note** Always keep unused adapter ports and fiber connectors capped with a clean dust cap.

---

## Clean Fiber-Optic Cable Connectors

---

**Step 1** Fold a clean wipe several times to get a pad of six to eight layers of material.

**Step 2** Remove the protective cap on the LC/UPC optical fiber cable connector.

**Step 3** Dampen (but do not soak) a corner of the pad with alcohol using the alcohol dispenser.

**Step 4** Firmly press the tip of the ferrule into the alcohol-moistened area of the wipe. Pinch the wipe firmly with your fingers against the ferrule and twist the ferrule to firmly wipe the ferrule. Repeat this step three times, using a clean alcohol-moistened area each time.



**Note** The design of the LC connector makes it difficult to clean the entire perimeter of the ferrule, because only a small portion close to the ferrule tip is accessible. Clean the tip of the ferrule and the entire accessible perimeter. Keep the fiber connector capped at all times when not in use.

---

**Step 5** Press the ferrule tip into a clean, dry spot on the wipe and perform the pinch-and-twist procedure described in Step 4 once.

**Step 6** Discard the used wipe.

**Step 7** (Optional) A couple of short blasts of clean, dry, oil-free compressed air should remove any tissue fragments that may have been deposited on the ferrule during cleaning.

**Step 8** Whenever possible, inspect the ferrule end-face to ensure that the cleaning procedure effectively removed the dust/dirt from the ferrule and that no cleaning-induced damages are present.

**Step 9** If the ferrule end-face is still dirty, repeat Steps 1 through 8.

- Step 10** If the ferrule shows damages (for example, scratches or pits across the fiber core), replace the fiber patch cord with a new one equipped with a defect-free connector.
- Defects on the fiber cable connector are likely to damage the mating connector inside the ONS 15216-ID-50, which results in more costly repairs.
- Step 11** If the ferrule end-face is clean and damage-free, place the connector into the corresponding clean mating adapter on the ONS 15216-ID-50 front panel following the instructions in the next section.

## Install and Route Fiber-Optic Cables



**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051



**Caution**

When connecting an optical fiber patch cord between the ONS 15216-ID-50 and the optical card ports in the ONS 15454, use the electrostatic discharge wristband supplied with the ONS 15454. Plug the wristband into the ESD jack on the lower right front side of the ONS 15454.



**Note**

Always clean all fiber connectors thoroughly before making the connection with the mating adapter. Very small particles can permanently damage the end of the mating fiber inside the ONS 15216-ID-50 module, which makes regular cleaning imperative. For cleaning instructions see [“Fiber Optic Connector Cleaning and Maintenance” section on page 9](#).



**Note**

The ONS 15216-ID-50 front panel features LC/UPC bulkhead adapters. Always use fiber-optic cables equipped with the corresponding (LC/UPC) connector type. Using any other type of connector results in damage to the connector and/or adapter.

- Step 1** Place the LC/UPC cable connector in front of the corresponding bulkhead adapter on the front panel of the ONS 15216-ID-50.
- Step 2** Align the keyed ridge of the cable connector with the slot in the receiving adapter.
- Step 3** Gently push the cable connector into the adapter until you hear a click, which indicates that the latching system is engaged.
- Step 4** Open the fiber guide by pulling the fiber guide locker on the appropriate side of the front panel. The top is secured by a spring-ball screw that enables the fiber guide locker to be easily opened or closed.
- Step 5** Route the fiber cables through the fiber guide and lock them into place using the fiber guide locker.

# Operation

This section explains how to monitor performance on the ONS 15216-ID-50 module and how to remove the module from the Cisco ONS 15216 FlexLayer shelf assembly.

## Monitoring Performance

The ONS 15216-ID-50 module uses Optical Test Access Port (TAP) devices to enable passive access and monitoring in the fiber-optic network. The TAPs enable network-based intrusion detection system sensors to operate efficiently without interruption. They send traffic data to a monitoring device by splitting the network signal, without introducing delay or changing the content or structure of the information contained in the packets. An OSA (Optical Spectrum Analyzer) or PM (Power Meter) can be used for optical power monitoring and optical analysis.

Table 3 shows the manufacturer-specified TAP split ratios for the TAP coupler’s optical power in the ONS 15216-ID-50 module. The split ratio denotes the ratio of the TAP input signal to the output signal.

**Table 3** *Manufacturer-Specified TAP Split Ratio*

Parameter	Condition	Min.	Max	Units
MON Loss <sup>1</sup>	TX-MON (TAP 1) with respect to COM-TX	18.5	21.5	dB
	ODD-TX-MON (TAP 2) with respect to ODD-TX	24	27	dB
	EVEN-TX-MON (TAP 3) with respect to EVEN-TX	24	27	dB

1. The Insertion Loss value is measured as the maximum IL inside the range 1530.33 to 1561.83 nm.

## Remove the Module

This procedure describes the steps for removing the ONS 15216-ID-50 module from the FlexLayer shelf.

- 
- Step 1** Disconnect the fiber-optic connectors.
  - Step 2** Open the fiber guide by pulling the fiber guide locker on the appropriate side of the front panel. The top is secured by a spring-ball screw that enables the fiber guide locker to be easily opened or closed.
  - Step 3** Gently pull the cable connector out of the adapter.
  - Step 4** Slide the module out of the assembly.
- 

## Reference

This section contains optical, environmental, equipment, and mechanical specifications for the ONS 15216-ID-50 module.

# Optical Specifications



Note

All optical specifications in [Table 4](#) are guaranteed within the whole operating temperature, for all SOP (State of Polarization), and over -0.5dB clear bandwidth except those specially defined.

**Table 4** *Optical Specifications*

Parameter	Condition	Min.	Max	Units
Wavelength Range		1530.33	1561.83	nm
-0.50 dB Clear Bandwidth	23 to 32 F (-5 to 0 C)	-8	+8	GHz
	32 to 131 F (0 to 55 C)	-10	+10	GHz
-1.0 dB Clear Bandwidth	23 to 32 F (-5 to 0 C)	-10	+10	GHz
	3° to 131 F (0 to 55 C)	-12	+12	GHz
Number of channel		80		
Insertion Loss <sup>1</sup> DEMUX	COM-RX → ODD-TX	1.5	2.5	dB
	COM-RX → EVEN-TX			
Insertion Loss <sup>2</sup> MUX	ODD-RX → COM-TX	1	2	dB
	EVEN-RX → COM-TX			
MON Loss <sup>3</sup>	TX-MON (TAP 1) with respect to COM-TX	18.5	21.5	dB
	ODD-TX-MON (TAP 2) with respect to ODD-TX	24	27	dB
	EVEN-TX-MON (TAP 3) with respect to EVEN-TX	24	27	dB
Adjacent Channel Isolation <sup>4</sup> DEMUX	COM-RX → ODD-TX	25		dB
	COM-RX → EVEN-TX			
Adjacent Channel Isolation MUX	ODD-RX → COM-TX	20		dB
	EVEN-RX → COM-TX			
Channels Band Ripple <sup>5</sup>	Each ITU channel over 8 GHz Clear Bandwidth		0.40	dB
Insertion Loss Uniformity <sup>6</sup>			0.50	dB
Optical Return Loss	All Ports	45		dB
Directivity	All Ports that Apply	45		dB
PMD <sup>7</sup> DEMUX	All Channels		0.30	ps
PMD MUX	All Channels		0.30	ps
PDL <sup>8</sup> DEMUX	All Channels		0.40	dB
PDL MUX	All Channels		0.40	dB
Chromatic Dispersion <sup>9</sup>	All Channels	-20	+20	ps/nm
Optical Power			500	mW

1. The Insertion Loss values are measured as the maximum IL inside the Operating Wavelength Bandwidth ( 80 pm, centred on each ITU wavelength of the channel).
2. The Insertion Loss values are measured as the maximum IL inside the Operating Wavelength Bandwidth.
3. The Insertion Loss value is measured as the maximum IL inside the range 1530.33 to 1561.83 nm.
4. Adjacent Channel Isolation is defined as the difference between the maximum IL in the 50 GHz transmitted channel Bandwidth (ITU 80 pm) and the minimum IL measured over the Operating Wavelength Bandwidth of both adjacent 50 GHz channels.
5. Ripple is defined as the difference between the minimum and the maximum IL values measured within the overall Operating Wavelength Bandwidth, centred on each ITU wavelength of the channel.
6. Insertion Loss Uniformity is defined as the difference between the maximum insertion losses over any two operating wavelength bandwidths.
7. PMD (Polarization Mode Dispersion) is defined as the maximum of the DGD versus the wavelength curve in the 50GHz transmitted channel bandwidth (Operating Wavelength Bandwidth).
8. PDL (Polarization Dependent Loss) is defined as the difference between the maximum and minimum IL in the 50GHz transmitted channel Bandwidth (Operating Wavelength Bandwidth) evaluated at all SOP, measured at a given wavelength.
9. Chromatic Dispersion is defined as the maximum of derivative of the Group Delay versus the wavelength curve in the 50GHz transmitted channel bandwidth (Operating Wavelength Bandwidth).

## Mechanical Specifications

The 15216-ID-50 module is provided with all required pigtailed. The mechanical dimensions of the package are indicated in [Table 5](#).

**Table 5** *Mechanical Specifications*

Parameter	Condition	JDSU Specification
Fiber Type	Single Mode Fiber	900 pm, SMF-28 or equivalent
Connector Type	All Ports	LC/UPC II
Adapter Type	All Ports	LC
Module Dimensions (Cassette Package Size)		1.50 in x 4.60 in x 7.15 in
		3.8 cm x 11.68 cm x 18.16 cm

## Cisco ONS 15216 FlexLayer Compatibility Specifications

Four ONS 15216-ID-50 modules can fit in 1RU Cisco ONS 15216 chassis. For reference, [Table 6](#) lists the ONS 15216 FlexLayer chassis information.

**Table 6** *ONS 15216 FlexLayer Chassis Information*

CISCO PN	P.ID	DESCRIPTION
74-3232-XX	15216-FLA-SA=	FlexLayer Four-Slot Shelf Assembly

## Environmental Specifications

*Table 7 Environmental Performance Specifications*

Environmental Condition	MIN	MAX	Units
Operating Temperature	23	131	Fahrenheit
	-5	55	Celsius
Storage Temperature	-40	185	Fahrenheit
	-40	85	Celsius
Operating Humidity	5	95	%RH
Storage Humidity	5	95	%RH

## Where to Find Safety and Warning Information

Before installing, operating, or servicing the ONS 15216-ID-50 module, read the *Cisco Optical Transport Products Safety and Compliance Information* document that accompanies the product. This publication describes the international agency compliance and safety information for the Cisco ONS 15xxx systems. It also includes translations of the safety warnings that appear in the ONS 15xxx system documentation.

## Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

### Cisco.com

You can access the most current Cisco documentation at this URL:

<http://www.cisco.com/techsupport>

You can access the Cisco website at this URL:

<http://www.cisco.com>

You can access international Cisco websites at this URL:

[http://www.cisco.com/public/countries\\_languages.shtml](http://www.cisco.com/public/countries_languages.shtml)

## Product Documentation DVD

The Product Documentation DVD is a comprehensive library of technical product documentation on a portable medium. The DVD enables you to access multiple versions of installation, configuration, and command guides for Cisco hardware and software products. With the DVD, you have access to the same HTML documentation that is found on the Cisco website without being connected to the Internet. Certain products also have PDF versions of the documentation available.

The Product Documentation DVD is available as a single unit or as a subscription. Registered Cisco.com users (Cisco direct customers) can order a Product Documentation DVD (product number DOC-DOCDVD= or DOC-DOCDVD=SUB) from Cisco Marketplace at this URL:

<http://www.cisco.com/go/marketplace/>

## Cisco Optical Networking Product Documentation CD-ROM

Optical networking-related documentation, including Cisco ONS 15xxx product documentation, is available in a CD-ROM package that ships with your product. The Optical Networking Product Documentation CD-ROM is updated periodically and may be more current than printed documentation.

## Ordering Documentation

Registered Cisco.com users may order Cisco documentation at the Product Documentation Store in the Cisco Marketplace at this URL:

<http://www.cisco.com/go/marketplace/>

Nonregistered Cisco.com users can order technical documentation from 8:00 a.m. to 5:00 p.m. (0800 to 1700) PDT by calling 1 866 463-3487 in the United States and Canada, or elsewhere by calling 011 408 519-5055. You can also order documentation by e-mail at [tech-doc-store-mkpl@external.cisco.com](mailto:tech-doc-store-mkpl@external.cisco.com) or by fax at 1 408 519-5001 in the United States and Canada, or elsewhere at 011 408 519-5001.

## Documentation Feedback

You can rate and provide feedback about Cisco technical documents by completing the online feedback form that appears with the technical documents on Cisco.com.

You can submit comments about Cisco documentation by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems  
Attn: Customer Document Ordering  
170 West Tasman Drive  
San Jose, CA 95134-9883

We appreciate your comments.

## Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

[http://www.cisco.com/en/US/products/products\\_security\\_vulnerability\\_policy.html](http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html)

From this site, you will find information about how to:

- Report security vulnerabilities in Cisco products.
- Obtain assistance with security incidents that involve Cisco products.
- Register to receive security information from Cisco.



A current list of security advisories, security notices, and security responses for Cisco products is available at this URL:

<http://www.cisco.com/go/psirt>

To see security advisories, security notices, and security responses as they are updated in real time, you can subscribe to the Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed. Information about how to subscribe to the PSIRT RSS feed is found at this URL:

[http://www.cisco.com/en/US/products/products\\_psirt\\_rss\\_feed.html](http://www.cisco.com/en/US/products/products_psirt_rss_feed.html)

## Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you have identified a vulnerability in a Cisco product, contact PSIRT:

- For Emergencies only—[security-alert@cisco.com](mailto:security-alert@cisco.com)

An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- For Nonemergencies—[psirt@cisco.com](mailto:psirt@cisco.com)

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532



Tip

We encourage you to use Pretty Good Privacy (PGP) or a compatible product (for example, GnuPG) to encrypt any sensitive information that you send to Cisco. PSIRT can work with information that has been encrypted with PGP versions 2.x through 9.x.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

[http://www.cisco.com/en/US/products/products\\_security\\_vulnerability\\_policy.html](http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html)

The link on this page has the current PGP key ID in use.

If you do not have or use PGP, contact PSIRT at the aforementioned e-mail addresses or phone numbers before sending any sensitive material to find other means of encrypting the data.

## Obtaining Technical Assistance

Cisco Technical Support provides 24-hour-a-day award-winning technical assistance. The Cisco Technical Support & Documentation website on Cisco.com features extensive online support resources. In addition, if you have a valid Cisco service contract, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not have a valid Cisco service contract, contact your reseller.

## Cisco Technical Support & Documentation Website

The Cisco Technical Support & Documentation website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, at this URL:

<http://www.cisco.com/techsupport>

Access to all tools on the Cisco Technical Support & Documentation website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>



### Note

Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

## Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests, or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)

EMEA: +32 2 704 55 55

USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

## Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—An existing network is down, or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of the network is impaired, while most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

## Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Quick Reference Guide* is a handy, compact reference tool that includes brief product overviews, key features, sample part numbers, and abbreviated technical specifications for many Cisco products that are sold through channel partners. It is updated twice a year and includes the latest Cisco offerings. To order and find out more about the Cisco Product Quick Reference Guide, go to this URL:

<http://www.cisco.com/go/guide>

- Cisco Marketplace provides a variety of Cisco books, reference guides, documentation, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

<http://www.cisco.com/go/marketplace/>

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

<http://www.cisco.com/packet>

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

or view the digital edition at this URL:

<http://ciscoiq.texterity.com/ciscoiq/sample/>


- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:  
<http://www.cisco.com/ipj>
- Networking products offered by Cisco Systems, as well as customer support services, can be obtained at this URL:  
<http://www.cisco.com/en/US/products/index.html>
- Networking Professionals Connection is an interactive website for networking professionals to share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:  
<http://www.cisco.com/discuss/networking>
- World-class networking training is available from Cisco. You can view current offerings at this URL:  
<http://www.cisco.com/en/US/learning/index.html>

CCSP, CCVP, the Cisco Square Bridge logo, Follow Me Browsing, and StackWise are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn, and iQuick Study are service marks of Cisco Systems, Inc.; and Access Registrar, Aironet, BPX, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, FormShare, GigaDrive, GigaStack, HomeLink, Internet Quotient, IOS, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, LightStream, Linksys, MeetingPlace, MGX, the Networkers logo, Networking Academy, Network Registrar, *Packet*, PIX, Post-Routing, Pre-Routing, ProConnect, RateMUX, ScriptShare, SlideCast, SMARTnet, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0601R)

Any Internet Protocol (IP) addresses used in this document are not intended to be actual addresses. Any examples, command display output, and figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses in illustrative content is unintentional and coincidental.

© 2006 Cisco Systems, Inc. All rights reserved.

 Printed in the USA on recycled paper containing 10% postconsumer waste.