Installation Note for the Cisco CWDM Passive Optical System

Product Numbers: CWDM-MUX-AD-1470=, CWDM-MUX-AD-1490=, CWDM-MUX-AD-1510=, CWDM-MUX-AD-1530=, CWDM-MUX-AD-1550=, CWDM-MUX-AD-1570=, CWDM-MUX-AD-1590=, CWDM-MUX-AD-1610=, CWDM-MUX-4=, CWDM-MUX-8=, CWDM-MUX-4-SF1=, CWDM-MUX-4-SF2=, CWDM-CHASSIS-2=

This installation note provides the technical specifications and installation instructions for the Cisco Coarse Wave Division Multiplexer (CWDM) passive optical system.

Contents

This installation note contains the following sections:

CISCO SYSTEMS

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

Overview

The Cisco CWDM passive optical system provides optical networking support for high-speed data communication for metropolitan area networks (MANs) over a grid of eight CWDM optical wavelengths in both ring or point-to-point configurations.

The Cisco CWDM passive optical system includes the following components:

- 2-slot chassis for Cisco Optical Add/Drop Multiplexers (OADMs)
- CWDM OADMs
  - Dual single-channel OADMs
  - 4-channel OADM
  - 8-channel multiplexer/demultiplexer
  - Single fiber 4-channel multiplexer/demultiplexers
- CWDM GBICs

CWDM 2-Slot Chassis

The CWDM 2-slot chassis (CWDM-CHASSIS-2) is a standard 19-inch chassis that is one rack unit (RU) in height. Each CWDM 2-slot chassis can hold two CWDM OADM modules. You can install the CWDM 2-slot chassis in the same equipment rack as your system or in an adjacent rack so that you can connect the OADMs to the CWDM GBICs.

CWDM OADMs

The CWDM OADMs are passive devices that can multiplex/demultiplex or add/drop wavelengths from multiple fibers onto one optical fiber. The OADM connectors are interfaced to the color-matching CWDM GBICs on the equipment side. All the modules are the same size. The CWDM 2-slot chassis allows you to rack mount up to two CWDM OADMs in a single rack unit. There are four different types of CWDM OADMs:

- Dual Single-Channel OADMs (CWDM-MUX-AD-xxxx—Allows you to add/drop two channels of the same wavelength into the two directions of an optical ring. The other wavelengths are passed through the OADM. Dual fiber is used for both the network and the CWDM GBIC connections. Eight versions of this OADM are available, one for each wavelength of light. (See Table 1.) The dual single-channel OADMs are color coded and match the color coding of the CWDM GBICs.

Table 1   Dual Single-Channel OADMs

Product Number	Description	Connector Color Code
CWDM-MUX-AD-1470=	Dual single-channel OADM (1470 nm)	Gray
CWDM-MUX-AD-1490=	Dual single-channel OADM (1490 nm)	Violet
CWDM-MUX-AD-1510=	Dual single-channel OADM (1510 nm)	Blue
CWDM-MUX-AD-1530=	Dual single-channel OADM (1530 nm)	Green

Table 1   Dual Single-Channel OADMs (continued)

Product Number	Description	Connector Color Code
CWDM-MUX-AD-1550=	Dual single-channel OADM (1550 nm)	Yellow
CWDM-MUX-AD-1570=	Dual single-channel OADM (1570 nm)	Orange
CWDM-MUX-AD-1590=	Dual single-channel OADM (1590 nm)	Red
CWDM-MUX-AD-1610=	Dual single-channel OADM (1610 nm)	Brown

- 4-Channel OADM (CWDM-MUX-4=)—Allows you to add/drop four channels (with different wavelengths) into one direction of an optical ring. The other wavelengths are passed through the OADM. Dual fiber is used for both the network and the GBIC connections. The four wavelengths are set to 1470 nm, 1510 nm, 1550 nm, and 1590 nm.

- 8-Channel Multiplexer/Demultiplexer (CWDM-MUX-8=)—Allows you to multiplex/demultiplex eight separate channels into one pair of fiber. Dual fiber is used for both the network and the GBIC connections. The eight available wavelengths are 1470 nm, 1490 nm, 1510 nm, 15300 nm, 1550 nm, 1570 nm, 1590 nm, and 1610 nm.

- Single-Fiber 4-Channel Multiplexer/Demultiplexer (CWDM-MUX-4-SFx=)—Allows you to multiplex/demultiplex four separate channels into one strand of fiber. Dual fiber is used for the connections to the GBICs and single fiber is used for the network connections. The two models (CWDM-MUX-4-SF1= and CWDM-MUX-4-SF2=) must be used together to create a four-channel single-fiber point-to-point link. This module uses the same CWDM GBICs as all of the other CWDM OADMs.

See Table 2 for a comparison of the CWDM passive device types.

Table 2   CWDM Passive Device Type Comparison

Product Number	Device Type	Number of Fiber Strands to the Network	Number of Gigabit Ethernet Links (Maximum)	Network Architecture Options
CWDM-MUX-AD-xxxx=	OADM (dual add/drop)	2	8	Ring (point-to-point possible)
CWDM-MUX-4=	OADM	2	8	Ring, point-to-point
CWDM-MUX-8=	Mux/Demux	2	8	Ring, point-to-point
CWDM-MUX-4-SFx=	Mux/Demux	1	4	Point-to-point only

Figure 1 shows the front panel of the CWDM 4-channel OADM module. Figure 2 shows the CWDM 8-channel multiplexer/demultiplexer module. Figures 3 through 10 show the dual single-channel OADM modules for each of the available wavelengths.

The OADM module ports are color coded to help with installation. Each color indicates the wavelength of the port. For more information about the color codes, see the "Connecting the CWDM Passive Optical System to Your System" section on page 14. Figure 11 and Figure 12 show the front panels of the CWDM 4-channel multiplexer/demultiplexer modules (CWDM-MUX-4-SF1 and CWDM-MUX-4-SF2).
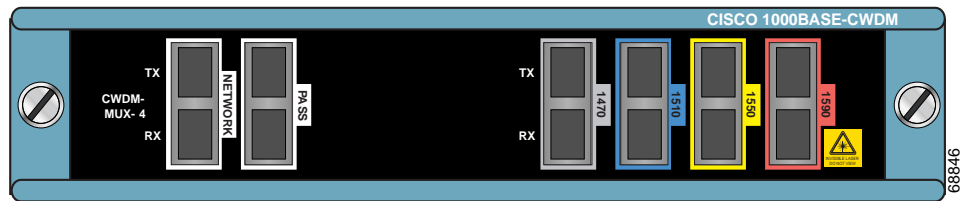
Figure 1   4-Channel OADM (CWDM-MUX-4) Front Panel

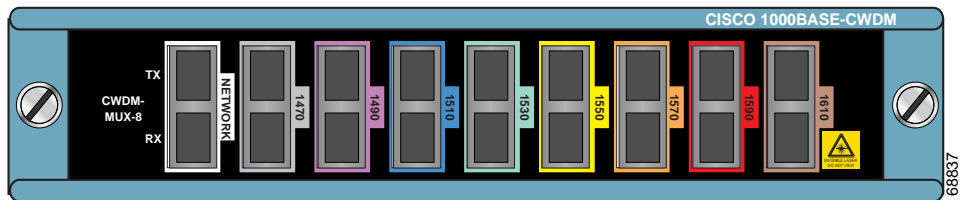*Figure 2   8-Channel Multiplexer/Demultiplexer (CWDM-MUX-8) Front Panel*

Figure 3   Dual Single-Channel OADM Front Panel (1470 nm)

Figure 4   Dual Single-Channel OADM Front Panel (1490 nm)

Figure 5   Dual Single-Channel OADM Front Panel (1510 nm)
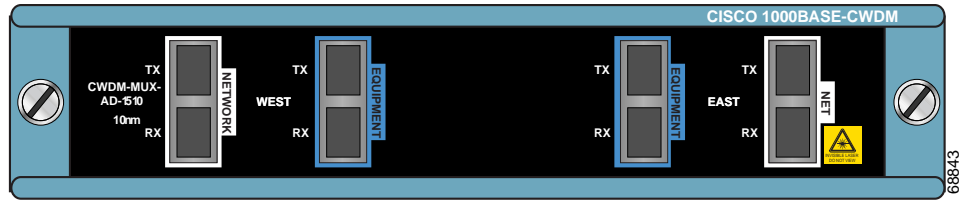

Figure 6   Dual Single-Channel OADM Front Panel (1530 nm)

Figure 7   Dual Single-Channel OADM Front Panel (1550 nm)

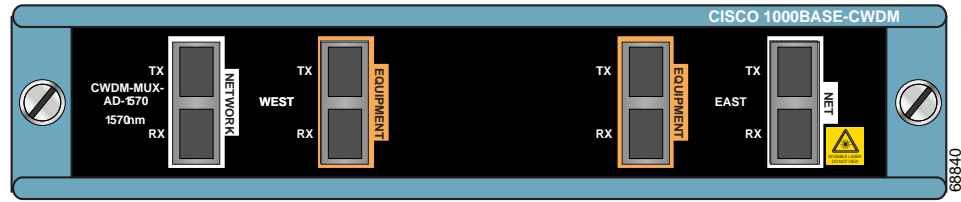*Figure 8   Dual Single-Channel OADM Front Panel (1570 nm)*

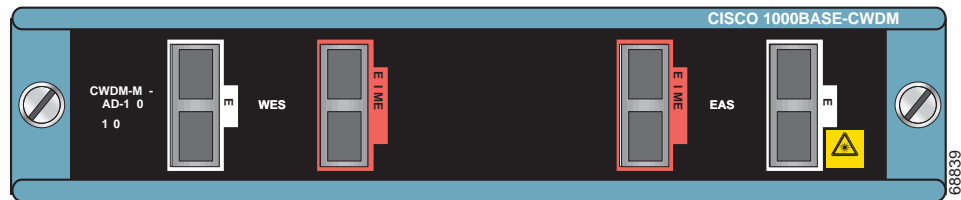*Figure 9   Dual Single-Channel OADM Front Panel (1590 nm)*

Figure 10   Dual Single-Channel OADM Front Panel (1610 nm)

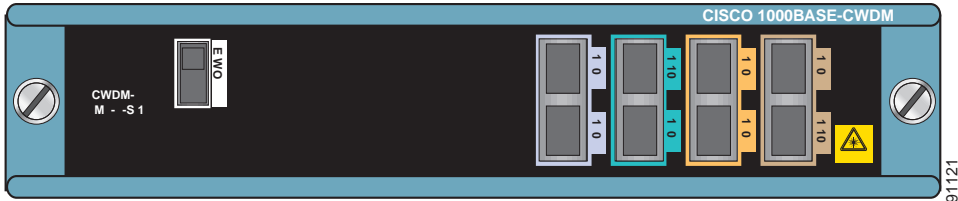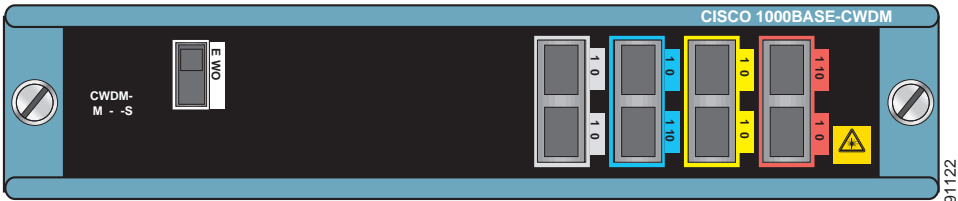*Figure 11   Single-Fiber 4-Channel Multiplexer/Demultiplexer (CWDM-MUX-4-SF1) Front Panel*

Figure 12   Single-Fiber 4-Channel Multiplexer/Demultiplexer (CWDM-MUX-4-SF2) Front Panel

CWDM GBICs

A CWDM GBIC is a hot-swappable input/output device that links your switching module to the CWDM passive optical system using a pair of single-mode fiber-optic cables. You can connect your multiplexed/demultiplexed wavelengths and added/dropped channels to CWDM GBICs that are installed in your system.

CWDM GBICs are available in eight wavelengths (see Table 3.) Each GBIC is color coded to match the connector colors on the OADM modules.

Table 3   CWDM GBICs

Product Number	Description	Connector Color Code
CWDM-GBIC-1470=	1000BASE-CWDM, 1470 nm	Gray
CWDM-GBIC-1490=	1000BASE-CWDM, 1490 nm	Violet
CWDM-GBIC-1510=	1000BASE-CWDM, 1510 nm	Blue
CWDM-GBIC-1530=	1000BASE-CWDM, 1530 nm	Green

Table 3   CWDM GBICs (continued)

Product Number	Description	Connector Color Code
CWDM-GBIC-1550=	1000BASE-CWDM, 1550 nm	Yellow
CWDM-GBIC-1570=	1000BASE-CWDM, 1570 nm	Orange
CWDM-GBIC-1590=	1000BASE-CWDM, 1590 nm	Red
CWDM-GBIC-1610=	1000BASE-CWDM, 1610 nm	Brown

For information on installing, removing, and maintaining the CWDM GBICs, refer to the *CWDM GBIC Installation Note* that accompanies the CWDM GBICs.

Safety Overview

Throughout this publication, safety warnings appear in procedures that, if performed incorrectly, can harm you. A warning symbol precedes each warning statement.

Warning Definition

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung WICHTIGE SICHERHEITSANWEISUNGEN

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem! FONTOS BIZTONSÁGI ELÕÍRÁSOK

Ez a figyelmezetõ jel veszélyre utal. Sérülésveszélyt rejtõ helyzetben van. Mielõtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplõ figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ÕRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban találhatók.

Avvertenza   IMPORTANTI ISTRUZIONI SULLA SICUREZZA

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel   VIKTIGE SIKKERHETSINSTRUKSJONER

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso   INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GUARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡Advertencia!   INSTRUCCIONES IMPORTANTES DE SEGURIDAD

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GUARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

Предупреждение ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ
Примечание Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告 有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意 保存这些说明
注意 本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注 これらの注意事項を保管しておいてください。
注 この資料は、製品に付属のインストレーション ガイドと併用してください。詳細は、インストレーション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

Warning   **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

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

Hardware Requirements

Use single-mode fiber-optic cable with SC connectors to connect the CWDM passive optical system to your system.

Required Tools

You will need these tools to install the CWDM passive optical system:

- Wrist strap or other personal grounding device
- Antistatic mat or antistatic foam
- Number 1 and number 2 Phillips screwdrivers for the captive installation screws on most modules

Installing the CWDM Passive Optical System

The following sections provide the installation procedures for the components:

Installing the 2-Slot Chassis

Note   Ensure that you install the 2-slot chassis in the same rack or an adjacent rack to your system so that you can connect all the cables between your CWDM OADM modules and the CWDM GBICs in your system.
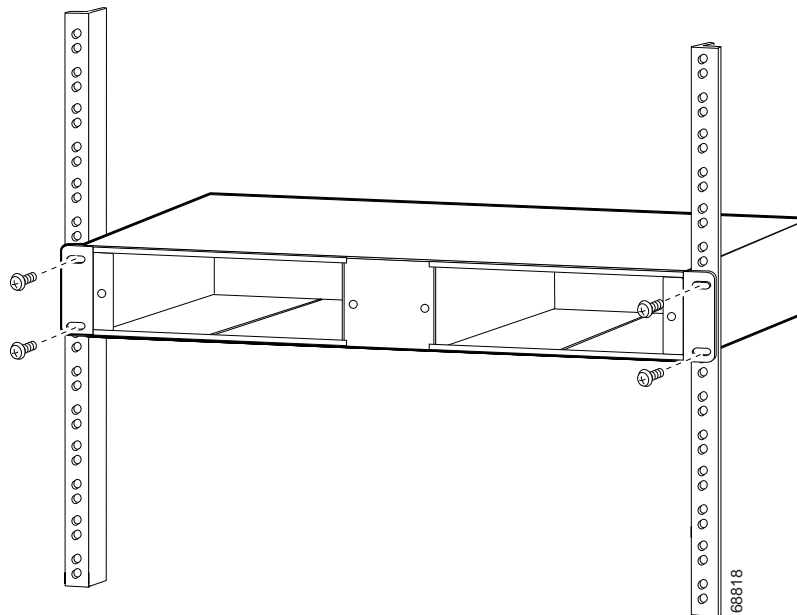
Caution   When performing the following procedures, wear a grounding strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap.

To mount the 2-slot chassis in an equipment rack, follow these steps:

Step 1 Align the mounting holes in the L brackets with the mounting holes in the equipment rack.

Step 2 Secure the 2-slot chassis using four (two per side) 12-24 x 3/4-inch screws through the elongated holes in the L bracket and into the threaded holes in the mounting post. (See Figure 13.)

Step 3 Use a tape measure and level to ensure that the 2-slot chassis is mounted straight and level.

Figure 13   Mounting the 2-Slot Chassis in the Rack

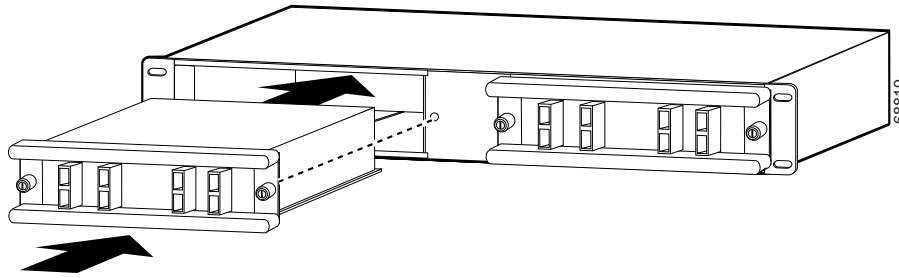# Installing the CWDM OADM and Multiplexer/Demultiplexer Modules

⚠

Caution When performing the following procedures, wear a grounding strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap.

To install the CWDM OADM or multiplexer/demultiplexer modules, follow these steps:

Step 1 Loosen the captive screws on the blank plug-in module faceplate and remove the faceplate.

Step 2 Align the CWDM OADM module or the multiplexer/demultiplexer module with the slot on the 2-slot chassis. (See Figure 14.)

Figure 14   Installing a CWDM OADM or Multiplexer/Demultiplexer Module

Step 3 Gently push the OADM or multiplexer/demultiplexer module into the 2-slot chassis slot. Ensure that you line up the captive screws on the OADM or multiplexer/demultiplexer module with the screw holes on the 2-slot chassis.

Step 4 Tighten the two captive screws.

Removing the CWDM OADM or Multiplexer/Demultiplexer Module

⚠️
Caution When performing the following procedures, wear a grounding strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap.

To remove the CWDM OADM module or the multiplexer/demultiplexer module, follow these steps:

Step 1 Loosen the captive screw on each side of the OADM module or the multiplexer/demultiplexer module using a screwdriver.

Step 2 Gently pull on both captive screws to release the OADM module or the multiplexer/demultiplexer module from the 2-slot chassis.

Step 3 Pull the OADM module or the multiplexer/demultiplexer module out of the 2-slot chassis.

Step 4 Replace the blank module faceplate if you do not intend to install another OADM or multiplexer/demultiplexer module.

Installing, Removing, and Maintaining CWDM GBICs

For information on installing, removing, and maintaining the CWDM GBICs, refer to the *CWDM GBIC Installation Note* that accompanies the CWDM GBICs.

Connecting the CWDM Passive Optical System to Your System

Use the CWDM passive optical system connector color codes shown in Table 4 to help you connect the CWDM passive optical system to your system.

Table 4   CWDM Passive Optical System Connector Color Codes

Color	Connector (Wavelength) Descriptions
Gray	Longwave 1470 nm laser single mode
Violet	Longwave 1490 nm laser single mode
Blue	Longwave 1510 nm laser single mode
Green	Longwave 1530 nm laser single mode
Yellow	Longwave 1550 nm laser single mode
Orange	Longwave 1570 nm laser single mode
Red	Longwave 1590 nm laser single mode
Brown	Longwave 1610 nm laser single mode

See Figure 1 through Figure 12 for the OADM and multiplexer/demultiplexer module front panels.

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

Connecting Cables to the Dual Single-Channel OADM Module

✎
Note   Make sure that the CWDM GBIC color matches the color of the OADM port to which it is connected.

To connect the cables to the dual single-channel OADM module, follow these steps (see Figure 15):

Step 1   Insert the CWDM GBICs into the appropriate connectors on your switch/router system if you have not already done so. For more information on CWDM GBICs, refer to the *CWDM GBIC Installation Note*.

✎
Note   Always use single-mode fiber-optic patch cables to connect dual single-channel OADM ports to the CWDM GBICs.

⚠️
Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.**

✎
Note   Clean all fiber-optic plugs on the cables before inserting the plugs into the fiber-optic connectors.
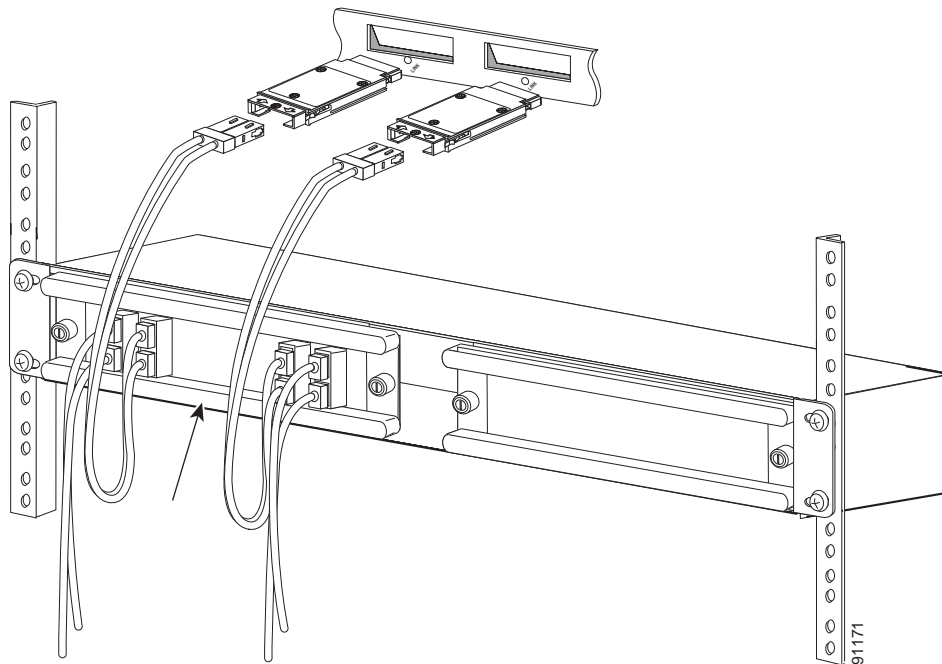
Step 2 Connect the single-mode fiber-optic cable from the CWDM GBIC (Tx/Rx) to the module equipment connectors (TX/RX).

✎

Note Connect the Tx ports to the Rx ports and the Rx ports to the Tx ports to ensure that the system operates correctly.

Step 3 If you use both channels of the module, repeat Step 2 for the second channel.

Step 4 Connect the west backbone single-mode fiber-optic cable to the module's NETWORK WEST connector, and connect the east backbone single-mode fiber-optic cable to the module's NETWORK EAST connector.

Figure 15   Cabling a CWDM Dual Single-Channel OADM Module

Connecting Cables to the CWDM 4-Channel OADM Module

> **Note** Make sure that the CWDM GBIC color matches the color of the OADM port to which it is connected.

To connect the cables to the CWDM 4-channel OADM module, follow these steps (see Figure 16):

Step 1 Insert the CWDM GBICs into the appropriate connectors on your switch/router system if you have not already done so. For more information on CWDM GBICs, refer to the *CWDM GBIC Installation Note*.

> **Note** Always use single-mode fiber-optic patch cables to connect the CWDM OADM ports to the CWDM GBICs.

> **Warning** **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.**

> **Note** Clean all fiber-optic plugs on the cables before inserting the plugs into the fiber-optic connectors.

Step 2 Connect the single-mode fiber-optic cables from the CWDM GBICs (Tx/Rx; up to four channels) to the 4-channel module equipment connectors (Tx/Rx; up to four wavelengths, including 1470 nm, 1510 nm, 1550 nm, 1590 nm).
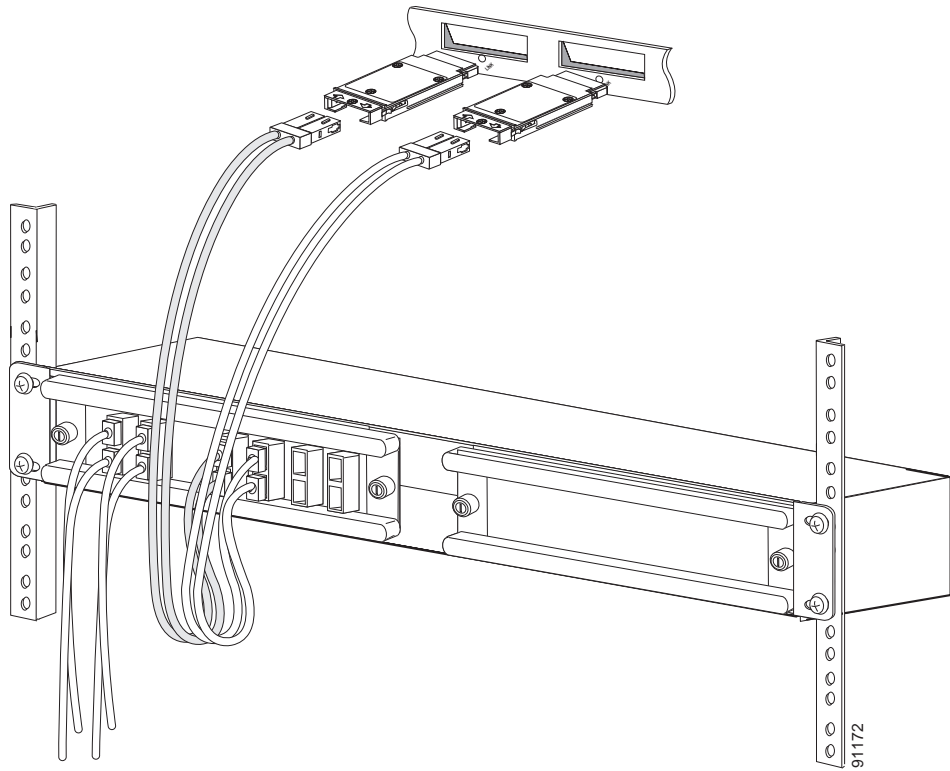
> **Note** Connect the Tx ports to the Rx ports and the Rx ports to the Tx ports to ensure that the system operates correctly.

Step 3 Connect the one backbone single-mode fiber-optic cable to the module's NETWORK connector, and connect the other backbone single-mode fiber-optic cable to the module's PASS connector.

Figure 16   Cabling a 4-Channel OADM Module

Connecting Cables to the CWDM 8-Channel Multiplexer/Demultiplexer Module

Note Make sure that the CWDM GBIC color matches the color of the OADM port to which it is connected.

To connect cables to a CWDM 8-channel multiplexer/demultiplexer module, follow these steps (see Figure 17):

Step 1 Insert the CWDM GBICs into the appropriate connectors on your switch/router system if you have not already done so. For more information on CWDM GBICs, refer to the *CWDM GBIC Installation Note*.

Note Clean all fiber-optic plugs on the cables before inserting the plugs into the fiber-optic connectors.

Note Always use single-mode fiber-optic patch cables to connect the 8-channel multiplexer/demultiplexer ports to the CWDM GBICs.

Warning **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.**

Step 2 Connect the single pair fiber-optic cables from the CWDM GBICs (Tx/Rx; up to eight channels) to the 8-channel multiplexer/demultiplexer module equipment connectors (Tx/Rx; up to eight wavelengths).
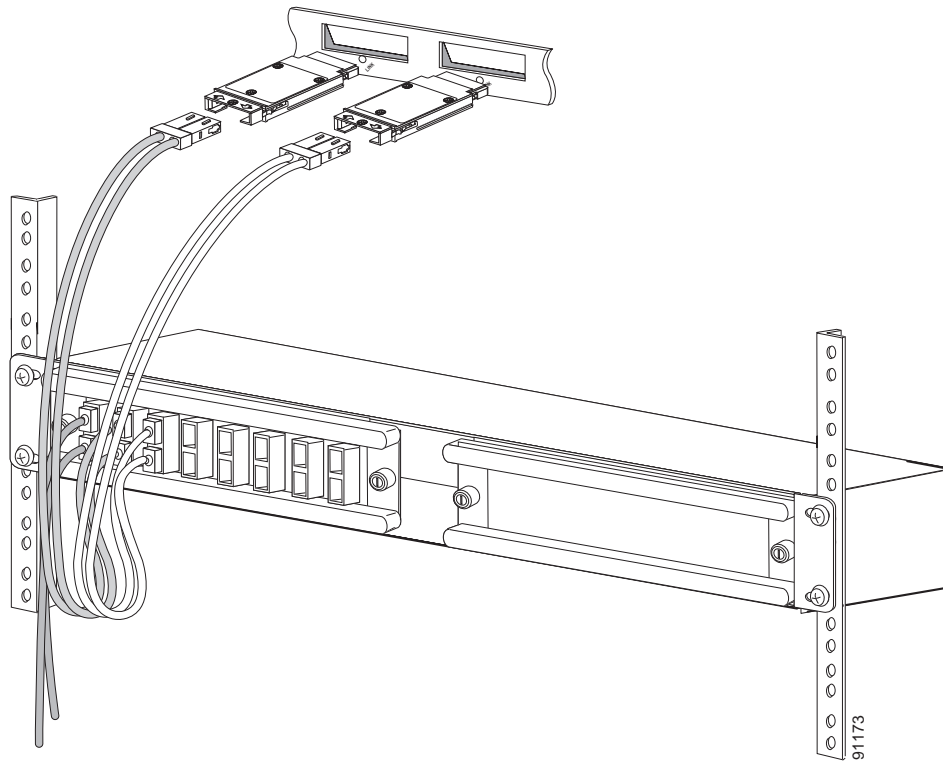
Note Connect the Tx ports to the Rx ports and the Rx ports to the Tx ports to ensure that the system operates correctly.

Step 3 Connect the backbone single pair fiber-optic cable to the multiplexer/demultiplexer module's NETWORK connector.

Figure 17   Cabling a CWDM 8-Channel Multiplexer/Demultiplexer Module

Connecting Cables to the Single-Fiber 4-Channel Multiplexer/Demultiplexer Module

Note   Make sure that the CWDM GBIC color matches the color of the OADM port to which it is connected.

To connect the cables to the single-fiber 4-channel multiplexer/demultiplexer module, follow these steps (see Figure 16):

Step 1   Insert the CWDM GBICs into the appropriate connectors on your switch/router system if you have not already done so. For more information on CWDM GBICs, refer to the *CWDM GBIC Installation Note*.

Note   Always use single-mode fiber-optic patch cables to connect single-fiber 4-channel multiplexer/demultiplexer ports to the CWDM GBICs.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.**

Note   Clean all fiber-optic plugs on the cables before inserting the plugs into the fiber-optic connectors.

Step 2   Connect the single-mode fiber-optic cables from the CWDM GBICs (Tx/Rx; up to four channels) to the single-fiber 4-channel multiplexer/demultiplexer module connectors (Tx/Rx; up to four wavelengths, including 1470 nm, 1510 nm, 1550 nm, 1590 nm).
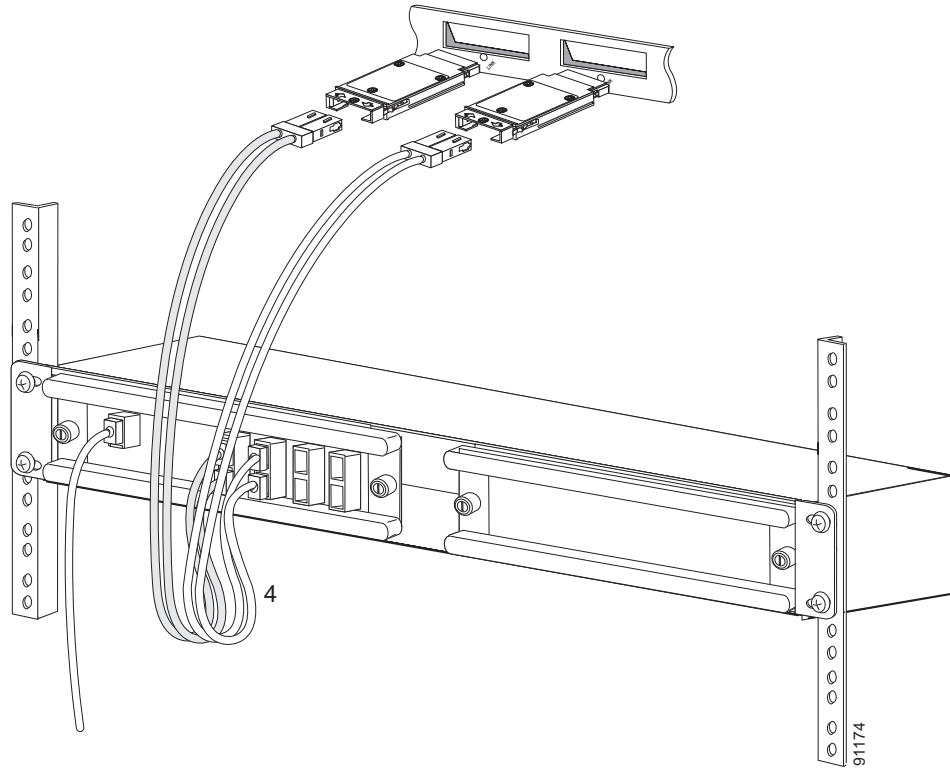
Note   Connect the Tx ports to the Rx ports and the Rx ports to the Tx ports to ensure that the system operates correctly.

Step 3   Connect the one backbone single-mode fiber-optic cable to the NETWORK connector.

Figure 18   *Cabling a Single-Fiber 4-Channel Multiplexer/Demultiplexer Module (CWDM-MUX-4-SF1/2)*

Specifications

Table 5 lists the environmental specifications for the CWDM OADM and multiplexer/demultiplexer modules. Table 6 lists the optical specifications for the CWDM OADM and multiplexer/demultiplexer modules.

Table 5   CWDM Passives Physical and Environmental Specifications

Item	Specification
Physical Characteristics	
Dimensions	8.35 x 1.75 x 8.7 in. (212 x 44 x 221 mm)
Weight	1.5 lbs. (0.68 kg)
Environmental	
Operating temperature	32 to 140 ºF (0 to 60ºC)
Storage temperature	-40 to 185ºF (–40 to 85ºC)

Table 6   CWDM OADM and Multiplexer/Demultiplexer Module Optical Specifications

Specification	CWDM-MUX-AD-xxxx	CWDM-MUX-4	CWDM-MUX-8	CWDM-MUX-4-SF1/2
Max Insertion Loss (dB)				
Add	1.9	4.0	4.0	3.0
Drop	2.3	5.0	5.0	3.0
Pass	2.0	2.6	–	–
Typical Insertion Loss (dB)				
Add	1.2	3.0	3.0	3.0
Drop	1.6	4.0	4.0	3.0
Pass	1.5	2.0	–	–
Isolation (dB)				
Add	>25	>8	>8	>30
Drop	>50	>50	>50	>30
Pass	>28	–	–	–

Translated Safety Warnings

This section contains the translations to the warnings that appear in this publication.

Installation Warning

Warning	**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**
Waarschuwing	**Deze apparatuur mag alleen worden geïnstalleerd, vervangen of hersteld door bevoegd geschoold personeel.**
Varoitus	**Tämän laitteen saa asentaa, vaihtaa tai huoltaa ainoastaan koulutettu ja laitteen tunteva henkilökunta.**
Attention	**Il est vivement recommandé de confier l'installation, le remplacement et la maintenance de ces équipements à des personnels qualifiés et expérimentés.**
Warnung	**Das Installieren, Ersetzen oder Bedienen dieser Ausrüstung sollte nur geschultem, qualifiziertem Personal gestattet werden.**
Figyelem!	**A berendezést csak szakképzett személyek helyezhetik üzembe, cserélhetik és tarthatják karban.**
Avvertenza	**Questo apparato può essere installato, sostituito o mantenuto unicamente da un personale competente.**
Advarsel	**Bare opplært og kvalifisert personell skal foreta installasjoner, utskiftninger eller service på dette utstyret.**
Aviso	**Apenas pessoal treinado e qualificado deve ser autorizado a instalar, substituir ou fazer a revisão deste equipamento.**
¡Advertencia!	**Solamente el personal calificado debe instalar, reemplazar o utilizar este equipo.**
Varning!	**Endast utbildad och kvalificerad personal bör få tillåtelse att installera, byta ut eller reparera denna utrustning.**
Предупреждение	Установку, замену и обслуживание этого оборудования может осуществлять только специально обученный квалифицированный персонал.
警告	只有经过培训且具有资格的人员才能进行此设备的安装、更换和维修。
警告	この装置の設置、交換、保守は、訓練を受けた相応の資格のある人が行ってください。

Product Disposal Warning

Warning	**Ultimate disposal of this product should be handled according to all national laws and regulations.**
Waarschuwing	**Het uiteindelijke wegruimen van dit product dient te geschieden in overeenstemming met alle nationale wetten en reglementen.**
Varoitus	**Tämä tuote on hävitettävä kansallisten lakien ja määräysten mukaisesti.**
Attention	**La mise au rebut ou le recyclage de ce produit sont généralement soumis à des lois et/ou directives de respect de l'environnement. Renseignez-vous auprès de l'organisme compétent.**
Warnung	**Die Entsorgung dieses Produkts sollte gemäß allen Bestimmungen und Gesetzen des Landes erfolgen.**
Figyelem!	**A készülék végsõ elhelyezésérõl az adott országban érvényes törvények és elõírások szerint kell intézkedni.**
Avvertenza	**Lo smaltimento di questo prodotto deve essere eseguito secondo le leggi e regolazioni locali.**
Advarsel	**Endelig kassering av dette produktet skal være i henhold til alle relevante nasjonale lover og bestemmelser.**
Aviso	**Deitar fora este produto em conformidade com todas as leis e regulamentos nacionais.**
¡Advertencia!	**Al deshacerse por completo de este producto debe seguir todas las leyes y reglamentos nacionales.**
Varning!	**Vid deponering hanteras produkten enligt gällande lagar och bestämmelser.**
Предупреждение	Окончательная установка данного изделия должна выполняться в соответствии со всеми региональными и местными правилами и нормами.
警告	本产品的废弃处理应根据所有国家的法律和规章进行。
警告	この製品を廃棄処分する際は、各国の法律および規制に従って取り扱ってください。

Class 1M Laser Caution

⚠️

Caution	Class 1M laser radiation when open. Do not view directly with optical instruments.
Voorzichtig	Klasse-1M laserstraling indien toegangspaneel open is. Niet rechtstreeks bekijken met optische instrumenten.
Varo	Säteilee luokan 1M lasersätelyä avattuna. Älä katso säteeseen optisilla laitteilla.
Prudence	Radiation laser de classe 1M en cas d'ouverture. Ne pas observer directement avec des instruments optiques.
Vorsicht	Laserstrahlung der Klasse 1 M, wenn geöffnet. Nicht mit optischen Instrumenten direkt hineinsehen.
Figyelem!	Nyitott állapotban Class 1M besorolású lézersugárzás van jelen. Ne nézze közvetlenül optikai berendezésekkel!
Attenzione	Radiazioni laser Classe 1 quando aperto. Non osservare in maniera diretta con strumenti ottici.
OBS!	Laserstråling i klasse 1M i åpen stilling. Skal ikke ses direkte med optiske instrumenter.
Cuidado	Radiação laser classe 1M quando aberto. Não olhar diretamente com instrumentos ópticos.
Precaución	Los productos láser Clase 1M emiten radiación una vez abiertos. No los mire directamente con instrumentos ópticos.
Försiktig!	Klass 1M laser utstrålning när öppen. Betrakta ej direkt med optiska instrument.
Внимание	При открывании возможно наличие лазерного излучения класса 1M. Не смотрите непосредственно на лазерный луч через оптические приборы.
注意	打开时，会产生 1M 类激光辐射，请勿直接用光学仪器观看。
警告	装置を開いた状態では、Class 1Mレーザーが放射されています。光学機器を使用して直接見ないでください。

Unterminated Fiber Warning

⚠

Warning Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.

Waarschuwing Er kunnen onzichtbare laserstralen worden uitgezonden vanuit het uiteinde van de onafgebroken vezelkabel of connector. Niet in de straal kijken of deze rechtstreeks bekijken met optische instrumenten. Als u de laseruitvoer met bepaalde optische instrumenten bekijkt (zoals bijv. een oogloep, vergrootgras of microscoop) binnen een afstand van 100 mm kan dit gevaar voor uw ogen opleveren.

Varoitus Päättämättömän kuitukaapelin tai -liittimen päästä voi tulla näkymätöntä lasersäteilyä. Älä tuijota sädettä tai katso sitä suoraan optisilla välineillä. Lasersäteen katsominen tietyillä optisilla välineillä (esim. suurennuslasilla tai mikroskoopilla) 10 cm:n päästä tai sitä lähempää voi olla vaarallista silmille.

Attention Des émissions de radiations laser invisibles peuvent se produire à l'extrémité d'un câble en fibre ou d'un raccord sans terminaison. Ne pas fixer du regard le rayon ou l'observer directement avec des instruments optiques. L'observation du laser à l'aide certains instruments optiques (loupes et microscopes) à une distance inférieure à 100 mm peut poser des risques pour les yeux.

Warnung Eine unsichtbare Laserstrahlung kann vom Ende des nicht angeschlossenen Glasfaserkabels oder Steckers ausgestrahlt werden. Nicht in den Laserstrahl schauen oder diesen mit einem optischen Instrument direkt ansehen. Ein Betrachten des Laserstrahls mit bestimmten optischen Instrumenten, wie z.B. Augenlupen, Vergrößerungsgläsern und Mikroskopen innerhalb eines Abstands von 100 mm kann für das Auge gefährlich sein.

Figyelem! A lezáratlan optikai kábelek és a csatlakozók láthatatlan lézerfényt bocsáthatnak ki. Ne nézzen bele a sugárba, és ne nézze közvetlenül, optikai berendezések segítségével! Ha a kibocsátott lézert 100 mm-esnél kisebb távolságból nézi bizonyos optikai eszközökkel (például nagyítóval vagy mikroszkóppal), látáskárosodást szenvedhet.

Avvertenza L'estremità del connettore o del cavo ottico senza terminazione può emettere radiazioni laser invisibili. Non fissare il raggio od osservarlo in modo diretto con strumenti ottici. L'osservazione del fascio laser con determinati strumenti ottici (come lupette, lenti di ingrandimento o microscopi) entro una distanza di 100 mm può provocare danni agli occhi.

Advarsel Usynlig laserstråling kan emittere fra enden av den ikke-terminerte fiberkabelen eller koblingen. Ikke se inn i strålen og se heller ikke direkte på strålen med optiske instrumenter. Observering av laserutgang med visse optiske instrumenter (for eksempel øyelupe, forstørrelsesglass eller mikroskoper) innenfor en avstand på 100 mm kan være farlig for øynene.

Aviso Radiação laser invisível pode ser emitida pela ponta de um conector ou cabo de fibra não terminado. Não olhe fixa ou diretamente para o feixe ou com instrumentos ópticos. Visualizar a emissão do laser com certos instrumentos ópticos (por exemplo, lupas, lentes de aumento ou microscópios) a uma distância de 100 mm pode causar riscos à visão.

¡Advertencia! El extremo de un cable o conector de fibra sin terminación puede emitir radiación láser invisible. No se acerque al radio de acción ni lo mire directamente con instrumentos ópticos. La exposición del ojo a una salida de láser con determinados instrumentos ópticos (por ejemplo, lupas y microscopios) a una distancia de 100 mm puede comportar lesiones oculares.

Varning! Osynlig laserstrålning kan komma från änden på en oavslutad fiberkabel eller -anslutning. Titta inte rakt in i strålen eller direkt på den med optiska instrument. Att titta på laserstrålen med vissa optiska instrument (t.ex. lupper, förstoringsglas och mikroskop) från ett avstånd på 100 mm kan skada ögonen.

Предупреждение Световоды и разъемы без заглушек могут испускать невидимое лазерное излучение. Не допускайте попадания лазерного луча в глаза и не смотрите на него через оптические приборы. Нельзя смотреть на источник лазерного излучения через некоторые оптические приборы (например увеличительное стекло, лупу или микроскоп) с расстояния ближе 100 мм: это может привести к травме органов зрения.

警告 无终端接头的光纤缆的末端或接头有可能发出不可见的激光辐射。请勿直视光束或直接用光学仪器观看。在 100 毫米的距离内用某些光学仪器（例如小型放大镜、放大镜和显微镜）观看激光输出有可能伤害眼睛。

警告 終端されていない光ファイバ ケーブルまたはコネクタの開口部からは、目に見えないレーザー光線が放射されていることがあります。光線をのぞきこんだり、光学機器を使用して直接見たりしないでください。ある種の光学機器（ルーペ、拡大鏡、顕微鏡など）を使用して 100 mm 以内の距離からレーザー光線を見ると、目を痛めることがあります。

Obtaining Documentation

Cisco provides several ways to obtain documentation, 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 on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco web sites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Registered Cisco.com users can order the Documentation CD-ROM (product number DOC-CONDOCCD=) through the online Subscription Store:

http://www.cisco.com/go/subscription

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/en/US/partner/ordering/index.shtml

- Registered Cisco.com users can order the Documentation CD-ROM (Customer Order Number DOC-CONDOCCD=) through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

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You can submit comments electronically on Cisco.com. On the Cisco Documentation home page, click **Feedback** at the top of the page.

You can e-mail your comments to bug-doc@cisco.com.

You can submit your comments by mail by using the response card 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.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) Website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

Cisco.com offers a suite of interactive, networked services that let you access Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com provides a broad range of features and services to help you with these tasks:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The avenue of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Cisco TAC Website

You can use the Cisco TAC website to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC website, go to this URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

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

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

http://www.cisco.com/en/US/support/index.html

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC website so that you can describe the situation in your own words and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

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

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

  http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide,* and the *Internetworking Design Guide.* For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco monthly periodical that provides industry professionals with the latest information about the field of networking. You can access *Packet* magazine at this URL:

  http://www.cisco.com/en/US/about/ac123/ac114/about_cisco_packet_magazine.html

- *iQ Magazine* is the Cisco monthly periodical that provides business leaders and decision makers with the latest information about the networking industry. You can access *iQ Magazine* at this URL:

  http://business.cisco.com/prod/tree.taf%3fasset_id=44699&public_view=true&kbns=1.html

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in the design, development, and operation of public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training, with current offerings in network training listed at this URL:

  http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html