# Installing CWDM Gigabit Interface Converters

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**Caution:** Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**Caution:** Only qualified technicians should install this equipment.

Place all printed circuit boards on an antistatic mat until you are ready to install them. If you do not have an antistatic mat, wear a discharge leash to free yourself of static before touching any of the printed circuit boards, or free yourself of static by touching a grounded metal object before handling a printed circuit board.

## Product Safety

Meets requirements of:

CSA 22.2 No. 950-M95/UL1950, 3rd ed.
EN60950: 1992 /A1:1993 /A2:1993 /A3:1995 /A4:
199721CFR, Chapter I
EN60825-1:1994 /A11:1996

**Warning:** Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

**Vorsicht:** Glasfaserkomponenten können Laserlicht bzw. Infrarotlicht abstrahlen, wodurch Ihre Augen geschädigt werden können. Schauen Sie niemals in einen Glasfaser-LWL oder ein Anschlußteil. Gehen Sie stets davon aus, daß das Glasfaserkabel an eine Lichtquelle angeschlossen ist.

**Avertissement:** L'équipement à fibre optique peut émettre des rayons laser ou infrarouges qui risquent d'entraîner des lésions oculaires. Ne jamais regarder dans le port d'un connecteur ou d'un câble à fibre optique. Toujours supposer que les câbles à fibre optique sont raccordés à une source lumineuse.

**Advertencia:** Los equipos de fibra óptica pueden emitir radiaciones de láser o infrarrojas que pueden dañar los ojos. No mire nunca en el interior de una fibra óptica ni de un puerto de conexión. Suponga siempre que los cables de fibra óptica están conectados a una fuente luminosa.

⚠️ **Avvertenza:** Le apparecchiature a fibre ottiche emettono raggi laser o infrarossi che possono risultare dannosi per gli occhi. Non guardare mai direttamente le fibre ottiche o le porte di collegamento. Tenere in considerazione il fatto che i cavi a fibre ottiche sono collegati a una sorgente luminosa.

⚠️ 警告：光ファイバ装置は目に有害なレーザー光や赤外線を放射することがあります。光ファイバやコネクタ・ポートを覗き込まないでください。光ファイバ・ケーブルは光源に接続されているものと思ってください。

## Introduction

This book describes the Nortel Networks* CWDM Gigabit Interface Converter and the optical routing system in which it operates. It includes instructions for installing and monitoring the device in a switch and planning considerations for setting up your network. This book contains the following topics:

## CWDM GBIC description

Nortel Networks coarse wavelength division multiplexed Gigabit Interface Converters (CWDM GBICs) link Gigabit Ethernet ports with fiber optic networks for transmitting and receiving optical signals. WDM technology transmits multiple wavelengths on a single fiber.

CWDM GBICs (Figure 1) use Avalanche Photodiode (APD) technology to improve transmission distance and optical link budget.

**Figure 1**  CWDM GBIC and label



Wavelength
color code

Model number

Serial number

Wavelength

Bar code

Interface type

Fiber mode

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AA1419017

1000BASE-WDM GBIC
1470nmAPD
Single Mode
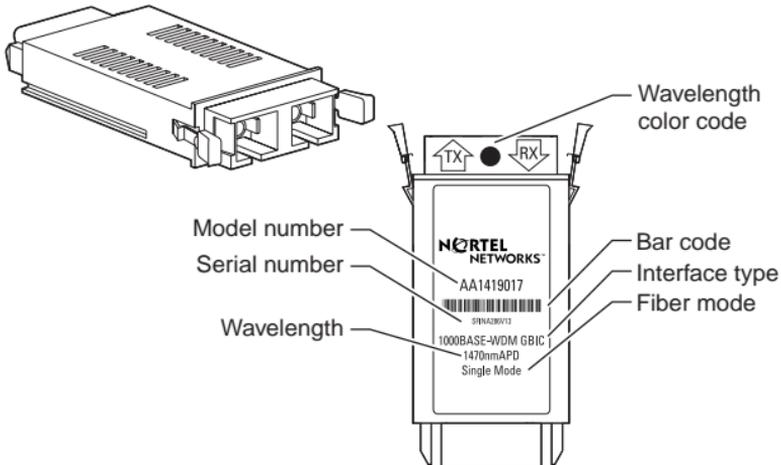
10396EA

→

**Note:** When you contact Nortel Networks about this
product, have the following information available:

- Nortel Networks serial number
- Wavelength
- Interface type
- CWDM GBIC model number

# About the optical routing system

CWDM GBICs are components in the optical routing system designed to support high speed data communication for Metropolitan Area Networks (MANs). CWDM GBICs transmit optical signals to a multiplexer. The multiplexer combines wavelengths traveling on different fibers onto a single fiber (Figure 2). At the receiver end of the link, a demultiplexer separates the wavelengths and routes them onto different fibers which terminate at separate CWDM GBICs.

**Figure 2**   Wavelength division multiplexing
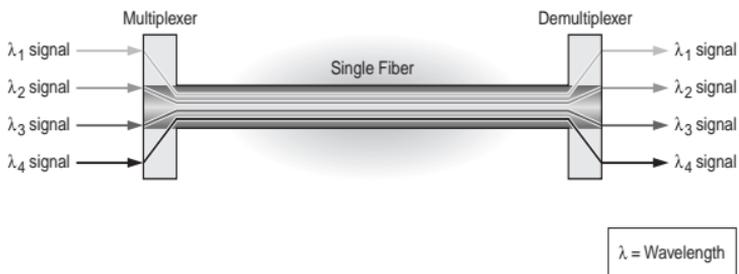


This section contains the following topics:

## Parts of the optical routing system

The optical routing system uses a grid of eight wavelengths in both ring and point-to-point configurations. Components include:

- CWDM GBIC
- Optical multiplexer-demultiplexer (CWDM OMUX)
- Optical add/drop multiplexer (CWDM OADM)
- Optical shelf to house the multiplexers (part AA1402001)

There are eight different CWDM GBICs, one for each supported wavelength. Table 1 lists the CWDM GBICs and corresponding multiplexers by wavelength and color code. Color matching simplifies the CWDM GBIC-multiplexer connection.

**Table 1**   CWDM GBIC model numbers

| Wavelength (nm)/ color code | Part number | | | |
|---|---|---|---|---|
| | CWDM GBIC | CWDM OADM | CWDM OMUX-4 | CWDM OMUX-8 |
| 1470 /Gray | AA1419017 | AA1402002 | | AA1402010 |
| 1490 /Violet | AA1419018 | AA1402003 | AA1402009 | ↓ |
| 1510 /Blue | AA1419019 | AA1402004 | | |
| 1530 /Green | AA1419020 | AA1402005 | AA1402009 | |
| 1550 /Yellow | AA1419021 | AA1402006 | | |
| 1570 /Orange | AA1419022 | AA1402007 | AA1402009 | |
| 1590 /Red | AA1419023 | AA1402008 | | |
| 1610 /Brown | AA1419024 | AA1402011 | AA1402009 | |

## Planning transmission distance

The design of your optical routing system depends on the maximum transmission distance supported. Signal loss is expected in the fiber and each device the signal passes through.

Given a maximum system loss budget of 30 dB and assuming fiber loss of 0.25 dB/km, the optical routing system will support a maximum distance of 120 km with no intermediate multiplexer.

See *Installation and Networking Guidelines for Optical Routing*, part number 212257-B, for the following information:

- Determining maximum transmission distance for your point-to-point, mesh ring, or hub and spoke network configuration

- Connecting CWDM GBICs to multiplexers.

> → **Note:** If you replace an APD CWDM GBIC with a non-APD CWDM GBIC, make sure your configuration does not exceed its maximum transmission distance. For information about identifying APD CWDM GBICs installed in your switch, please see "Monitoring a CWDM GBIC from the switch" on page 13.

## Preventing receiver saturation

To prevent receiver saturation, a minimum attenuation of 13 dB must be present between the transmitting and receiving CWDM GBIC. Use an in-line optical attenuator to insert a minimum attenuation of 13 dB when:

- Testing the CWDM GBIC in loopback mode

- Using short runs of fiber with no intermediate multiplexer

## Exceeding class 1 laser power level warning

Muxing together several CWDM GBICs can produce a radiant power level in the fiber which exceeds the class 1 laser limit. The warning in Figure 3 appears on the CWDM OMUX.

**Figure 3**  Class 1M laser warning

> LASER RADIATION
> DO NOT VIEW DIRECTLY WITH OPTICAL
> INSTRUMENTS (MAGNIFIERS)
> CLASS 1M LASER PRODUCT
> TOTAL RADIANT POWER LEVEL 30 MILLIWATTS
> WAVELENGTH RANGE 1450 TO 1650 NM
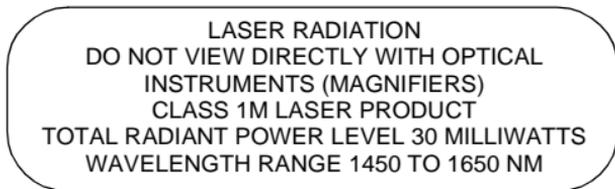
⚠ **Warning:** Never look directly at the output of a fiber which contains muxed CWDM GBICs, especially with a magnifier. Fiber optic equipment can emit laser light that can injure your eyes.

## Handling, safety, and environmental guidelines

Before installing a CWDM GBIC, read the following handling, safety, and environmental guidelines:

- CWDM GBICs are static sensitive. To prevent damage from electrostatic discharge (ESD), follow your normal board and component handling procedures.

- CWDM GBICs are dust sensitive. When you store a CWDM GBIC, or when you disconnect it from a fiber optic cable, always keep the dust cover over the CWDM GBIC's optical bores.

- To clean contaminants from the ferrules of the CWDM GBIC optical connector, use an alcohol swab or equivalent. This also helps to prevent damage to the ferrules during handling.

- Dispose of this product according to all national laws and regulations.

⚠ **Warning:** Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

## Installing a CWDM GBIC

Use the following procedure to install a CWDM GBIC in a switching module. This procedure requires an alcohol swab for cleaning the ferrules of the optical connector to prevent damage during handling.

To install a CWDM GBIC in the switching module:

1 Remove the CWDM GBIC from its protective packaging.

2 Verify that the CWDM GBIC is the correct wavelength for your network configuration (Table 1 on page 8).

3 Remove the dust cover from the CWDM GBIC's optical bores.

4   To prevent damage during handling, clean the ferrules of the optical connector with an alcohol swab.

5   Grasp the CWDM GBIC between your thumb and forefinger.

6   Insert the CWDM GBIC into the slot on the front panel of the Gigabit Ethernet switching module (Figure 4). A clicking sound indicates it is properly seated.

**Figure 4**   Inserting a CWDM GBIC into the switching module
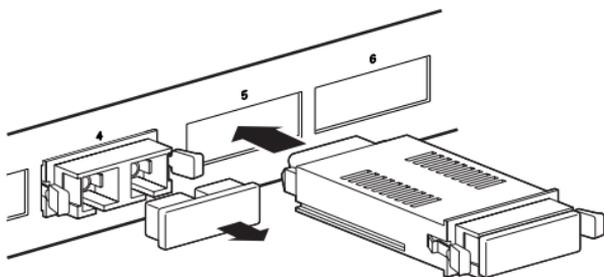


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The CWDM GBIC is installed.

> → **Note:** CWDM GBICs are keyed to prevent improper insertion. If the CWDM GBIC resists pressure, do not force it. Remove it, turn it over, and reinsert it.

For instructions about connecting the CWDM GBIC to a multiplexer, see *Installation and Networking Guidelines for Optical Routing*, part number 212257-B.

# Monitoring a CWDM GBIC from the switch

You can monitor the CWDM GBIC from the command line interface or graphical user interface of your switch. For more information, see the user's guide for your switch. The following examples are for the Nortel Networks Passport 8600, which identifies the CWDM GBIC by wavelength.

To view CWDM GBIC port information in the Passport 8600:

➔ From the CLI runtime prompt, enter one of the following:

- `show port info all`
- `show port info int` (Figure 5)

**Figure 5** `show port info int` command output

```
Passport-8610:6# show port info int

================================================================================
                               Port Interface
================================================================================

PORT                       LINK  PORT            PHYSICAL            STATUS
NUM   INDEX DESCRIPTION    TRAP  LOCK   MTU      ADDRESS            ADMIN  OPERATE
--------------------------------------------------------------------------------
1/1   64    GbicLx         true  false  1950     00:e0:7b:bc:2c:00 up      up
1/2   65    GbicLx         true  false  1950     00:e0:7b:bc:2c:08 up      up
1/3   66    GbicLx         true  false  1950     00:e0:7b:bc:2c:10 up      up
1/4   67    GbicLx         true  false  1950     00:e0:7b:bc:2c:18 up      up
1/5   68    GbicLx         true  false  1950     00:e0:7b:bc:2c:20 up      up
1/6   69    GbicLx         true  false  1950     00:e0:7b:bc:2c:28 up      up
1/7   70    GbicLx         true  false  1950     00:e0:7b:bc:2c:30 up      up
1/8   71    GbicLx         true  false  1950     00:e0:7b:bc:2c:38 up      up
2/1   128   Gbic1470(APD)  true  false  1950     00:e0:7b:bc:2c:40 up      up
2/2   129   Gbic1490(APD)  true  false  1950     00:e0:7b:bc:2c:48 up      up
2/3   130   Gbic1510(APD)  true  false  1950     00:e0:7b:bc:2c:50 up      up
2/4   131   Gbic1530(APD)  true  false  1950     00:e0:7b:bc:2c:58 up      up
2/5   132   Gbic1550(APD)  true  false  1950     00:e0:7b:bc:2c:60 up      up
2/6   133   Gbic1570(APD)  true  false  1950     00:e0:7b:bc:2c:68 up      up
2/7   134   Gbic1590(APD)  true  false  1950     00:e0:7b:bc:2c:70 up      up
2/8   135   Gbic1610(APD)  true  false  1950     00:e0:7b:bc:2c:78 up      up
```

To view CWDM GBIC details from Nortel Networks Passport 8600 Device Manager:

**1** From the Device Manager graphical window, select the port where the CWDM GBIC is installed.

**2** From the menubar, select Edit > Port.

The port dialog box opens to the Interface tab (Figure 6).

**Figure 6** Device Manager Edit > Port output
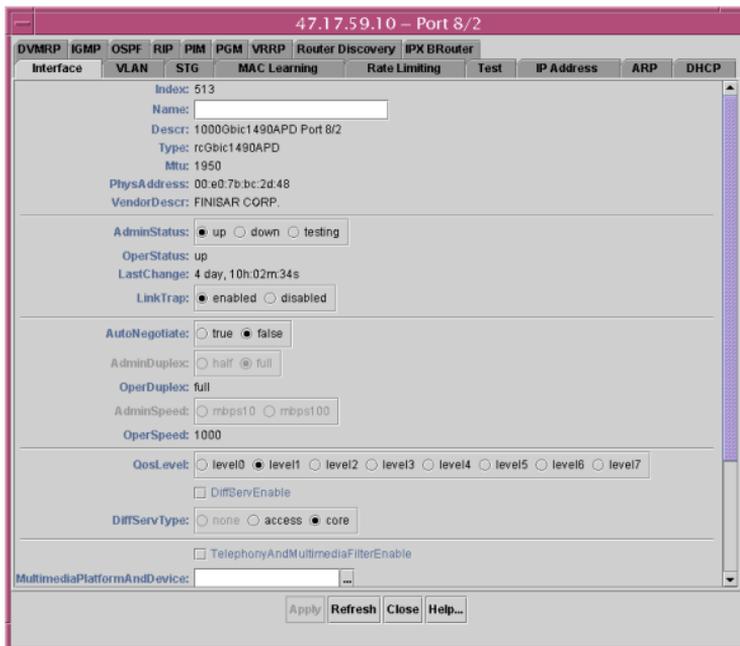
# Removing a CWDM GBIC

Use the following procedure to remove a CWDM GBIC. When storing it, place a dust cover over the fiber optic bores.

> **→** **Note:** When disposing of a CWDM GBIC, comply with all national laws and regulations.

To remove a CWDM GBIC from the switching module:

1 Disconnect the fiber cable from the CWDM GBIC connector.

2 Grasp the extraction tabs (Figure 1) located on either side of the CWDM GBIC between your thumb and forefinger.

3 Slide the CWDM GBIC out of the Gigabit Ethernet module slot.

4 If the CWDM GBIC does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the CWDM GBIC from the slot.

# CWDM GBIC specifications

**Table 2**  General specifications

| Item | Specification |
|------|---------------|
| Physical dimensions | 0.39 X 1.18 X 2.56 inches<br>(1 X 3 X 6.5 cm) |
| Connectors | single mode fiber optic SC |
| Cabling | SMF, 9 μm |
| Data rate | Minimum    0.125 Gb/sec<br>Maximum   1.25 Gb/sec |
| Total System Budget<br>@ 1.25 Gb/s<br>BER < $10^{-9}$ w/PRBS $2^7-1$ | 30 dB[a] |
| Data format | 8 B/10 B |
| Operating temperature<br>(case temperature) | Minimum      $0^{o}$C<br>Maximum   $70^{o}$C |
| Storage temperature | Minimum    -10$^{o}$C<br>Maximum    85$^{o}$C |
| Maximum distance | 120 km[b] |

a. Total system budget is defined as $P_{out} - P_{in}$ – typical connector losses.

b. Given 30 dB loss budget and 0.25 dB/km fiber loss, up to 120 km in transmission distance is supported with no intermediate multiplexer.

**Table 3** Optical parameters

| Item | Symbol | Min. | Typical | Max |
|------|--------|------|---------|-----|
| Transmitter center wavelength (nm) Over 0 to 70$^{\circ}$C case temperature[a] | $\lambda_c$ | (x-4) | (x+1) | (x+7) |
| Transmitter center wavelength (nm) Over 0 to 60$^{\circ}$C case temperature[a] | $\lambda_c$ | (x-4) | (x+1) | (x+6) |
| Wavelength temperature dependence | | | 0.08 nm/$^{\circ}$C | |
| Sidemode suppression ratio | SMSR | 30 dB | | |
| Transmitter optical output power Average power coupled into single mode fiber | $P_{out}$ | +2.0 dBm | | +6.0 dBm |
| Transmitter extinction ratio | OMI | 9 dB | | |
| Transmitter eye opening Conforms with IEEE 802.3 and Fibre Channel Eye Masks | | 60% | | |
| Optical return loss | ORL | 14 dB | | |
| Optical input wavelength | $\lambda_{in}$ | 1450 nm | | 1620 nm |
| Receiver optical input power (BER< $10^{-9}$ w/PRBS $2^7$-1) At 1.25 Gb/s, 60$^{\circ}$C case temperature. | $P_{in}$ | -30 dBm | | -7 dBm |

**Table 3**  Optical parameters (continued)

| Item | Symbol | Min. | Typical | Max |
|------|--------|------|---------|-----|
| Receiver optical input power (BER < $10^{-9}$ w/PRBS $2^7$-1) At 1.25 Gb/s, 70$^o$C case temperature. | $P_{in}$ | -28 dBm | | -7 dBm |
| Dispersion penalty at 60 km | | | 2.0 dB | |
| Dispersion penalty at 100 km | | | 3.0 dB | |

a. Center wavelength "x" is 1470, 1490, 1510, 1530, 1550, 1570, 1590, or 1610 nm.

**Table 4**  Electrical power interface specifications

| Item | Symbol | Min. | Typical | Max |
|------|--------|------|---------|-----|
| Supply current | $I_s$ | | 250 mA | 300 mA |
| Maximum voltage | $V_{max}$ | | | 6 V |
| Surge current | $I_{surge}$ | | | 350 mA |
| Input voltage | $V_{cc}$ | 4.75 V | 5.00 V | 5.25 V |

# Connecting to Nortel Networks online

This section describes products, services, and support systems that can be accessed online.

## Hard-copy technical manuals

You can print selected technical manuals and release notes free, directly from the Internet. Go to the www.nortelnetworks.com/documentation URL. Find the product for which you need documentation. Then locate the specific category and model or version for your hardware or software product. Use Adobe* Acrobat Reader* to open the manuals and release notes, search for the sections you need, and print them on most standard printers. Go to Adobe Systems at the www.adobe.com URL to download a free copy of the Adobe Acrobat Reader.

You can purchase selected documentation sets, CDs, and technical publications through the Internet at the www1.fatbrain.com/documentation/nortel/ URL.

## How to get help

If you purchased a service contract for your Nortel Networks product from a distributor or authorized reseller, contact the technical support staff for that distributor or reseller for assistance.

If you purchased a Nortel Networks service program, contact one of the following Nortel Networks Technical Solutions Centers:

| Technical Solutions Center | Telephone |
|---|---|
| Europe, Middle East, and Africa | (33) (4) 92-966-968 |
| North America | (800) 4NORTEL or (800) 466-7835 |
| Asia Pacific | (61) (2) 9927-8800 |
| China | (800) 810-5000 |

Additional information about the Nortel Networks Technical Solutions Centers is available from the www.nortelnetworks.com/help/contact/global URL.

An Express Routing Code (ERC) is available for many Nortel Networks products and services. When you use an ERC, your call is routed to a technical support person who specializes in supporting that product or service. To locate an ERC for your product or service, go to the http://www130.nortelnetworks.com/cgi-bin/eserv/common/essContactUs.jsp URL.