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Billerica, MA 01821-4130

# Installing SFP and XFP Transceivers and GBICs



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**EMI Compliance**

Meets requirements of:

FCC Part 15, Subparts A and B, Class A  
EN55022: 1998/CISPR22:1997), Class A  
General License VDE 0871, Class B  
(AmtsbIVfg No. 243/1991, Vfg 46/1992) VCCI Class A ITE  
EN55024:1998/CISPR24:1997



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

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**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.

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### Product Safety

Meets requirements of:

IEC 60950 3rd edition

CSA 22.2 No. 60950, 3rd edition.

UL 60950 3rd edition:

EN60950, 3rd edition

EN60825-1 ,+A11, +A2



8769EB



**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.

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**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。

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# Introduction

This document provides technical specifications and installation instructions for:

- Gigabit Interface Converters (GBICs):  
Which includes Coarse Wavelength Division Multiplexed (CWDM) GBICs.
- Small Form Factor Pluggable (SFP) transceivers:  
Which includes Coarse Wavelength Division Multiplexed (CWDM) SFPs.
- 10 Gigabit Small Form Factor Pluggable (XFP) transceivers

Unless otherwise specified, the terms GBIC and SFP also apply to CWDM GBICs and CWDM SFPs. In this guide, when instructions apply only to a specific GBIC or SFP type (for example, a CWDM GBIC or a CWDM SFP type), that term will be specified.

For a list of supported GBICs, SFPs, and XFPs see your latest product-specific release notes.

This document includes the following topics:

Topic	Page
<a href="#">Handling, safety, and environmental guidelines</a>	4
<a href="#">GBICs</a>	5
<a href="#">SFPs</a>	9
<a href="#">XFPs</a>	14
<a href="#">Installation</a>	17

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<a href="#">Technical Specifications</a>	23
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## Handling, safety, and environmental guidelines

Before installing your GBIC, SFP, or XFP read the following handling, safety, and environmental guidelines:

- GBICs, SFPs, and XFPs are static sensitive. To prevent damage from electrostatic discharge (ESD), follow your normal board and component handling procedures.
- GBICs, SFPs, and XFPs are dust sensitive. When you store a GBIC, SFP or XFP, or when you disconnect it from a fiber optic cable, always keep the dust cover over the GBIC, SFP, or XFP optical bore.
- To clean contaminants from the optical bores of a GBIC SFP, or XFP, use an alcohol swab or equivalent to clean the ferrules of the optical connector.
- 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.

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# GBICs

GBICs are hot-swappable input/output enhancement components designed for use with Nortel Networks\* products to allow Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.

This section provides a GBIC model list and describes the typical GBIC labeling structure:

- [Table 1](#) lists and describes the standard GBIC models.
- [Table 2 on page 6](#) lists and describes the CWDM GBIC models.

**Table 1** GBIC models


Model number	Product number	Description
1000BASE-SX	• AA1419001	Short wavelength 550 m
1000BASE-LX	• AA1419002	Long wavelength 5 km
1000BASE-XD	• AA1419003	Extended distance 50 km
1000BASE-ZX	• AA1419004	Extended distance 70 km
1000BASE-T	• AA1419041 • AA1419042 (Operable in BayStack products only)	Copper category 5 unshielded twisted pair (UTP) Maximum distance 100 m



**Note:** GBIC wavelength distance may vary, depending on the quality of fiber optic cable used.

There are eight different CWDM GBICs, one for each supported wavelength. [Table 2](#) lists the CWDM GBICs and corresponding multiplexers by wavelength and color code. Color matching simplifies the CWDM GBICs-multiplexer connection.

**Table 2** CWDM GBIC model numbers

Wavelength (nm) /color code	Part number			
	CWDM GBIC	CWDM OADM	CWDM OMUX-4	CWDM OMUX-8
1470 /Gray	AA1419017	AA1402002		
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	

See *Installation and Networking Guidelines for Optical Routing*, for the following CWDM GBICs information:

- Determining maximum transmission distance for your point-to-point, mesh ring, or hub and spoke network configuration.
- Connecting CWDM GBICs to multiplexers.



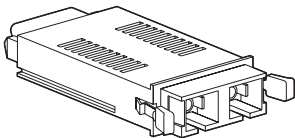


**Note:** Depending on the GBIC manufacture, your GBIC can have various locking/extractor mechanisms as shown in [Figure 1](#).

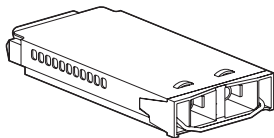
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[Figure 1](#) shows the two GBIC insertion and removal mechanisms—extractor tabs and extractor handle.

**Figure 1** GBIC extraction tabs and extractor handle



GBIC model with  
extractor tabs



GBIC model with  
extractor handle

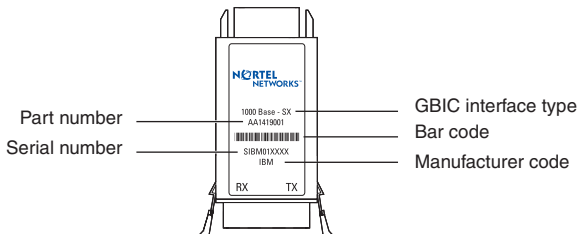
9702FA

For installation instructions, see [“Installation” on page 17](#).

## GBIC labeling

The Nortel Networks label on a typical GBIC contains a Nortel Networks serial number, a bar code, a manufacturer's code, an interface type, and a part number (Figure 2).

**Figure 2** Nortel Networks GBIC label



9706EA



**Note:** When you contact a Nortel Networks service representative for troubleshooting purposes, you must have the following information available:

- Nortel Networks serial number
- Manufacturer's code
- Interface type
- GBIC part number

# SFPs

This section describes the SFP and label, and provides a model list for 1000BASE-SX, 1000BASE-LX, 1000BASE-BX, and 1000BASE-T SFPs.

This section also describes the Nortel Networks\* coarse wavelength division multiplexed (CWDM) SFPs and provides a CWDM SFP model list.

This section includes the following topics:

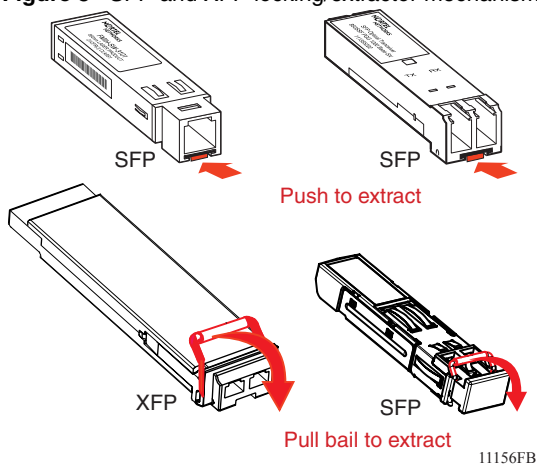
- [“Locking/extractor mechanisms,” next](#)
- [“SFP labeling” on page 11](#)
- [“SFP models” on page 11](#)
- [“CWDM SFP models” on page 12](#)

## Locking/extractor mechanisms

Depending on the transceiver manufacturer, your SFP or XFP transceiver can have various types of locking/extractor mechanisms.

[Figure 3 on page 10](#) shows two typical locking/extractor mechanisms used on SFP and XFP transceivers; other locking/extractor mechanisms exist, although not shown here.

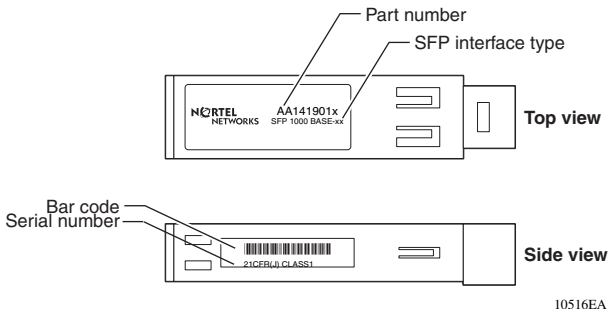
**Figure 3** SFP and XFP locking/extractor mechanism



## SFP labeling

The Nortel Networks label on a typical SFP contains a Nortel Networks serial number, a bar code, a manufacturer's code, an interface type, and a part number (Figure 4).

**Figure 4** Nortel Networks SFP label



## SFP models

SFPs are hot-swappable input/output enhancement components designed for use with Nortel Networks\* products to allow Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.

[Table 3 on page 12](#) lists and describes the Nortel Networks SFP models.

**Table 3** 1000BASE-SFP models

Model number	Product number	Description
1000BASE-SX (LC Type)	AA1419013	Small Form Factor Pluggable, short wavelength 550 m
1000BASE-SX (MT-RJ Type)	AA1419014	Small Form Factor Pluggable, short wavelength 550 m
1000BASE-LX (LC Type)	AA1419015	Small Form Factor Pluggable, long wavelength 5 km
1000BASE-BX (bi-directional)	<ul style="list-style-type: none"><li>AA1419069</li><li>AA1419070</li></ul>	Small Form Factor Pluggable, long wavelength 10 km (Bi-directional-1310 nm/1490 nm).
1000BASE-T	AA1419043	Copper category 5 unshielded twisted pair (UTP) Maximum distance 100 m



**Note:** The cable distance may vary depending on the quality of fiber optic cable used.

## CWDM SFP models

CWDM SFPs are transceivers that link Gigabit Ethernet ports with fiber optic networks. WDM technology consolidates multiple optical channels, using specific wavelengths to expand available bandwidth, on a common optical fiber.

CWDM SFPs are components in the optical routing system, designed to support high speed data communications for Metropolitan Area Networks (MANs). The system uses a grid of eight CWDM optical wavelengths in both ring and point-to-point configurations. All components are color-coded by wavelength.

[Table 4](#) lists the Nortel Networks CWDM SFPs and describes their wavelengths, color codes, part numbers, and cable lengths.

**Table 4** Nortel Networks CWDM SFP transceiver list

<b>CWDM SFP</b>	<b>Product number</b>	<b>Cable Length</b>
1470nm/Gray	<ul style="list-style-type: none"><li>• AA1419025</li><li>• AA1419033</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1490nm/Violet	<ul style="list-style-type: none"><li>• AA1419026</li><li>• AA1419034</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1510nm/Blue	<ul style="list-style-type: none"><li>• AA1419027</li><li>• AA1419035</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1530nm/Green	<ul style="list-style-type: none"><li>• AA1419028</li><li>• AA1419036</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1550nm/Yellow	<ul style="list-style-type: none"><li>• AA1419029</li><li>• AA1419037</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1570nm/Orange	<ul style="list-style-type: none"><li>• AA1419030</li><li>• AA1419038</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1590nm/Red	<ul style="list-style-type: none"><li>• AA1419031</li><li>• AA1419039</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>
1610nm/Brown	<ul style="list-style-type: none"><li>• AA1419032</li><li>• AA1419040</li></ul>	<ul style="list-style-type: none"><li>• 40 KM</li><li>• 70 KM</li></ul>



**Note:** The cable distance may vary depending on the quality of fiber optic cable used.

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## XFPs

This section describes the XFP and label, and provides a model list for 10BASE-SR, and 10BASE-LR XFPs.

This section includes the following topics:

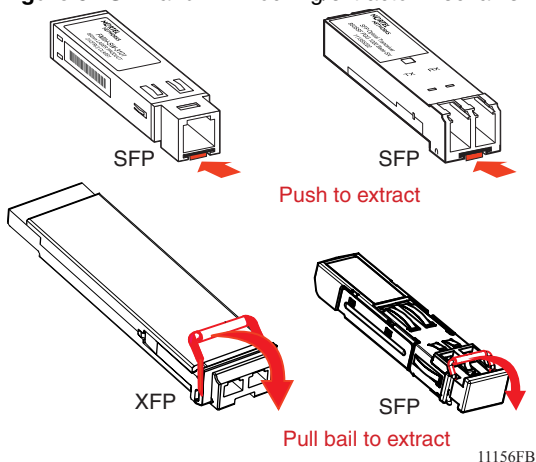
- “XFP locking/extractor mechanisms,” next
- “XFP labeling” on page 15
- “XFP models” on page 16

### XFP locking/extractor mechanisms

Depending on the XFP manufacturer, your XFP can have various types of locking/extractor mechanisms. [Figure 5 on page 15](#) shows one version; other locking/extractor mechanisms exist, although not shown here.



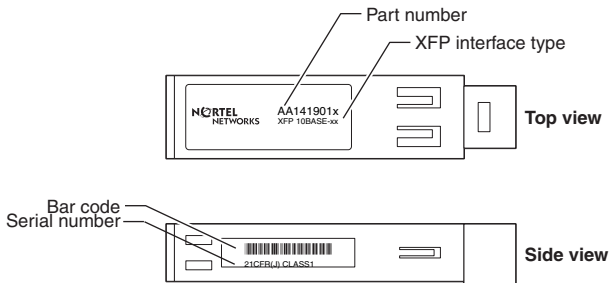
**Figure 5** SFP and XFP locking/extractor mechanism



## XFP labeling

The Nortel Networks label on a typical XFP ([Figure 6 on page 16](#)) contains a Nortel Networks serial number, a bar code, a manufacturer's code, an interface type, and a part number.

**Figure 6** Nortel Networks XFP label



10516EB

## XFP models

XFPs are hot-swappable input/output enhancement components designed for use with Nortel Networks products to allow 10 Gigabit Ethernet ports to link with other 10 Gigabit Ethernet ports over various media types.

[Table 5 on page 17](#) lists and describes the Nortel Networks XFP models.

**Table 5** 10GBASE-SR and 1GBASE-LR XFP models

Model number	Product number	Description
10BASE-SR	AA1403005	Small Form Factor Pluggable XFP transceiver. The range is 300m with MMF.
10BASE-LR	AA1403001	Small Form Factor Pluggable XFP transceiver. The range is 10km with SMF.
10BASE-ER	AA1403003	Small Form Factor Pluggable XFP transceiver. The range is 40 km.

## Installation

This section describes how to install and remove GBICs, SFPs, and XFPs.

This section includes the following topics:

- [“Installing a GBIC,” next](#)
- [“Removing a GBIC” on page 19](#)
- [“Installing an SFP or XFP” on page 20](#)
- [“Removing an SFP or XFP” on page 21](#)

## Installing a GBIC

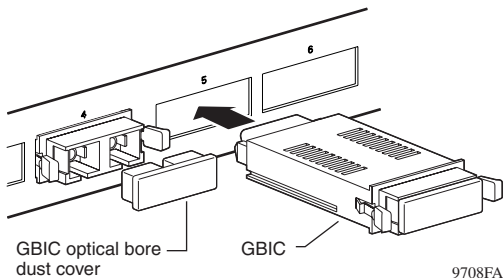
To install a GBIC:



**Caution:** GBICs, SFPs, and XFPs are keyed to prevent incorrect insertion. If the GBIC, SFP or XFP, resists pressure, do not force it; turn it over, and reinsert it.

- 1 Remove the GBIC from its protective packaging.
- 2 Verify that the GBIC is the correct model for your network configuration (See “GBICs” on page 5).
- 3 Grasp the GBIC between your thumb and forefinger.
- 4 Insert the GBIC into the slot on the front panel of the Gigabit Ethernet switching module (See Figure 7 on page 18).

**Figure 7** Inserting the GBIC into the switching module



- 5 Remove the dust cover from the GBIC's optical bores.



**Note:** If you are installing a CWDM GBIC, see *Installation and Networking Guidelines for Optical Routing*, for instructions about connecting a CWDM GBIC to a multiplexer.

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## Removing a GBIC

To remove a GBIC:

- 1 Disconnect the network fiber cable from the GBIC connector.
- 2 Depending on your GBIC model, either grasp the extraction tabs ([See Figure 1 on page 7](#)) located on either side of the GBIC with your thumb and forefinger, or lift the extractor handle attached to the GBIC.
- 3 Slide the GBIC out of the Gigabit Ethernet module slot.
- 4 If the GBIC does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the GBIC from the slot.
- 5 Attach a dust cover over the fiber optic bores and store the GBIC in a safe place until needed.



**Note:** If you are discarding the GBIC, be sure to dispose of the GBIC according to all national laws and regulations.

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## Installing an SFP or XFP

CWDM SFPs are installed similar to the LC type SFPs.



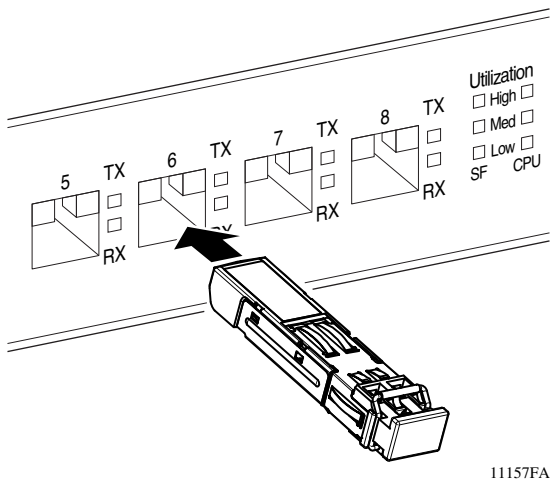
**Caution:** GBICs and SFPs are keyed to prevent incorrect insertion. If the GBIC or SFP resists pressure, do not force it; turn it over, and reinsert it.

To install an SFP or XFP:

- 1 Remove the SFP or XFP from its protective packaging.
- 2 Verify that the SFP or XFP is the correct model for your network configuration ([See Table 3 on page 12](#) and [Table 4 on page 13](#)).
- 3 Grasp the SFP or XFP between your thumb and forefinger.
- 4 Insert the SFP into the SFP slot on the module and the XFP into the XFP slot on the module (see [Figure 8 on page 21](#)).

Apply a light pressure to the SFP or XFP until the device clicks and locks into position in the module.

**Figure 8** Inserting an SFP or XFP



- 5** Remove the dust cover from the SFP or XFP optical bores.

## Removing an SFP or XFP

CWDM SFP removal steps are similar to removal steps of any other LC type SFP.

To remove an SFP or XFP:

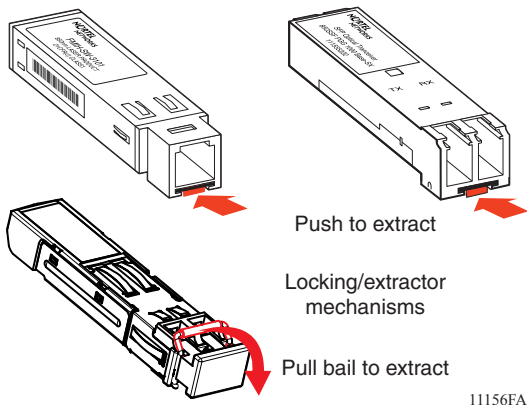
- 1** Disconnect the network fiber cable from the SFP or XFP connector.

- Depending on your SFP or XFP model, press the locking/extractor mechanism on the SFP or XFP to release the SFP or XFP (See Figure 9 on page 22).



**Note:** Your SFP or XFP locking/extractor mechanism may be different than the models shown.

**Figure 9** Removing an SFP or XFP



- Slide the SFP out of the module SFP slot. Slide the XFP out of the module XFP slot.
- If the SFP or XFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP or XFP from the slot.



- 5 Attach a dust cover over the fiber optic bores and store the SFP or XFP in a safe place until needed.



**Note:** If you are discarding the SFP or XFP, be sure to dispose of the SFP or XFP according to all national laws and regulations.

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## Technical Specifications

This section includes the following topics:

- [“GBIC specifications,” next](#)
- [“CWDM GBIC specifications” on page 32](#)
- [“SFP specifications” on page 35](#)
- [“CWDM SFP specifications” on page 43](#)
- [“XFP specifications” on page 46](#)

## GBIC specifications

This section provides technical specifications for the supported GBIC models and includes the following topics:

- [“GBIC physical specifications,” next](#)
- [“1000BASE-SX specifications” on page 24](#)
- [“1000BASE-LX specifications” on page 25](#)
- [“1000BASE-XD specifications” on page 27](#)
- [“1000BASE-ZX specifications” on page 29](#)
- [“1000BASE-T specifications” on page 31](#)

## GBIC physical specifications

This section describes general GBIC specifications ([Table 6](#)).

**Table 6** GBIC specifications

Specification	Descriptions
Dimensions (H x W x D)	0.39 x 1.18 x 2.56 inches (1 x 3 x 6.5 cm)
Connectors	<ul style="list-style-type: none"><li>• Multimode fiber optic: SC</li><li>• Single-mode fiber optic: SC</li><li>• RJ-45</li></ul>

GBIC ports for both multi-mode and single-mode fiber have SC-type connectors and a minimum cable distance of 6.5 feet (2 m).

## 1000BASE-SX specifications

The Model 1000BASE-SX GBIC provides 1000BASE-SX (850 nm, short wavelength, Gigabit Ethernet) connectivity using SC duplex multimode fiber connectors. The Model 1000BASE-SX GBIC supports full-duplex operation only.

[Table 7](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-SX GBIC.

**Table 7** 1000BASE-SX specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, 1000BASE-SX</li></ul>
Connectors	Duplex SC fiber optic connector

**Table 7** 1000BASE-SX specifications (continued)

Type	Specifications
Cabling	<ul style="list-style-type: none"><li>62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Distance	<ul style="list-style-type: none"><li>902 ft. (275 m) using 62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>1804 ft. (550 m) using 50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Wavelength	850 nm
Optical budget	7 dB
<b>Laser Transmitter Characteristics</b>	
Minimum launch power	-10 dBm
Maximum launch power	-4 dBm
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-17 dBm
Maximum input power	0 dBm

### 1000BASE-LX specifications

The Model 1000BASE-LX GBIC provides 1000BASE-LX (1310 nm, wavelength, Gigabit Ethernet) connectivity using SC duplex fiber connectors. The long wavelength optical transceivers used in the LX model provide variable distance ranges using both multimode and single-mode fiber optic cabling. The Model 1000BASE-LX GBIC supports full-duplex operation only.

Table 8 describes standards, connectors, cabling, and distance for the Model 1000BASE-LX GBIC.

**Table 8** 1000BASE-LX specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"> <li>802.3z, 1000BASE-LX</li> </ul>
Connectors	Duplex SC fiber optic connector
Cabling	<ul style="list-style-type: none"> <li>62.5 <math>\mu</math>m MMF optic cable</li> <li>50 <math>\mu</math>m MMF optic cable</li> <li>10 <math>\mu</math>m SMF optic cable</li> </ul>
Distance	<ul style="list-style-type: none"> <li>1804 ft. (550 m) using 62.5 <math>\mu</math>m MMF optic cable</li> <li>1804 ft. (550 m) using 50 <math>\mu</math>m MMF optic cable</li> <li>16405 ft. (5 km) using 10 <math>\mu</math>m SMF optic cable</li> </ul>
Wavelength	1310 nm
Optical budget	10.5 dB
<b>Laser Transmitter Characteristics</b>	
Minimum launch power	-9.5 dBm
Maximum launch power	-3 dBm
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-20 dBm
Maximum input power	-3 dBm



**Note:** When multimode fiber is used in long-distance applications, external, removable, mode-conditioning patch cords may be required to prevent differential mode delay (DMD). You can order mode conditioning patch cords through Nortel Networks:

- SC-SC Mode-Conditioning Patch Cord 62.5/125 (part number AA0018035)
- SC-SC Mode-Conditioning Patch Cord 50/125 (part number AA0018036)

### 1000BASE-XD specifications

The Model 1000BASE-XD GBIC provides Gigabit Ethernet connectivity using SC duplex single-mode fiber connectors. High-performance optical transceivers enable Gigabit Ethernet link distances up to 50 kilometers (km) over single-mode fiber. The ports operate in full-duplex mode only.

[Table 9](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-XD GBIC.

**Table 9** 1000BASE-XD GBIC specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, Ethernet full duplex</li></ul>
Connectors	Duplex SC single-mode fiber optic connector
Cabling	Single-mode fiber optic cable

**Table 9** 1000BASE-XD GBIC specifications (continued)

Type	Specifications
Distance	Up to 50 km using single-mode fiber cable, depending on the quality of the fiber
Optical budget	17 dB
<b>Laser Transmitter Characteristics</b>	
Wavelength	1550 ± 10 nm
Maximum spectral width	0.2 nm
Maximum launch power	0 dBm or 1.0 mW
Minimum launch power into fiber	-5 dBm or 0.3 mW
Distance	50 km
<b>Receiver Characteristics</b>	
Wavelength	1200 to 1620 nm
Minimum receiver sensitivity	-22 dBm
Maximum input power	-3 dBm



**Note:** Nortel Networks recommends that you use an in-line attenuator for shorter link distances to avoid overloading the receiver.

## 1000BASE-ZX specifications

The Model 1000BASE-ZX GBIC provides Gigabit Ethernet connectivity using SC duplex single-mode fiber connectors. High-performance optical transceivers enable Gigabit Ethernet link distances up to 70 km over single-mode fiber cable. The ports operate in full-duplex mode only.

[Table 10](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-ZX GBIC.

**Table 10** 1000BASE-ZX GBIC specifications

Type	Specifications
Standards	Conforms to the following standards: 802.3z, Ethernet full duplex
Connectors	SC duplex single-mode fiber optic connector
Cabling	Single-mode fiber optic cable
Distance	Up to 70 km using single-mode fiber optic cable, depending on the quality of the fiber
Optical Budget	22 dB
<b>Laser Transmitter Characteristics</b>	
Wavelength	1550 ± 10 nm
Maximum spectral width	0.2 nm
Maximum launch power	5 dBm or 3.0 mW
Minimum launch power	0 dBm
Distance	70 km

**Table 10** 1000BASE-ZX GBIC specifications (continued)

Type	Specifications
<b>Receiver Characteristics</b>	
Wavelength	1200 nm to 1620 nm
Minimum receiver sensitivity	-22 dBm
Maximum input power	-3 dBm



**Note:** When shorter lengths of single-mode fiber cable are used, there is a risk of overloading the receiver. It may be necessary to insert an in-line optical attenuator in the link to prevent overloading, as follows:

- Insert a 10 dB in-line optical attenuator between the fiber optic cable plant and the receiving port on the 1000BASE-ZX GBIC, at each end of the link, if the fiber optic cable span is less than 25 km.
- Insert a 5 dB in-line optical attenuator between the fiber optic cable plant and the receiving port on the 1000BASE-ZX GBIC, at each end of the link, if the fiber optic cable span is less than 50 km.



## 1000BASE-T specifications

The Model 1000BASE-T GBIC provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector. The 1000BASE-T Model GBIC operates at 1000 Mb/s (1 Gb/s) and does not support 100BASE-T and 10BASE-T interfaces.



**Note:** You must disable autonegotiation before operating the 1000BASE-T GBIC. By default, GBICs inserted into certain product-specific modules are set for Autonegotiation = “True.”

The maximum power requirements of the GBIC is 375 mA at 5V.

[Table 11](#) describes the 1000BASE-T GBIC specifications.

**Table 11** 1000BASE-T GBIC specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, 802.3ab</li></ul>
Connectors	RJ-45
Cabling	Category 5 copper cabling
Distance	Up to 100m

## CWDM GBIC specifications

This section provides technical specifications for the supported CWDM GBIC models and includes the following topics:

- “CWDM GBIC physical specifications,” next
- “CWDM optical specifications” on page 33
- “CWDM GBIC electrical power interface specifications” on page 35

### CWDM GBIC physical specifications

Table 12 describes general CWDM GBIC specifications.

**Table 12** CWDM general specifications

Item	Specification
Physical dimensions	0.39 X 1.18 X 2.56 inches (1 X 3 X 6.5 cm)
Connectors	single mode fiber optic SC
Cabling	SMF, 9 $\mu$ m
Data rate	Minimum 0.125 Gb/s Maximum 1.25 Gb/s
Total System Budget @ 1.25 Gb/s BER < $10^{-9}$ w/PRBS $2^7-1$	30 dB — Total system budget is defined as $P_{out} - P_{in}$ —typical connector losses.
Data format	8 B/10 B
Operating temperature (case temperature)	Minimum 0°C Maximum 70°C

**Table 12** CWDM general specifications (continued)

Item	Specification
Storage temperature	Minimum -10°C Maximum 85°C
Maximum distance	120 km — 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.

**CWDM optical specifications**

[Table 13](#) describes CWDM GBIC optical characteristics.

**Table 13** Optical characteristics

Item	Symbol	Min.	Typical	Max
Transmitter center wavelength (nm) Over 0 to 70°C case temperature <sup>a</sup>	$\lambda_c$	(x-4)	(x+1)	(x+7)
Transmitter center wavelength (nm) Over 0 to 60°C case temperature <sup>a</sup>	$\lambda_c$	(x-4)	(x+1)	(x+6)
Wavelength temperature dependence			0.08 nm/°C	
Sidemode suppression ratio	SMSR	30 dB		
Transmitter optical output power Average power coupled into single mode fiber	P <sub>out</sub>	+2.0 dBm		+6.0 dBm
Transmitter extinction ratio	OMI	9 dB		

**Table 13** Optical characteristics (continued)

Item	Symbol	Min.	Typical	Max
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°C case temperature.	$P_{in}$	-30 dBm		-7 dBm
Receiver optical input power (BER < $10^{-9}$ w/PRBS $2^7-1$ ) At 1.25 Gb/s, 70°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.

## CWDM GBIC electrical power interface specifications

Table 14 describes the CWDM GBIC electrical power interface specifications.

**Table 14** 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

## SFP specifications

This section provides technical specifications for the supported SFP models and includes the following topics:

- “SFP physical specifications” on page 36
- “1000BASE-SX (LC Type) specifications” on page 36
- “1000BASE-LX (LC Type) specifications” on page 37
- “1000BASE-SX (MT-RJ Type) specifications” on page 39
- “1000BASE-T specifications” on page 40
- “1000BASE-BX (Bi-directional) specifications” on page 41

## SFP physical specifications

[Table 15](#) describes general 1000BASE-SX, 1000BASE-LX, 1000BASE-BX, and 1000BASE-T SFP specifications.

**Table 15** 1000BASE-SX, 1000BASE-LX SFP, and 1000BASE-T specifications

Specification	Descriptions
Dimensions (H x W x D)	0.53 x 0.33 x 2.22 inches (13.4 x 8.5 x 56.4 mm)
Connectors	<ul style="list-style-type: none"><li>• Multimode fiber optic: LC or MT-RJ</li><li>• Single-mode fiber optic: LC or MT-RJ</li><li>• Single-fiber LC fiber optic connector</li></ul>

## 1000BASE-SX (LC Type) specifications

The Model 1000BASE-SX SFP provides 1000BASE-SX (850 nm, short wavelength, Gigabit Ethernet) connectivity using LC duplex multimode fiber connectors. The Model 1000BASE-SX SFP supports full-duplex operation only.

[Table 16](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-SX SFP.

**Table 16** 1000BASE-SX SFP specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, 1000BASE-SX</li></ul>
Connectors	Duplex LC fiber optic connector

**Table 16** 1000BASE-SX SFP specifications (continued)

Type	Specifications
Cabling	<ul style="list-style-type: none"><li>62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Distance	<ul style="list-style-type: none"><li>902 ft. (275 m) using 62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>1804 ft. (550 m) using 50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Wavelength	850 nm
Optical budget	7 dB
<b>Laser Transmitter Characteristics</b>	
Minimum launch power	-10 dBm
Maximum launch power	-4 dBm
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-17 dBm
Maximum input power	0 dBm

### 1000BASE-LX (LC Type) specifications

The Model 1000BASE-LX SFP provides 1000BASE-LX (1310 nm, long wavelength, Gigabit Ethernet) connectivity using LC duplex fiber connectors. The long wavelength optical transceivers used in the LX model provide variable distance ranges using both multimode and single-mode fiber optic cabling. The Model 1000BASE-LX supports full-duplex operation only.

Table 17 describes standards, connectors, cabling, and distance for the Model 1000BASE-LX.

**Table 17** 1000BASE-LX SFP specifications

Type	Specifications
Standards	Conforms to the following standards: 802.3z, 1000BASE-LX
Connectors	Duplex LC fiber optic connector
Cabling	<ul style="list-style-type: none"> <li>62.5 <math>\mu\text{m}</math> MMF optic cable</li> <li>50 <math>\mu\text{m}</math> MMF optic cable</li> <li>10 <math>\mu\text{m}</math> SMF optic cable</li> </ul>
Distance	<ul style="list-style-type: none"> <li>1804 ft. (550 m) using 62.5 <math>\mu\text{m}</math> MMF optic cable</li> <li>1804 ft. (550 m) using 50 <math>\mu\text{m}</math> MMF optic cable</li> <li>16405 ft. (5 km) using 10 <math>\mu\text{m}</math> SMF optic cable</li> </ul>
Wavelength	1310 nm
Optical budget	10.5 dB

#### **Laser Transmitter Characteristics**

Minimum launch power	-9.5 dBm
Maximum launch power	-3.0 dBm
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-20.0 dBm
Maximum input power	-3.0 dBm



## 1000BASE-SX (MT-RJ Type) specifications

The Model 1000BASE-SX (MT-RJ Type) SFP GBIC provides Gigabit Ethernet connectivity using MT-RJ multi-mode fiber connectors. [Table 18](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-SX (MT-RJ Type) SFP GBIC.

**Table 18** 1000BASE-SX SFP specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, Ethernet full duplex</li></ul>
Connectors	Duplex MT-RJ fiber optic connector
Cabling	<ul style="list-style-type: none"><li>• 62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>• 50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Distance	<ul style="list-style-type: none"><li>• 902 ft. (275 m)/62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>• 1804 ft. (550 m)/50 <math>\mu\text{m}</math> MMF optic cable</li></ul>
Optical budget	7 dB
<b>Laser Transmitter Characteristics</b>	
Wavelength	850 nm
Maximum spectral width	0.85 nm
Maximum launch power	-4.0 dBm
Minimum launch power into fiber	-9.5 dBm
<b>Receiver Characteristics</b>	
Wavelength	850 nm
Minimum receiver sensitivity	-17 dBm

**Table 18** 1000BASE-SX SFP specifications (continued)

Type	Specifications
Maximum input power	0 dBm

### 1000BASE-T specifications

The Model 1000BASE-T SFP provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector. The 1000BASE-T Model SFP operates at 1000 Mb/s (1 Gb/s) and does not support 100BASE-T and 10BASE-T interfaces).



**Note:** You must disable autonegotiation before operating the 1000BASE-T SFP. By default, SFPs inserted into certain product-specific modules are set for Autonegotiation = “True.”

The maximum power requirements of the SFP is 375 mA at 5V.

[Table 19](#) describes the 1000BASE-T SFP specifications.

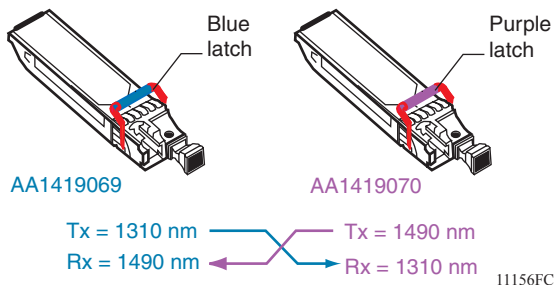
**Table 19** 1000BASE-T SFP specifications

Type	Specifications
Standards	Conforms to the following standards: <ul style="list-style-type: none"><li>• 802.3z, 802.3ab</li></ul>
Connectors	RJ-45
Cabling	Category 5 copper cabling
Distance	Up to 100m

## 1000BASE-BX (Bi-directional) specifications

The 1000BASE-BX bi-directional SFPs (part numbers AA1419069 and AA1419070) provide 1000BASE-BX (1310 nm/1490 nm, wavelength, Gigabit Ethernet) connectivity over a single fiber (Figure 10).

**Figure 10** Bi-directional 1000BASE-BX models



As shown in Figure 10, the Tx and Rx paths share the same fiber, at two different wavelengths (one model transmits at 1310 nm and receives at 1490 nm, while the mating model transmits at 1490 nm and receives at 1310 nm). You can only connect to a mating pair, as shown in Figure 10.

You can use 1000BASE-BX SFPs to double the number of your fiber links. For example, if you have 20 installed fiber pairs with 20 conventional ports connected, you can use 1000BASE-BX SFPs to expand to 40 ports, using the same fiber.

The long wavelength optical transceivers used in these models provide variable distance ranges using both multimode and single-mode fiber optic cabling.

[Table 20](#) describes standards, connectors, cabling, and distance for the Model 1000BASE-BX SFP.

**Table 20** 1000BASE-BX SFP specifications

Type	Specifications
Standards	Conforms to the following standards: 802.3ah, 1000BASE-BX10
Connectors	Single-fiber LC fiber optic connector
Cabling	<ul style="list-style-type: none"><li>62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>50 <math>\mu\text{m}</math> MMF optic cable</li><li>10 <math>\mu\text{m}</math> SMF optic cable</li></ul>
Distance	<ul style="list-style-type: none"><li>1804 ft. (550 m) using 62.5 <math>\mu\text{m}</math> MMF optic cable</li><li>1804 ft. (550 m) using 50 <math>\mu\text{m}</math> MMF optic cable</li><li>32,80805 ft. (10 km) using 10 <math>\mu\text{m}</math> SMF optic cable</li></ul>
Wavelength	1310 nm/1490 nm
Optical budget	11.0 dB
<b>Laser Transmitter Characteristics</b>	
Minimum launch power	-9.0 dBm
Maximum launch power	-3.0 dBm
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-20.0 dBm
Maximum input power	-3.0 dBm

## CWDM SFP specifications

[Table 21](#) describes CWDM SFP (70 km) specifications.

[Table 22](#) describes CWDM SFP (40 km) specifications.

**Table 21** CWDM SFP (70 km) specifications

Item	Specification
Physical dimensions	0.457 X .604 X 2.18 inches (11.6 X 15.3 X 55.43 mm)
Connectors	Duplex LC fiber optic
Cabling	SMF, 9 $\mu$ m
Data rate	Nominal range 1.0625 to 1250 Mbaud
Average launch power	minimum -3 dBm maximum +2 dBm
Optical budget	20 dBm
Operating temperature range	0°C to 60°C
Regulatory	Class 1 devices per FDA/CDRH and 1EC8251 Laser Safety Regulations
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-23 dBm
Maximum input power	-3 dBm



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**Note:** A minimum attenuation of 5 dBm must be present between the transmitter and receiver. To avoid receiver saturation, you must insert a minimum attenuation of 5 dBm when:

- testing the CWDM SFP in loopback mode.
- using short runs of fiber with no intermediate CWDM OADM or CWDM OMUX.

To determine the expected signal loss for a CWDM OADM, CWDM OMUX, or fiber length, see *Installation and Networking Guidelines for Optical Routing*.

Given a loss budget of 24 dBm and assuming fiber loss of .25 dB/km, up to 96 km reach is supported with no intermediate CWDM OADM or CWDM OMUX.

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**Table 22** CWDM SFP (40 km) specifications

Item	Specification
Physical dimensions	0.457 X .604 X 2.18 inches (11.6 X 15.3 X 55.43 mm)
Connectors	Duplex LC fiber optic
Cabling	SMF, 9 $\mu$ m
Average launch power	minimum      -4 dBm maximum      +1 dBm
Data rate	Nominal      1.0625 to 1250 Mbaud range
Optical budget	17 dBm
Operating temperature range	0°C to 60°C

**Table 22** CWDM SFP (40 km) specifications (continued)

Item	Specification
Regulatory	Class 1 devices per FDA/CDRH and IEC60825-1 Laser Safety Regulations
<b>Receiver Characteristics</b>	
Minimum receiver sensitivity	-21 dBm
Maximum input power	-3 dBm



**Note:** A minimum attenuation of 5 dBm must be present between the transmitter and receiver. To avoid receiver saturation, you must insert a minimum attenuation of 5 dBm when:

- testing the CWDM SFP in loopback mode.
- using short runs of fiber with no intermediate CWDM OADM or CWDM OMUX.

To determine the expected signal loss for a CWDM OADM, CWDM OMUX, or fiber length, see *Installation and Networking Guidelines for Optical Routing*.

Given a loss budget of 24 dBm and assuming fiber loss of .25 dB/km, up to 96 km reach is supported with no intermediate CWDM OADM or CWDM OMUX.

## XFP specifications

This section provides technical specifications for the supported XFP models and includes the following topics:

- “XFP physical specifications,” next
- “10GBASE-SR specifications” on page 47
- “10GBASE-LR specifications” on page 51
- “10GBASE-ER specifications” on page 55

## XFP physical specifications

[Table 23](#) describes general 10GBASE-SR, 10GBASE-LR, and 10GBASE-ER specifications.

**Table 23** 10GBASE-SR, 10GBASE-LR, and 10GBASE-ER specifications

Specification	Descriptions
Dimensions (H x W x D)	0.49 x 0.72 x 2.79 inches (12.5 x 18.35 x 71.1 mm)
Connectors	Standard LC-UPC optical connectors



## 10GBASE-SR specifications

Table 24 lists the transmit specifications for the 10GBASE-SR XFP.

**Table 24** 10GBASE-SR XFP transmit specifications

Item	Specification
Signaling speed (nominal)	10.3125 GBd
Signaling speed variation from nominal (max)	+ or - 100 ppm
Center wavelength (range)	840 to 860 nm
RMS spectral width <sup>a</sup> (max)	See footnote <sup>b</sup>
Average launch power (max)	See footnote <sup>c</sup>
Average launch power (min) <sup>d</sup>	-7.3 dBm
Launch power (min) in OMA	See footnote <sup>b</sup>
Average launch power of OFF transmitter ( <sup>e</sup> max)	-30 dBm
Extinction ratio (min)	3 dB
RIN <sub>12</sub> OMA (max)	-128 dB/Hz
Optical Return Loss Tolerance (max)	12 dB
Encircled flux	See footnote <sup>f</sup>
Transmitter eye mask definition (X1, X2, X3, Y1, Y2, Y3)	(0.25,0.40,0.45,0.25,0.28,0.40)
Transmitter and dispersion penalty <sup>g</sup> (max)	3.9 dB

- a. RMS spectral width is the standard deviation of the spectrum.
- b. Trade-offs are available between spectral width, center wavelength, and minimum optical modulation amplitude
- c. The 10GBASE-S launch power is the lesser of the class 1 safety limit or the average receive power (max) (see [Table 25 on page 49](#)).
- d. Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant, however, a value above this does not ensure compliance.
- e. Examples of an OFF transmitter are: no power supplied to the PMD, laser shutdown for safety conditions, activation of a PMD\_global\_transmit\_disable, or other optional transmitter shut down conditions.
- f. The encircled flux at 19  $\mu\text{m}$  must be greater than or equal to 86% and the encircled flux at 4.5  $\mu\text{m}$  must be less than or equal to 30% when measured into Type A1a (50/125  $\mu\text{m}$  multimode) fiber per ANSI/TIA/EIA-445-203-2001.
- g. TDP (max) and OMA (min) are at the respective wavelength and spectral width.

Table 25 lists the receive specifications for the 10GBASE-SR XFP.

**Table 25** 10GBASE-SR XFP receive specifications

Item	Specification
Signaling speed (nominal)	10.3125 GBd
Signaling speed variation from nominal (max)	+ or - 100 ppm
Center wavelength (range)	840 to 860 nm
Average receive power <sup>a</sup> (max)	-1.0 dBm
Average receive power <sup>b</sup> (min)	-9.9 dBm
Receiver sensitivity (max) in OMA <sup>c</sup>	0.077 (-11.1) mW (dBm)
Receiver reflectance (max)	-12 dB
Stressed receiver sensitivity in OMA <sup>d e</sup> (max)	0.18 (-7.5) mW (dBm)
Vertical eye closure penalty <sup>f</sup> (min)	3.5 dB
Stressed eye jitter <sup>g</sup> (min)	0.3 UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3 GHz

- The receiver must be able to tolerate, without damage, continuous exposure to an optical input signal having a power level equal to the Average receive power (max) plus at least 1 dB.
- Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant, however, a value above this does not ensure compliance.
- Receiver sensitivity is informative.

- d. Measured with conformance test signal at TP3 for  $BER = 10^{-12}$ .
- e. The stressed sensitivity values are for system level BER measurements which include the effects of CDR circuits. Nortel Networks recommends that you allocate at least 0.4 dB additional margin if you make component level measurements without the effect of CDR circuits.
- f. Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
- g. Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

## 10GBASE-LR specifications

Table 26 lists the transmit specifications for the 10GBASE-LR XFP.

**Table 26** 10GBASE-LR XFP transmit specifications

Item	Specification
Signaling speed (nominal)	10.3125 GBd
Signaling speed variation from nominal (max)	+ or - 100 ppm
Center wavelength (range)	1260 to 1355 nm
Side Mode Suppression Ratio (minimum)	30 dB
Average launch power (max)	0.5 dBm
Average launch power <sup>a</sup> (min)	-8.2 dBm
Launch power (min) in OMA minus transmission and dispersion penalty (TDP)	-6.2 dBm
Optical Modulation Amplitude <sup>b</sup> (min)	-5.2 dBm
Average launch power of OFF transmitter <sup>c</sup> (max)	-30 dBm
Extinction ratio (min)	3.5 dB
RIN <sub>OMA</sub> (max)	-128 dB/Hz
Optical Return Loss Tolerance (max)	12 dB
Transmitter Reflectance <sup>d</sup> (max)	-12 dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25,0.40,0.45,0.25,0.28,0.40}

- a. Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant, however, a value above this does not ensure compliance.
- b. Even if the TDP < 1 db, the OMA (min) must exceed this value.
- c. Examples of an OFF transmitter are: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD\_global\_transmit\_disable or other optional transmitter shut down conditions.
- d. Transmitter reflectance is defined looking into the transmitter.

Table 27 lists the receive specifications for the 10GBASE-LR XFP.

**Table 27** 10GBASE-LR XFP receive specifications

Item	Specification
Signaling speed (nominal)	10.3125 GBd
Signaling speed variation from nominal (max)	+ or - 100 ppm
Center wavelength (range)	1260 to 1355nm
Average receive power <sup>a</sup> (max)	0.5 dBm
Average receive power <sup>b</sup> (min)	-14.4 dBm
Receiver sensitivity (max) in OMA <sup>c</sup>	0.055 (-12.6) mW (dBm)
Receiver reflectance (max)	-12 dB
Stressed receiver sensitivity in OMA <sup>d e</sup>	0.093 (-10.3) mW (dBm)
Vertical eye closure penalty <sup>f</sup> (min)	2.2 dB
Stressed eye jitter <sup>g</sup> (min)	0.3 UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3 GHz

- a. The receiver must be able to tolerate continuous exposure to an optical input signal having a power level equal to the Average receive power (max) plus at least 1 dB.
- b. Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant, however, a value above this does not ensure compliance.
- c. Receiver sensitivity is informative.

- d. Measured with conformance test signal at TP3 for  $BER = 10^{-12}$
- e. The stressed sensitivity values are for system level BER measurements which include the effects of CDR circuits. Nortel Networks recommends that you allocate at least 0.4dB additional margin if you make component level measurements without the effect of CDR circuits.
- f. Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
- g. Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.



## 10GBASE-ER specifications

Table 28 lists the transmit specifications for the 10GBASE-ER XFP.

**Table 28** 10GBASE-ER XFP transmit specifications

Item	Specification	
Signaling speed (nominal)	10.3125 GBd	
Signaling speed variation from nominal (max)	+ or - 100 ppm	
Center wavelength (range)	1530 to 1565 nm	
Side Mode Suppression Ratio (minimum)	30 dB	
Average launch power (max)	4.0 dBm	
Average launch power <sup>a</sup> (min)	-4.7 dBm	
Launch power (min) in OMA minus transmission and dispersion penalty (TDP)	-2.1 dBm	
Optical Modulation Amplitude <sup>b</sup> (min)	-1.7 dBm	
Average launch power of OFF transmitter <sup>c</sup> (max)	-30 dBm	
Transmitter and dispersion penalty (max)	3.0 dB	
Extinction ratio (min)	3 dB	
RIN <sub>12</sub> OMA (max) <sup>d</sup>	-128 dB/Hz	
Optical Return Loss Tolerance (max)	21 dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25,0.40,0.45,0.25,0.28,0.40}	

- a. Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant, however, a value above this does not ensure compliance.
- b. Even if the TDP < 1 db, the OMA (min) must exceed this value.
- c. Examples of an OFF transmitter are: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD\_global\_transmit\_disable or other optional transmitter shut down conditions.
- d. Relative intensity noise (RIN) measurement is made with a return loss at 21 dB.

**Table 29** lists the receive specifications for the 10GBASE-ER XFP.

**Table 29** 10GBASE-ER XFP receive specifications

Item	Specification
Signaling speed (nominal)	10.3125 GBd
Signaling speed variation from nominal (max)	+ or - 100 ppm
Center wavelength (range)	1530 to 1565nm
Average receive power (max)	-1.0 dBm
Average receive power <sup>a</sup> (min)	-15.8 dBm
Maximum receive power (for damage)	4.0 dBm
Receiver sensitivity (max) in OMA <sup>b</sup>	0.039 (-14.1) mW (dBm)
Receiver reflectance (max)	-26 dB
Stressed receiver sensitivity in OMA <sup>c d</sup>	0.074 (-11.3) mW (dBm)
Vertical eye closure penalty <sup>e</sup> (min)	2.7 dB
Stressed eye jitter <sup>f</sup> (min)	0.3 UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3 GHz

a. Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant, however, a value above this does not ensure compliance.

b. Receiver sensitivity is informative.

c. Measured with conformance test signal at TP3 for BER =  $10^{-12}$

- d. The stressed sensitivity values are for system level BER measurements which include the effects of CDR circuits. Nortel Networks recommends that you allocate at least 0.4dB additional margin if you make component level measurements without the effect of CDR circuits.
- e. Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
- f. Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

## 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 Nortel Networks Technical Support. To obtain contact information online, go to:

[www.nortel.com/cgi-bin/comments/comments.cgi](http://www.nortel.com/cgi-bin/comments/comments.cgi)

From there, click on Technical Support.

From the Technical Support page, you can open a Customer Service Request online or find the telephone number for the nearest Technical Solutions Center.

If you are not connected to the Internet, you can call 1-800-4NORTEL (1-800-466-7835) to learn the telephone number for the nearest Technical Solutions Center.

## Hard-copy technical manuals

You can print selected technical manuals and release notes free, directly from the Internet. Go to:

[www.nortel.com/documentation](http://www.nortel.com/documentation)

Find the product for which you need documentation. Then locate the specific category and model or version for your hardware or software product.

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