NORTEL

Nortel Ethernet Routing Switch 5500 Series

Installation — SFPs and XFPs

NN47200-302

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Contents

New in this release

The following sections detail what's new in *Nortel Ethernet Routing Switch 5500 Series Installation — SFPs and XFPs* for Release 5.1.

Features

See the following sections for information about feature changes.

1000BASE-BX support

The Ethernet Routing Switch 5500 Series supports the 1000BASE-BX SFP. See "1000BASE-BX DDI SFP specifications" (page 51).

XFPs

The Ethernet Routing Switch 5530 supports the 10GBASE-LR, 10GBASE-ER, and 10GBASE-SR 10 Gigabit small form factor pluggable transceivers. See "10 Gigabit small form factor pluggable transceivers" (page 55).

Other changes

See the following sections for information about changes that are not feature-related.

Cleaning procedures

The cleaning procedures for connectors and ports are updated. See "Fiber optic connector care" (page 12).

1000BASE-LX specifications

The launch optical power specifications for the AA1419015-E5 1000BASE-LX SFP are -9.5 to -3.0 dBm. See "1000BASE-LX SFP specifications" (page 45).

New document

This document is a new document based on *Nortel Ethernet Routing Switch 8600 Installation — SFP and XFP Transceivers and GBICs* (NN46205-305).

Introduction

This document provides installation instructions and technical specifications for Small Form Factor Pluggable (SFP) transceivers and 10 Gigabit SFPs (XFP).

For a list of supported SFPs and XFPs, see your latest product-specific release notes. Information contained in the Release Notes takes precedence over any information contained in this document.

Navigation

Safety and equipment care information

This section contains important safety and regulatory information. Read this section before you install Small Form Factor Pluggable (SFP) transceivers, 10 Gigabit SFP (XFP) transceivers, or GigaBit Interface Converters (GBIC).

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Navigation

Handling, safety, and environmental guidelines

Before you install a GBIC, SFP, or XFP, read the following handling, safety, and environmental guidelines:

- GBICs, SFPs, and XFPs are static sensitive. To learn how to prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).

- GBICs, SFPs, and XFPs use optical connectors whose performance can be reduced by dust contamination. When you store a GBIC, SFP, or

XFP, or when you disconnect it from a fiber optic cable, always keep a dust cover over the GBIC, SFP, or XFP optical bore.

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

Before you install an SFP, read the following handling, safety, and environmental guidelines:

• SFPs are static sensitive. To prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).

• SFPs use optical connectors whose performance can be reduced by dust contamination. When you store an SFP, or when you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

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

Before you install an SFP or XFP, read the following handling, safety, and environmental guidelines:

• SFPs and XFPs are static sensitive. To prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).

• SFPs and XFPs use optical connectors whose performance can be reduced by dust contamination. When you store an SFP or XFP, or when you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

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

Before you install a GBIC or SFP, read the following handling, safety, and environmental guidelines:

• GBICs and SFPs are static sensitive. To prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).

• GBICs and SFPs use optical connectors whose performance can be reduced by dust contamination. When you store a GBIC or SFP, or when you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

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

Before you install a GBIC, read the following handling, safety, and environmental guidelines:

• GBICs are static sensitive. To prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).

- GBICs use optical connectors whose performance can be reduced by dust contamination. When you store a GBIC, or when you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

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

Electrostatic discharge prevention

To prevent equipment damage, observe the following electrostatic discharge (ESD) precautions when handling or installing the components.

- Ground yourself and the equipment to an earth or building ground. Use a grounded workbench mat (or foam that dissipates static charge) and a grounding wrist strap. The wrist strap should touch the skin and be grounded through a one megaohm resistor.

- Do not touch anyone who is not grounded.

- Leave all components in their ESD-safe packaging until installation, and use only a static-shielding bag for all storage, transport, and handling.

- Clear the area of synthetic materials such as polyester, plastic, vinyl, or styrofoam because these materials carry static electricity that damages the equipment.

Care of fiber optic equipment

Fiber optic equipment must be kept clean and damage-free. Use the information in this section to properly maintain and care for fiber optic equipment.

Care of fiber optic equipment navigation

Fiber optic cable care

Although the glass fiber of fiber optic cable is protected with reinforcing material and plastic insulation, it is subject to damage. Use the following precautions to avoid damaging the glass fiber.

- Do not kink, knot, or vigorously flex the cable.

- Do not bend the cable to less than a 40 mm radius.

- Do not stand on fiber optic cable; keep the cable off the floor.

- Do not pull fiber optic cable any harder than you would a cable containing copper wire of comparable size.

- Do not allow a static load of more than a few pounds on any section of the cable.

- Place protective caps on fiber optic connectors that are not in use.

- Store unused fiber optic patch cables in a cabinet, on a cable rack, or flat on a shelf.

Frequent overstressing of fiber optic cable causes progressive degeneration that leads to failure.

If you suspect damage to a fiber optic cable, either due to mishandling or an abnormally high error rate observed in one direction, reverse the cable pairs. If the high error rate appears in the other direction, replace the cable.

> **CAUTION**
> **Risk of equipment damage**
> Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, it can be damaged by the weight of the electrical cable.

Fiber optic connector care

Before connecting them to transmission equipment, test equipment, patch panels, or other connectors, ensure fiber optic connectors are clean. The performance of an optical fiber connector depends on how clean the connector and coupling are at the time of connection.

A damaged or dirty connector can damage a connector with which it is mated. A connector must be absolutely clean before it is inserted into a transmitter or receiver.

Never clean an optical connector that is carrying light. Optical power can cause ignition of the cleaning material when it contacts the end of the optical connector, destroying the connector. Typical cleaning materials, for example, tissues saturated with alcohol, combust almost instantaneously when exposed to optical power levels of +15 dBm or higher.

Visually inspect the connector to determine cleanliness and to determine if it needs replacing. Any connector that has a scratch across the core, or a scratch that appears to end in the core, must be replaced.

The proper connector cleaning method depends on the connector contaminants:

- Cleanliness is best judged by visual inspection with a fiber microscope. First inspect the connector, then clean as required.

WARNING
Risk of eye injury

When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

- If you suspect only the possibility of dust particles (for example, which can occur when a connector is left uncapped in a clean environment), use high-quality canned air or a reel cleaner (for example, a Cletop) to clean the connector. A reel cleaner is a good choice for making sure that no dust contaminates the connector.

- If the connector is visibly dirty or suspected to be contaminated by chemicals (for example, matching gel), use high-quality alcohol and canned air to clean the connector (see the following procedure). This is the most thorough cleaning method. In some cases, a reel cleaner may suffice.

Always keep in mind that the more surface manipulation applied to the connector, the more likely the connector to become damaged.

When you insert a connector ferrule into a connector or adapter, ensure that the ferrule tip does not touch the outside of the mating connector or adapter. This can produce scratches and dirt deposits on the connector.

To help prevent them from collecting dust, ensure connectors are covered when not in use. To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care. Do not touch the connector end face.

Cleaning single connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

This procedure is appropriate when more than dust contamination is suspected.

Prerequisites

- lens-grade, lint-free tissue (for example, Kimwipes)

- optical-grade isopropyl alcohol (IPA) (98% or more pure)

- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.

- fiber optic microscope for inspecting connectors

> **WARNING**
> **Risk of eye injury**
>
> When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.
>
> To avoid getting debris in your eyes, wear safety glasses when working with the canned air duster.
>
> To avoid eye irritation on contact, wear safety glasses when working with isopropyl alcohol.

Procedure steps

Step	Action
1	Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
2	Gently wipe the cylindrical and end-face surfaces with a tissue dampened with optical-grade isopropyl alcohol.
3	Gently wipe the cylindrical and end-face surfaces with a dry tissue.

> **ATTENTION**
> Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

Step	Action
4	Dry the connector surfaces by applying canned air.
5	Inspect the connector to ensure it is clean and undamaged. To prevent contamination, do not touch the connector surfaces after cleaning; and cover connectors with dust caps if you are not going to use them right away.

—End—

Cleaning duplex connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

This procedure is appropriate when more than dust contamination is suspected.

Prerequisites

- lens-grade, lint-free tissue (for example, Kimwipes)

- optical-grade isopropyl alcohol (IPA) (98% or more pure)

- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.

- fiber optic microscope for inspecting connectors

> **WARNING**
> **Risk of eye injury**
>
> When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.
>
> To avoid getting debris in your eyes, wear safety glasses when working with the canned air duster.
>
> To avoid eye irritation on contact, wear safety glasses when working with isopropyl alcohol.

Procedure steps

Step	Action
1	To remove or retract the shroud, do one of the following. • On removable shroud connectors, hold the shroud on the top and bottom at the letter designation, apply medium pressure, and pull it free from the connector body. Do not discard the shroud. • On retractable shroud connectors, hold the shroud in its retracted position.
2	Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
3	Gently wipe the cylindrical and end-face surfaces of both ferrules using a tissue saturated with optical-grade isopropyl alcohol.
4	Gently wipe the cylindrical and end-face surfaces with a dry tissue.
5	Blow dry the connector surfaces with canned air.

> **ATTENTION**
>
> Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

6   Blow dry the connector surfaces with canned air.

7   Inspect the connector to ensure it is clean and undamaged.

8   Using care to not touch the clean ferrules, gently push the shroud back onto the connector until it seats and locks in place.

—End—

Cleaning receptacles

Clean connector receptacles or ports so that the optical signal is minimally attenuated by the connection.

Prerequisites

- optical-grade isopropyl alcohol (IPA) (98% or more pure)

- cleaning swabs (also called cleaning sticks or wands)

- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.

> **CAUTION**
> **Risk of equipment damage**
>
> To avoid contamination, optical ports should only be cleaned when there is evidence of contamination or reduced performance, or during their initial installation.
>
> To prevent oil contamination, use only high-quality canned compressed air.
>
> Do not allow the air extension tube to touch the bottom of the optical port.

Procedure steps

Step	Action
1	Remove dust or debris by blowing canned air into the optical port of the device using the canned air extension tube.
2	Clean the optical port by inserting a wand moistened with alcohol into the receptacle and rotating it.
	Each cleaning wand should only be used to clean one optical port.
3	Dry the optical port by inserting a dry wand into the receptacle and rotating it.

> **ATTENTION**
> Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

Step	Action
4	Remove any lint by blowing compressed air into the optical port.
5	Reconnect the optical connector and check for proper function.
	If you are not reinstalling the connector, be sure to use a protective cap.
	If problems persist, ensure that the connector or receptacle are not damaged.

—End—

Product safety warnings and information

The products described in this guide meet requirements of:

IEC 60950 3rd edition
CSA 22.2 No. 60950 3rd edition
UL 60950 3rd edition
EN60950 3rd edition
EN60825-1, +A11, +A2

ESD and installation caution messages

This section provides electrostatic discharge (ESD) and installation caution messages.

This section provides electrostatic discharge (ESD) and installation caution messages and translations.

> **CAUTION**
> **Risk of equipment damage**
> 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 you handle a printed circuit board.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an ESD jack.

> **CAUTION**
> **ATTENTION**
> **Risque d'endommagement de l'équipement**
> Pour prévenir tout dommage dû à une décharge électrostatique, vous devez toujours porter un un bracelet antistatique connecté à une prise ESD.

> **CAUTION**
> **ACHTUNG**
> **Risiko eines Geräteschadens**
> Risiko eines Geräteschadens Um Schäden durch elektrostatische Entladung zu verhindern, tragen Sie bei der Instandhaltung dieses Produkts immer ein antistatisches Band am Handgelenk, welches mit einer ESD-Buchse verbunden ist.

> **CAUTION**
> **PRECAUCIÓN**
> **Riesgo de daño del equipo**
> Para prevenir el daño producido por una descarga electrostática, use siempre una pulsera antiestática conectada a un enchufe ESD.

CAUTION
CUIDADO
Risco de danos ao equipamento
Para evitar danos com descarga eletrostática, sempre use uma pulseira antiestática que esteja conectada a uma tomada ESD.

CAUTION
ATTENZIONE
Rischio di danni all'apparecchiatura
Per evitare danni derivanti da scariche elettrostatiche, indossare sempre un polsino antistatico collegato a una presa ESD.

CAUTION
Risk of equipment damage
Only trained personnel can install this product.

CAUTION
ATTENTION
Risque d'endommagement de l'équipement
L'installation doit être effectuée exclusivement par un personnel qualifié.

CAUTION
ACHTUNG
Risiko eines Geräteschadens
Nur geschultes Personal kann dieses Produkt installieren.

CAUTION
PRECAUCIÓN
Riesgo de daño del equipo
Sólo el personal capacitado puede instalar este producto.

> **CAUTION**
> **CUIDADO**
> **Risco de danos ao equipamento**
> Somente pessoal treinado pode instalar este produto.

> **CAUTION**
> **ATTENZIONE**
> **Rischio di danni all'apparecchiatura**
> Questo prodotto può essere installato solo da personale esperto.

Laser safety warnings

This section provides laser safety warnings and translations.

CLASS 1 INVISIBLE LASER PRODUCT
LASERSCHUTZKLASSE 1 PRODUKT
TO EN 60825

8769EB

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。

> **WARNING**
> **Risk of eye injury by laser**
> 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.

> **WARNING**
> **AVERTISSEMENT**
> Risques de blessure oculaire par lumière laser L'équipement de fibres optiques peut émettre une lumière laser ou infrarouge nuisible à vos yeux. Ne regardez jamais en direction de fibres optiques ou d'un port connecteur. Supposez toujours que les câbles de fibres optiques sont connectés à une source de lumière.

WARNING
WARNUNG
Risiko einer Augenverletzung durch Laser Glasfasergeräte können Laserstrahlen oder ultraviolettes Licht aussenden, das Ihre Augen verletzen kann. Schauen Sie nie direkt in einen Glasfaserleiter oder Verbindungsanschluss. Gehen Sie immer davon aus, dass Glasfaserkabel mit einer Lichtquelle verbunden sind.

WARNING
ADVERTENCIA
Riesgo de lesión en los ojos por láser El equipo de fibra óptica puede emitir una luz láser o infrarroja que dañe sus ojos. Nunca mire un puerto de fibra óptica o conector. Siempre asuma que los cables de fibra óptica están conectados a una fuente de luz.

WARNING
AVISO
O laser pode causar ferimentos no olho O equipamento de fibra ótica pode emitir laser ou luz infravermelha que pode causar danos a sua vista. Nunca olhe para dentro da fibra ótica ou da porta do conector. Tenha sempre em mente que os cabos de fibra ótica estão ligados a uma fonte de luz.

WARNING
AVVISO
Rischio di ustioni agli occhi dovute al laser Le apparecchiature con fibre ottiche possono emettere raggi laser o infrarossi in grado di provocare ferite agli occhi. Non guardare mai all'interno di una porta di connessione o una fibra ottica. Tenere sempre presente che i cavi a fibra ottica sono collegati a una sorgente luminosa.

WARNING
Risk of eye injury by laser
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.

> **WARNING**
> **VORSICHT**
> Glasfaserkomponenten können Laserlicht bzw. Infrarotlicht abstrahlen, wodurch Ihre Augen geschädigt werden können. Schauen Sie niemals in einen Glasfaser-LWL oder ein Anschluβteil. Gehen Sie stets davon aus, daβ das Glasfaserkabel an eine Lichtquelle angeschlossen ist.

> **WARNING**
> **AVERTISSEMENT**
> L'quipement à fibre optique peut ämettre des rayons laser ou infrarouges qui risquent d'entraîner des läsions 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 raccordäs à une source lumineuse.

> **WARNING**
> **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.

> **WARNING**
> **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.

Electromagnetic interference compliance

> **WARNING**
> **Risk of electromagnetic radiation exposure**
> Use of controls or adjustments, or performance of procedures other than those specified herein can result in hazardous radiation exposure.

The products described in this guide meet requirements of:

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

Federal Communications Commission (FCC) Compliance Notice: Radio Frequency Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to take whatever measures may be necessary to correct the interference at their own expense.

European EN 55 022 statement

This is to certify that the Nortel Networks optical routing system is shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022 Class A (CISPR 22).

> **CAUTION**
> **Risk of radio interference**
> This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take appropriate measures.

> **ATTENTION**
> **Achtung:**
> Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaβnahmen verantwortlich ist.

> **ATTENTION**
> Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.

European EC Declaration of Conformity

These product conforms to the provisions of the R&TTE Directive 1999/5/EC.

Japan/Nippon Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Taiwan Bureau of Standards, Metrology and Inspection (BSMI) Statement

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class A limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe B prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

Small form factor pluggable transceivers

This section describes how to select and install small form factor pluggable (SFP) transceivers.

Use an SFP to interface a device motherboard to a fiber optic or unshielded twisted pair network cable. The SFPs described in this section provide Ethernet at 1 gigabit per second (Gbit/s).

Navigation

Selecting an SFP

Use an SFP transceiver to interface a device motherboard to a fiber optic or unshielded twisted pair network cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

Step	Action
1	Determine the required reach.
	Depending on the product, SFPs are available for cable distances of up to 100 meters (m), 550 m, 10 kilometers (km), 40 km, 70 km, and 120 km.
2	Determine the required media and connector type.
	Fiber optic cable is required for any reach over 100 m.

Possible media include CAT5, single mode fiber, and multimode fiber. Possible connectors include LC (Lucent optical connector), MT-RJ, and RJ-45.

3   If the media is optical fiber, determine any wavelength restrictions or requirements.

To expand available bandwidth on a common optical fiber, use CWDM SFPs.

4   Determine if digital diagnostic monitoring (DDM) is required.

Not all SFPs or products support DDM.

5   Use the following job aids to determine the appropriate SFP for your application.

—End—

Procedure job aid: SFPs and common applications

The following table describes the reach provided by various SFPs. This table is informational only—not all Nortel Ethernet switching and routing products support all the SFPs listed here.

Table 1
SFPs and common applications

SFP model	Common application
T1 Fast Ethernet to T1 Remote Bridge	Provides 1.544 Mbit/s connectivity with up to 2874 m reach over 22 AWG cable. The distance may be reduced when 24 AWG UTP CAT5/5E cable is used. Applications include connecting remote LANs and providing transparent LAN services over leased lines.
100BASE-FX	Provides 100 Mbit/s LAN services with up to 2 km reach.
1000BASE-T	Lowest-cost Gigabit Ethernet solution. Up to 100 m reach over Category 5 (CAT5) unshielded twisted pair (UTP).
1000BASE-SX	Well-suited for campus local area networks (LAN) and intrabuilding links. Up to 275 or 550 m reach (fiber-dependent) over a fiber pair.
1000BASE-LX	Up to 10 km reach over a single mode fiber (SMF) pair. Up to 550 m reach over a multimode fiber (MMF) pair.
1000BASE-XD	Up to 40 km reach over a single mode fiber pair.
1000BASE-ZX	Up to 70 km reach over a single mode fiber pair.

The Secure Router 4134 supports the 1000BASE-SX (AA1419048-E6) and the 1000BASE-LX (AA1419049-E6) SFPs.

Table 2
SFPs and common applications

SFP model	Common application
1000BASE-T	Lowest-cost Gigabit Ethernet solution. Up to 100 m reach over Category 5 (CAT5) unshielded twisted pair (UTP).
1000BASE-SX	Well-suited for campus local area networks (LAN) and intrabuilding links. Up to 275 or 550 m reach (fiber-dependent) over a fiber pair.
1000BASE-LX	Up to 10 km reach over a single mode fiber (SMF) pair. Up to 550 m reach over a multimode fiber (MMF) pair.
1000BASE-XD	Up to 40 km reach over a single mode fiber pair.
1000BASE-ZX	Up to 70 km reach over a single mode fiber pair.
1000BASE-BX	Up to 10 km reach. Bidirectional over one single mode fiber.
1000BASE-EX	Up to 120 km reach over a single mode fiber pair.

Procedure job aid: SFP models

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

The SFPs described in this section do not have Digital Diagnostic Interface capability, and are RoHS -E5 compliant.

CWDM SFPS are also supported. CWDM technology consolidates multiple optical channels on a common optical fiber. CWDM uses multiple wavelengths to expand available bandwidth.

CWDM SFPs are 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.

ATTENTION

The attainable cable length can vary depending on the quality of the fiber optic cable used.

Table 3
SFP models without DDI support

Model and connector	Product number	Description
1000BASE-SX (LC)	AA1419013-E5	850 (nm), up to 275 or 550 m

Model and connector	Product number	Description
1000BASE-SX (MT-RJ)	AA1419014-E5	850 nm, up to 275 or 550 m
1000BASE-LX (LC)	AA1419015-E5	1310 nm, up to 10 km
1000BASE-XD CWDM (LC)	AA1419025-E5 to AA1419032-E5	1470 nm to 1610 nm, up to 40 km
1000BASE-ZX CWDM (LC)	AA1419033-E5 to AA1419040-E5	1470 nm to 1610 nm, up to 70 km

Table 4
SFP models

Model and connector	Product number	Description
1000BASE-SX (LC)	AA1419013-E5	850 (nm), up to 275 or 550 m
1000BASE-SX (MT-RJ)	AA1419014-E5	850 nm, up to 275 or 550 m
1000BASE-LX (LC)	AA1419015-E5	1310 nm, up to 10 km
1000BASE-XD CWDM (LC)	AA1419025-E5 to AA1419032-E5	1470 nm to 1610 nm, up to 40 km
1000BASE-ZX CWDM (LC)	AA1419033-E5 to AA1419040-E5	1470 nm to 1610 nm, up to 70 km
100BASE-FX (LC)	AA1419074-E6	1310 nanometers (nm), up to 2 km Supported by the 4526FX, 4526T, 4526T-PWR, 4550T, 4550T-PWR and 4524GT
T1 (RJ-48C)	AA1419075-E6	1.544 Mbit/s Fast Ethernet to T1 remote bridge. Supported by the 4526FX, 4526T, 4526T-PWR, 4550T, 4550T-PWR and 4524GT

For specifications for these SFPs, see "SFP specifications" (page 37).

Procedure job aid: SFP models with DDI support

Any Digital Diagnostic Indicating (DDI) SFP can be used in any Secure Router 4134 module that supports SFPs. The optical functions of the SFP are supported. Access to the DDI information will be provided in a future release.

The following table lists and describes the Nortel SFP models with DDI capability. All these SFPs use LC connectors.

Table 5
SFP models with DDI capability

Model	Product number	Description
1000BASE-SX	AA1419048-E6	850 nm, up to 275 or 550 m
1000BASE-LX	AA1419049-E6	1310 nm, up to 10 km

For specifications for these SFPs, see "SFP specifications" (page 37).

Procedure job aid: SFP models with DDI support

Any Digital Diagnostic Indicating (DDI) SFP can be used in any Ethernet Routing Switch module that supports SFPs. The optical functions of the SFP are supported. Access to the DDI information will be provided in a future release.

The SFPs described in this section are all RoHS -E6 compliant.

The following table lists and describes the Nortel SFP models with DDI capability. All these SFPs use LC connectors.

Table 6
SFP models with DDI capability

Model	Product number	Description
1000BASE-T (RJ-45)	AA1419043-E6	CAT5 UTP, up to 100 m. Note that because the 1000BASE-T device is all electrical, there is no need for DDI support.
1000BASE-BX (LC type)	AA1419069-E6, AA1419070-E6	Bidirectional 1310 nm and 1490 nm, up to 10 km

For specifications for these SFPs, see "SFP specifications" (page 37).

Procedure job aid: SFP models with DDI support

Any Digital Diagnostic Indicating (DDI) SFP can be used in any Ethernet Routing Switch module that supports SFPs. The optical functions of the SFP are supported. Access to the DDI information will be provided in a future release.

The SFPs described in this section are all RoHS -E6 compliant.

The following table lists and describes the Nortel SFP models with DDI capability. All the optical SFPs use LC connectors.

Table 7
SFP models with DDI capability

Model	Product number	Description
1000BASE-T (RJ-45)	AA1419043-E6	CAT5 UTP, up to 100 m. Note that because the 1000BASE-T device is all electrical, there is no need for DDI support.
1000BASE-SX	AA1419048-E6	850 nm, up to 275 or 550 m
1000BASE-LX	AA1419049-E6	1310 nm, up to 10 km
1000BASE-XD	AA1419050-E6	1310 nm, up to 40 km
1000BASE-XD	AA1419051-E6	1550 nm, up to 40 km
1000BASE-ZX	AA1419052-E6	1550 nm, up to 70 km
1000BASE-XD CWDM	AA1419053-E6 to AA1419060-E6	1470 nm to 1610 nm, up to 40 km
1000BASE-ZX CWDM	AA1419061-E6 to AA1419068-E6	1470 nm to 1610 nm, up to 70 km
1000BASE-BX	AA1419069-E6, AA1419070-E6	Bidirectional 1310 nm and 1490 nm, up to 10 km

For specifications for these SFPs, see "SFP specifications" (page 37).

Procedure job aid: SFP models with DDI support

Digital Diagnostic Monitoring (DDM) allows the Metro Ethernet Routing Switch 8600 to monitor SFP laser operating characteristics. Metro Ethernet Routing Switch 8600 support for Digital Diagnostic Interfaces (DDI—an interface that supports DDM) involves data collection and alarm and warning monitoring. Static data collection includes the SFP vendor information, DDI support information, and DDI alarm and warning threshold values. Dynamic data collection includes temperature, supply voltage, laser bias current, transmit power, and receive power. DDM works at any time during active laser operation without affecting data traffic.

The warning and alarm status bits are only checked during initialization and during requests for dynamic data. If an alarm or warning is asserted or cleared, a message is logged and a trap is generated. DDM warning and alarm messages are mapped into WARNING and FATAL message categories for system logging purposes. If an alarm or warning is generated, the software does not automatically shut down the port.

CWDM SFPs are also supported. CWDM SFPs are designed to support high-speed data communications. A CWDM system uses a grid of wavelengths to provide multiple channels for both ring and point-to-point configurations. All components are color-coded by wavelength.

Any DDM SFP can be used in any Metro Ethernet Services Unit 1800 or 1850 device or Metro Ethernet Routing Switch 8600 module that supports SFPs. The optical functions of the SFP are supported. Access to the DDI information is only provided for:

- Metro ESU 1850

- Metro Ethernet Routing Switch 8600 modules 8630 and 8683

Access to DDI information is not supported for:

- Metro ESU 1800

- Metro Ethernet Routing Switch 8600 module 8668

The SFPs described in this section are all RoHS -E6 compliant.

For information about DDM, see *Nortel Metro Ethernet Routing Switch 8600 Diagnostics* (NN46220-700).

For information about DDM, see *Nortel Metro Ethernet Routing Switch 8600 Troubleshooting* (NN46220-701).

The following table lists and describes the Nortel SFP models with DDI capability. All the optical SFPs use LC connectors.

Table 8
SFP models with DDI capability

Model number and connector	Product number	Description
1000BASE-T (RJ-45)	AA1419043-E6	CAT5 UTP, up to 100 m. Note that because the 1000BASE-T device is all electrical, there is no need for DDI support.
1000BASE-SX	AA1419048-E6	850 nm, up to 275 or 550 m
1000BASE-LX	AA1419049-E6	1310 nm, up to 10 km
1000BASE-XD	AA1419050-E6	1310 nm, up to 40 km
1000BASE-XD	AA1419051-E6	1550 nm, up to 40 km
1000BASE-ZX	AA1419052-E6	1550 nm, up to 70 km
1000BASE-XD CWDM	AA1419053-E6 to AA1419060-E6	1470 nm to 1610 nm, up to 40 km
1000BASE-ZX CWDM	AA1419061-E6 to AA1419068-E6	1470 nm to 1610 nm, up to 70 km
1000BASE-BX	AA1419069-E6, AA1419070-E6	Bidirectional 1310 nm and 1490 nm, up to 10 km
1000BASE-EX	AA1419071-E6	1550 nm, up to 120 km

For specifications for these SFPs, see "SFP specifications" (page 37).

Installing an SFP

Install an SFP to provide an interface between the switch and the network cable.

Installing an SFP takes about three minutes.

The Secure Router 4134 supports the 1000BASE-SX (AA1419048-E6) and the 1000BASE-LX (AA1419049-E6) SFPs.

For translations of the following statements, see "ESD and installation caution messages" (page 17) and "Laser safety warnings" (page 20).

WARNING
Risk of eye injury by laser
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.

CAUTION
Risk of equipment damage
To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an ESD jack.

CAUTION
Risk of equipment damage
Only trained personnel can install this product.

Prerequisites

• Verify that the SFP is the correct model for your network configuration.

Procedure steps

Step	Action
1	Remove the SFP from its protective packaging.
2	Grasp the SFP between your thumb and forefinger.

3   As shown in the following figure, insert the device into the slot on the module.

Apply a light pressure to the device until it clicks and locks into position.

> **CAUTION**
> **Risk of equipment damage**
> SFPs are keyed to prevent incorrect insertion. If the SFP resists pressure, do not force it; turn it over, and reinsert it.
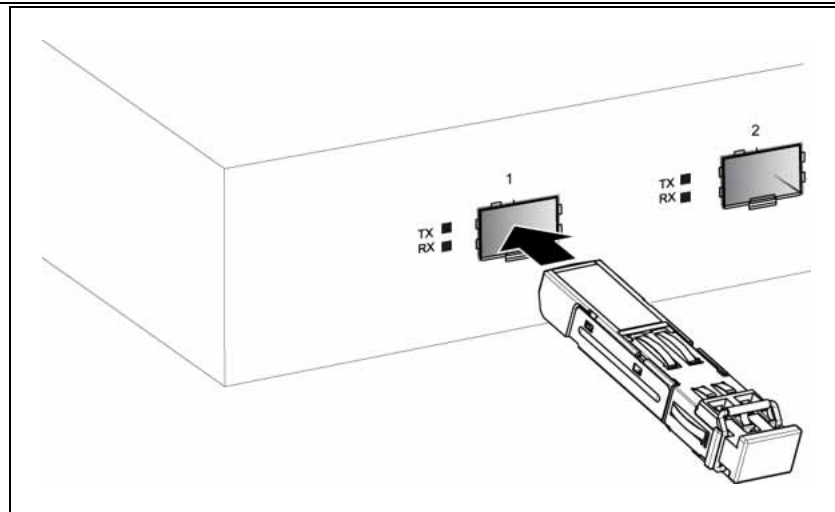
4   Remove the dust cover from the optical bore and insert the fiber optic connector.

—End—

Procedure job aid: locking and extractor mechanisms

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

The following figures shows a typical mechanisms used on SFP transceivers; other locking/extractor mechanisms exist, although they are not shown here. In Figure 1 "SFP with bail lock and extraction mechanism" (page 34), the SFP still has the bore plug installed. Pull the bail to release the device.

Figure 1
SFP with bail lock and extraction mechanism
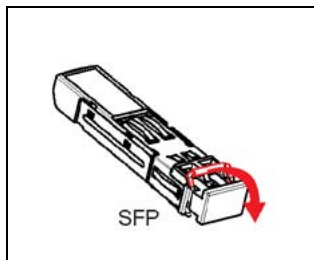
The following figure shows the 1000BASE-SX MT-RJ SFP. Push the tab to release the device.

Figure 2
1000BASE-SX MT-RJ SFP extraction mechanism
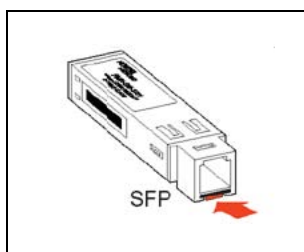
The following figure shows the wrap-around latch-type extraction mechanism. To remove the device, push the collar towards the module.

Figure 3
Wrap-around latch-type extraction mechanism

Removing an SFP

Remove an SFP to replace it or to commission it elsewhere.
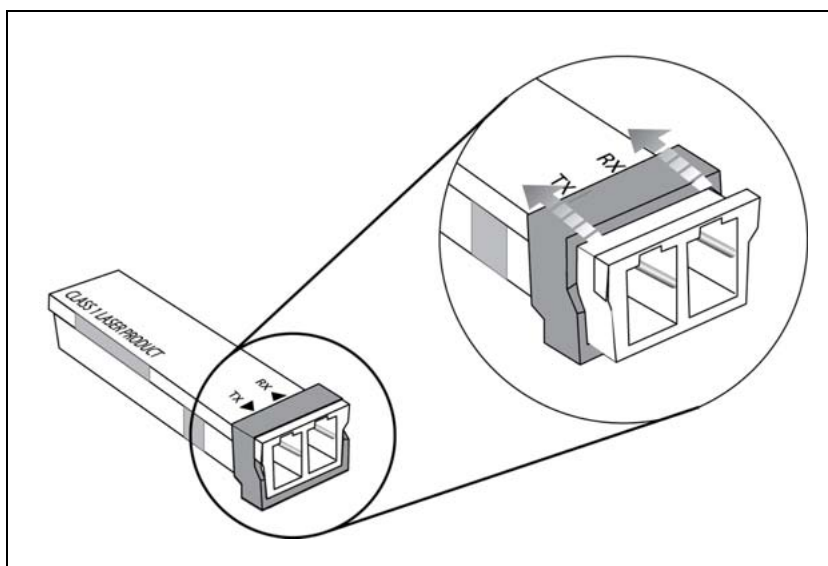
For translations of the following statements, see "ESD and installation caution messages" (page 17) and "Laser safety warnings" (page 20).

> **WARNING**
> **Risk of eye injury by laser**
> 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.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an ESD jack.

Procedure steps

Step	Action
1	Disconnect the network fiber cable from the SFP connector.
2	Affix dust covers over the fiber optic bore and connector.
3	Depending on your SFP model, to release the SFP, press the locking/extractor mechanism.
	Your SFP locking/extractor mechanism can be different than the models shown.
4	Slide the SFP out of the module SFP slot.
	If the SFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP from the slot.
5	Store the SFP in a safe place until needed.

> **ATTENTION**
> If you discard the SFP, be sure to dispose of it according to all national laws and regulations.

—End—

SFP specifications

This section provides technical specifications for the supported small form factor pluggable (SFP) models. Use this information to aid in proper network design.

The specifications given in this section meet or exceed those specified in the applicable IEEE standards, where they exist.

In these specifications, unless otherwise noted, *receiver sensitivity* is defined as the minimum average input optical power for which the receiver is guaranteed to meet the bit error rate (BER) of 10^{-12}.

Navigation

- "1000BASE-ZX DDI CWDM SFP specifications" (page 51)
- "1000BASE-BX DDI SFP specifications" (page 51)
- "1000BASE-EX DDI SFP specifications" (page 52)

SFP labels

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

Figure 4
SFP label
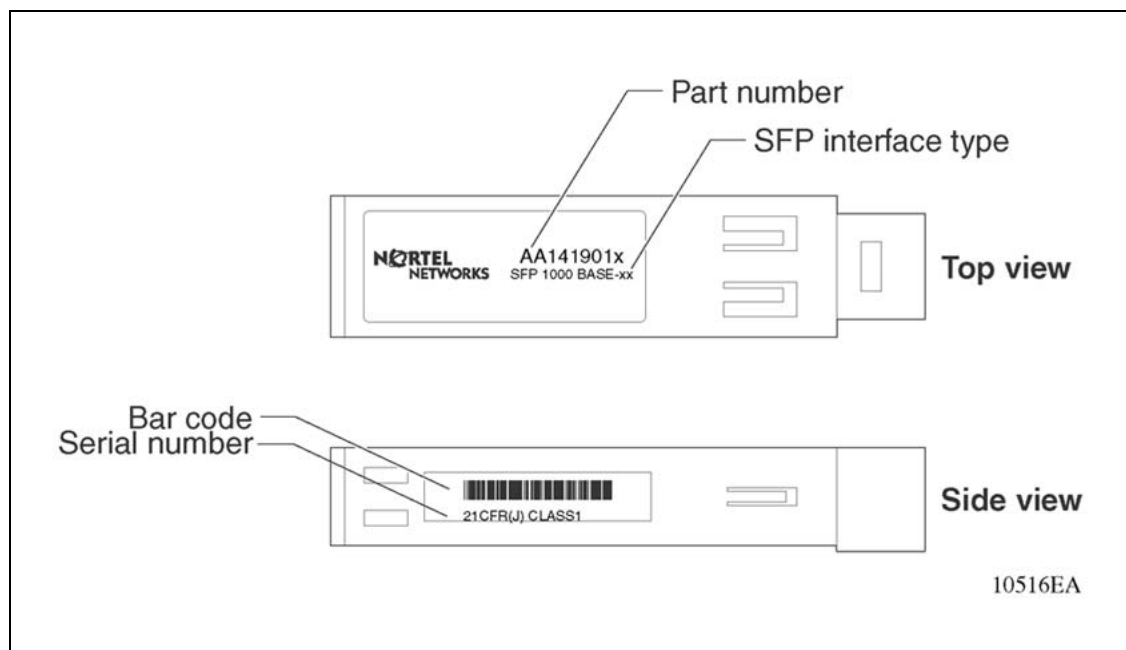
General SFP specifications

The following table describes general SFP specifications.

Table 9
General SFP specifications

Parameter	Description
Dimensions (H x W x D)	13.4 x 8.50 x 56.4 millimeters (mm) 0.53 x 0.33 x 2.22 inches (in.) unless otherwise stated
Operating temperature	-5 to 85C for RoHS -E6 models 0 to 60C for RoHS -E5 models
Storage temperature	-40 to 85C

Parameter	Description
Maximum supply current	300 mA unless otherwise stated
Maximum power consumption	1.0 W unless otherwise stated

100BASE-FX SFP specifications

The 100BASE-FX SFP provides 100 Mbit/s Ethernet Carrier Sense Multiple Access with Collision Detection (CSMA-CD) connectivity using multimode optical fiber. The part number for this model is AA1419074-E6

This device can be used with the Ethernet Routing Switch 4526FX, 4526T, 4526T-PWR, 4550T, 4550T-PWR, and 4524GT.

The following table describes the 100BASE-FX SFP specifications.

Table 10
100BASE-FX SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.5 W
Connectors	Duplex LC
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	• Up to 2 km using 500 MHz-km MMF optic cable
Wavelength	1310 nm
Link optical power budget	10 dB
Transmitter characteristics	
Maximum launch power	-14 dBm
Minimum launch power	-23.5 to -20 dBm
Receiver characteristics	
Receiver sensitivity	−33.5 dBm
Maximum input power	—

T1 SFP specifications

The T1 SFP provides full-duplex Fast Ethernet to T1 connectivity. The part number for this model is AA1419075-E6.

This device can be used with the Ethernet Routing Switch 4526FX, 4526T, 4526T-PWR, 4550T, 4550T-PWR, and 4524GT.

The following table describes the T1 SFP specifications.

Table 11
Fast Ethernet to T1 remote bridge specifications

Parameter	Specification
Maximum power consumption	1 W
Dimensions	Height: 13.8 mm (0.54 in) Width: 15.8 mm (0.62 in) Depth: 75.9 mm (2.99 in)
Standards	Compliant with G.703, G.775, G.823, T1.403, IEEE 802.3
Connectors	RJ-48C
Cabling	CAT5 with RJ-48C pin connection
Distance	Up to 2874 m over 22 AWG cable. The distance may be reduced when 24 AWG UTP CAT5/5E cable is used.
Line code	Binary 8 Zero Substitution (B8ZS) or Alternate Mark Inversion (AMI)

The T1 SFP uses an RJ-48C connector (see the following figure), which is similar to an RJ-45 connection, but with different pinouts.

Figure 5
RJ-48C connector
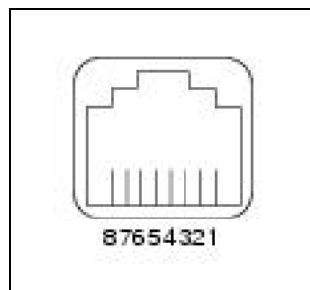
The following table describes the RJ-48C pinouts.

Table 12
RJ-48C pinouts

Pin	Description
1	Receive ring
2	Receive tip
3	Receive shield
4	Transmit ring
5	Transmit tip
6	Transmit shield

Pin	Description
7	Not used
8	Not used

The T1 equipment at the far end of the T1 connection must also use an RJ-48C jack. After the pinout of the RJ-48C jack at the far end is determined, determine if a straight-through or crossover cable is required. An off-the-shelf straight-through cable can be used to directly connect the T1 SFP module and the far-end T1 equipment if the far end has the pinout shown in the following table.

Table 13
RJ-48C pinouts (opposite Tx and Rx connection)

Pin	Description
1	Transmit (Tx) ring
2	Transmit tip
3	Transmit shield
4	Receive (Rx) ring
5	Receive tip
6	Receive shield
7	Not used
8	Not used

If the far end connection does not match the connections shown in this table (Table 13 "RJ-48C pinouts (opposite Tx and Rx connection)" (page 41)), then a crossover cable must be used. The crossover connections are as shown in the following table.

Table 14
RJ-48C crossover cable connections

Terminal A			Terminal B	
Pin	Description		Pin	Description
1	Receive ring		1	Transmit ring
2	Receive tip		2	Transmit tip
3	Receive shield		3	Transmit shield
4	Transmit ring		4	Receive ring
5	Transmit tip		5	Receive tip
6	Transmit shield		6	Receive shield

Terminal A			Terminal B	
Pin	**Description**		**Pin**	**Description**
7	Not used		7	Not used
8	Not used		8	Not used

You can use a short crossover cable with a straight-through cable adapter to connect to a straight-through cable. Do this to convert a straight-through cable to a crossover cable.

T1 SFP—default settings

The Ethernet Routing Switch 4500 Series switches configure the following T1 SFP parameters after the system powered up:

- Transmit Line Build Out (TLBO): set according to cable length.

- Framed or Unframed: Insert framing word into the frame (1 bit per T1 frame) or do not insert framing word into the frame.

- Line code: Binary 8 Zero Substitution (B8ZS) or Alternate Mark Inversion (AMI).

- Clock: Use Rx clock or internal clock for Tx clock (Nortel recommends internal clock for Tx clock).

- Framing: D4 or Extended Super Frame (ESF), depends on the framing word required by the T1 equipment at the far end.

The following table outlines the T1 SFP parameters with default settings:

Table 15
T1 SFP—default parameters

T1 SFP parameter	Default setting
T1 TLBO	0 (0 ft–133 ft)
T1 Framed or unframed	1 (framed)
T1 Line code	0 (B8ZS)
T1 Tx clock source	1 (Tx clock)
T1 Framing	1 (ESF)
T1 Rx sensitivity	1 (limited long haul)
T1 Yellow alarm	0 (normal operation)
T1 Fault propagation	0 (normal operation)
T1 Tx disabled behavior	2 (Alarm Indications Signal—AIS)
T1 Transmit AIS	0 (normal operation)

> **ATTENTION**
> The T1 SFP module must be configured to match the parameters of the T1 equipment at the far end. If you must change the parameters, contact Nortel Technical Support.

1000BASE-T SFP specifications

The 1000BASE-T SFP provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector. The 1000BASE-T SFP only operates at 1 gigabit per second (1 Gbit/s) and does not support 100BASE-T or 10BASE-T interfaces. The part number for this model is AA1419043-E6.

> **ATTENTION**
> Nortel recommends setting all 1000BaseT ports to auto-negotiate in accordance with the IEEE 802.3ab standard. By default, SFPs inserted into certain product-specific modules are set for autonegotiation = True.

The maximum current requirement of the SFP is 375 milliamperes (mA) at 5 volts (V).

The following table describes the 1000BASE-T SFP specifications.

Table 16
IEEE 802.3z 1000BASE-T SFP specifications

Parameter	Specifications
Standards	IEEE 802.3z, IEEE 802.3ab
Connectors	RJ-45
Cabling	CAT5E or better UTP
Distance	Up to 100 m

1000BASE-SX (LC) SFP specifications

The 1000BASE-SX SFP provides 1000BASE-SX Gigabit Ethernet connectivity at 850 nm using multimode optical fiber. This SFP supports full-duplex operation only. The part number for this model is AA1419013-E5.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX SFP.

Table 17
IEEE 802.3z 1000BASE-SX (LC) SFP specifications

Parameter	Specifications
Connectors	Duplex LC

Parameter	Specifications
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	• Up to 275 m using 62.5 µm MMF optic cable • Up to 550 m using 50 µm MMF optic cable
Wavelength	850 nanometers (nm)
Link optical power budget	7.0 deciBels (dB)
Transmitter characteristics	
Launch power	-10 to -4.0 deciBels referenced to 1 milliwatt (dBm)
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum input power	0 dBm

1000BASE-SX (MT-RJ) SFP specifications

The 1000BASE-SX (MT-RJ type) SFP provides Gigabit Ethernet connectivity using MT-RJ multimode fiber connectors. The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX (MT-RJ type) SFP. The part number for this model is AA1419014-E5.

Table 18
IEEE 802.3z 1000BASE-SX (MT-RJ) SFP specifications

Parameter	Specifications
Connectors	Duplex MT-RJ
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	• Up to 275 m using 62.5 µm MMF optic cable • Up to 550 m using 50 µm MMF optic cable
Wavelength	850 nm
Link optical power budget	7.0 dB
Transmitter characteristics	
Launch power	-10 to -4.0 dBm
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum input power	0 dBm

1000BASE-LX SFP specifications

The 1000BASE-LX SFP provides 1000BASE-LX Gigabit Ethernet connectivity at 1310 nanometers (nm) using single mode or multimode optical fiber. The 1000BASE-LX SFP supports full-duplex operation only. The part number for this model is AA1419015-E5.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-LX SFP.

Table 19
IEEE 802.3z 1000BASE-LX SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	• 50 micrometer (μm) multimode fiber (MMF) • 62.5 μm multimode fiber • 9 μm single mode fiber (SMF)
Distance	• Up to 550 meters (m) using MMF • Up to 10 kilometers (km) using SMF
Wavelength	1310 nm
Link optical power budget	11.5 dB
Transmitter characteristics	
Launch power	-9.5 to -3.0 dBm
Receiver characteristics	
Receiver sensitivity	-20 dBm
Maximum input power	-3.0 dBm

1000BASE-XD CWDM SFP specifications

The part numbers of the 40 km models range from AA1419025-E5 to AA1419032-E5.

> **CAUTION**
> **Risk of equipment damage**
> For the 40 km CWDM SFPs, a minimum attenuation of 4 dB must be present between the transmitter and receiver. To avoid receiver saturation, you must insert a minimum attenuation of 4 dB when you test the CWDM SFP in loopback mode, or use short runs of fiber with no intermediate CWDM OADM or CWDM OMUX.

To determine the expected signal loss for an optical add drop multiplexer (OADM), an optical multiplexer (OMUX), or fiber length, see *Nortel Ethernet Routing Switch 8600 Planning and Engineering — Network Design* (NN46205-200).

Table 20
1000BASE-XD CWDM (40 km) SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Operating temperature range	0 to 60C
Link optical power budget	17 dB
Transmitter characteristics	
Launch power	-4.0 to 1.0 dBm
Receiver characteristics	
Receiver sensitivity	-21 dBm
Maximum input power	-3.0 dBm

1000BASE-ZX CWDM SFP specifications

The part numbers of the 70 km models range from AA1419033-E5 to AA1419040-E5.

> **CAUTION**
> **Risk of equipment damage**
> For the 70 km CWDM SFPs, a minimum attenuation of 10 dB must be present between the transmitter and receiver.

Table 21
1000BASE-ZX CWDM (70 km) SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Operating temperature range	0 to 60C
Link optical power budget	20 dB

Parameter	Specifications
Transmitter characteristics	
Launch power	-3.0 to 2.0 dBm
Receiver characteristics	
Receiver sensitivity	-23 dBm
Maximum input power	-3.0 dBm

1000BASE-SX DDI SFP specifications

The following table describes the 1000BASE-SX DDI SFP, which has a reach of up to 550 m using 50 µm MMF, and of 275 m using 62.5 µm MMF. This SFP operates at 850 nm. The part number of this SFP is AA1419048-E6.

Table 22
1000BASE-SX SFP DDI (550 m) specifications

Parameter	Specifications
Maximum electrical power consumption	1 watt (W)
Connector	Duplex LC
Cabling	MMF
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	7.5 dB
Transmitter characteristics	
Launch power	-9.5 to -4.0 dBm
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum receiver power	0 dBm

1000BASE-LX DDI SFP specifications

This SFP can attain a reach of up to 10 km and operates at 1310 nm. The part number of this SFP is AA1419049-E6.

Table 23
1000BASE-LX DDI SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 watt (W)
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s

Parameter	Specifications
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	9.5 dB
Transmitter characteristics	
Launch power	-9.5 to -3.0 dBm
Receiver characteristics	
Receiver sensitivity	-19.0 dBm
Maximum receiver power	-3.0 dBm

1000BASE-XD DDI 1310 nm SFP specifications

The following table describes the 1000BASE-XD DDI SFP. This SFP operates at 1310 nm and has a reach of up to 40 km. The part number is AA1419050-E6.

Table 24
1000BASE-XD DDI 1310 nm SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B) code	1.25 Gbit/s
Link optical power budget	18 dB
Transmitter characteristics	
Launch power	-4.5 to 0 dBm
Receiver characteristics	
Receiver sensitivity	-22.5 dBm
Maximum receiver power	0 dBm

1000BASE-XD DDI 1550 nm SFP specifications

The following table describes the 1000BASE-XD DDI SFP. This SFP operates at 1550 nm and has a reach of up to 40 km. The part number is AA1419051-E6.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 3 dB of attenuation is present between the transmit and receive ports.

Table 25
1000BASE-XD DDI 1550 nm SFP specifications

Parameter	Specification
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 μm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	22 dB
Maximum dispersion power penalty	2 dB at 40 km
Transmitter characteristics	
Launch power	-2.0 to 3.0 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	0 dBm

1000BASE-ZX DDI SFP specifications

The following table describes the 1000BASE-ZX DDI SFP. This SFP operates at 1550 nm and has a reach of up to 70 km. The part number is AA1419052-E6.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 5 dB of attenuation is present between the transmit and receive ports.

Table 26
1000BASE-ZX DDI 1550 nm SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC

Parameter	Specifications
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	24 dB
Maximum dispersion power penalty	2 dB at 70 km
Transmitter characteristics	
Launch power	0 to 5 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	-0 dBm

1000BASE-XD DDI CWDM SFP specifications

The following table describes specifications for 1000BASE-XD CWDM SFPs numbered AA1419053-E6 to AA1419060-E6.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 4 dB of attenuation is present between the transmit and receive ports.

Table 27
1000BASE-XD CWDM SFP DDI (40 km) specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	17 dB
Maximum dispersion power penalty	1 dB at 40 km
Transmitter characteristics	
Launch power	-4.0 to 1.0 dBm
Receiver characteristics	
Receiver sensitivity	-21 dBm
Maximum receiver power	-3.0 dBm

1000BASE-ZX DDI CWDM SFP specifications

The following table describes specifications for CWDM SFPs numbered AA1419061-E6 to AA1419068-E6.

> ⚠️ **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 8 dB of attenuation is present between the transmit and receive ports.

Table 28
1000BASE-ZX CWDM SFP DDI (70 km) specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 μm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	24 dB
Maximum dispersion power penalty	2 dB at 70 km
Transmitter characteristics	
Launch power	0 to 5.0 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	-3.0 dBm

1000BASE-BX DDI SFP specifications

The 1000BASE-BX bidirectional SFPs (part numbers AA1419069-E6 and AA1419070-E6) provide Gigabit Ethernet connectivity over a single fiber.

Figure 6
1000BASE-BX
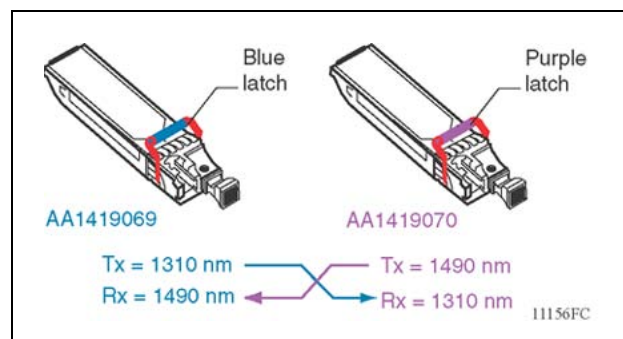
As shown in the previous figure, the transmit (Tx) and receive (Rx) paths share the same fiber by using two different wavelengths. One model transmits at 1310 nm and receives at 1490 nm, while the mating model transmits at 1490 nm and receives at 1310 nm. You can only connect a mating pair.

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 single mode fiber optic cabling.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX SFP.

Table 29
IEEE 802.3ah 1000BASE-BX10 SFP specifications

Parameter	Specifications
Connectors	Single-fiber LC
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Distance	Up to 10 km
Wavelength	1310 nm and 1490 nm
Link optical power budget	11.0 dB
Maximum transmitter and dispersion power penalty	3.3 dB
Transmitter characteristics	
Maximum launch power	-3.0 dBm
Minimum launch power	-9.0 dBm
Receiver characteristics	
Maximum receiver sensitivity	-19.5 dBm
Maximum input power (maximum average receive power)	-3.0 dBm

1000BASE-EX DDI SFP specifications

The following table describes the 1000BASE-EX DDI SFP. This SFP operates at 1550 nm and has a reach of up to 120 km. The part number of this SFP is AA1419071-E6.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 14 dB of attenuation is present between the transmit and receive ports.
>
> To attain the BER of 10^{-12}, the minimum attenuation between the transmit and receive ports is 15 dB.

Table 30
1000BASE-EX DDI SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.2 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	30 dB
Maximum dispersion power penalty	2.0 dB at 120 km
Transmitter characteristics	
Launch power	0 to 5.0 dBm
Receiver characteristics	
Receiver sensitivity	-30 dBm
Maximum receiver power	-9.0 dBm

10 Gigabit small form factor pluggable transceivers

This section describes how to install and remove 10 Gigabit Small Form Factor Pluggable (XFP) transceivers, and lists some technical specifications for the supported XFP models.

> **ATTENTION**
> Nortel recommends that you only use Nortel qualified XFPs. If you do choose to use other vendor XFPs, be aware that Nortel does not support the use of other XFPs.

Navigation

Selecting an XFP

Use an XFP transceivers to interface a device motherboard to a fiber optic cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

Step	Action
1	Determine the required reach.
	Depending on the product, XFPs are available for cable distances of up to 300 meters (m), 10 kilometers (km), 40 km, and 80 km.
2	Determine any wavelength restrictions or requirements.
3	Use the following job aids to determine the appropriate XFP for your application.

—End—

Procedure job aid: XFP models

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

All Nortel XFPs use LC connectors (Lucent optical connectors) to provide precision keying and low interface losses.

The following table lists and describes the Nortel XFP models. Not all products support all models. For specifications for these XFPs, see .

> **ATTENTION**
>
> You can configure the XFP to operate in either LAN or WAN mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

> ⚠ **CAUTION**
>
> Nortel recommends that you install only one 10GBASE-ZR/ZW XFP per module due to cooling limitations on the 8683XLR and 8683XZR modules. Nortel further recommends the installation of the XFP only in port 1. You can install a 10GBASE-SR, -LR/LW, or -ER/EW in one or both of the remaining ports.

Table 31
XFP models for the Ethernet Routing Switch 4500 Series

Model number	Product number	Description
10GBASE-SR	AA1403005-E5	850 nanometers (nm). The range is up to: • 22 m using 62.5 micrometer (μm), 160 megaHertz times km (MHz-km) MMF • 33 m using 62.5 μm, 200 MHz-km MMF • 66 m using 62.5 μm, 500 MHz-km MMF • 82 m using 50 μm, 500 MHz-km MMF • 300 m using 50 μm, 2000 MHz-km MMF
10GBASE-ZR/ZW	AA1403006-E5	1550 nm SMF. The range is up to 80 km.

Table 32
XFP models for the Ethernet Routing Switch 5500 Series

Model number	Product number	Description
10GBASE-SR	AA1403005-E5	850 nanometers (nm). The range is up to: • 22 m using 62.5 micrometer (μm), 160 megaHertz times km (MHz-km) MMF • 33 m using 62.5 μm, 200 MHz-km MMF • 66 m using 62.5 μm, 500 MHz-km MMF • 82 m using 50 μm, 500 MHz-km MMF • 300 m using 50 μm, 2000 MHz-km MMF
10GBASE-LR/LW	AA1403001-E5	1310 nm SMF. The range is up to 10 km.
10GBASE-ER/EW	AA1403003-E5	1550 nm SMF. The range is up to 40 km.

Table 33
XFP models

Model number	Product number	Description
10GBASE-SR	AA1403005-E5	850 nanometers (nm). The range is up to: • 22 m using 62.5 micrometer (μm), 160 megaHertz times km (MHz-km) MMF • 33 m using 62.5 μm, 200 MHz-km MMF • 66 m using 62.5 μm, 500 MHz-km MMF • 82 m using 50 μm, 500 MHz-km MMF • 300 m using 50 μm, 2000 MHz-km MMF
10GBASE-LR/LW	AA1403001-E5	1310 nm SMF. The range is up to 10 km.
10GBASE-ER/EW	AA1403003-E5	1550 nm SMF. The range is up to 40 km.
10GBASE-ZR/ZW	AA1403006-E5	1550 nm SMF. The range is up to 80 km.

Installing an XFP

Install an XFP to provide a 10 Gigabit Ethernet interface between the switch and other network devices.

Installing an XFP takes about three minutes.

For translations of the following statements, see "ESD and installation caution messages" (page 17).

WARNING
Risk of eye injury by laser
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.

CAUTION
Risk of equipment damage
To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an ESD jack.

CAUTION
Risk of equipment damage
Only trained personnel can install this product.

CAUTION
Risk of equipment damage
Nortel recommends that you install only one 10GBASE-ZR/ZW per module due to cooling limitations on the 8683XLR and 8683XZR modules. Nortel further recommends the installation of the XFP only in port 1. You can install a 10GBASE-SR, -LR/LW, or -ER/EW in one or both of the remaining ports.

Prerequisites

- Verify that the XFP is the correct model for your network configuration.

Procedure steps

Step	Action
1	Remove the XFP from its protective packaging.
2	Grasp the XFP between your thumb and forefinger.
3	Insert the XFP into the XFP slot on the module. Apply a light pressure to the XFP until the device clicks and locks into position in the module.

> **CAUTION**
> **Risk of equipment damage**
> XFPs are keyed to prevent incorrect insertion. If the XFP resists pressure, do not force it; turn it over, and reinsert it.
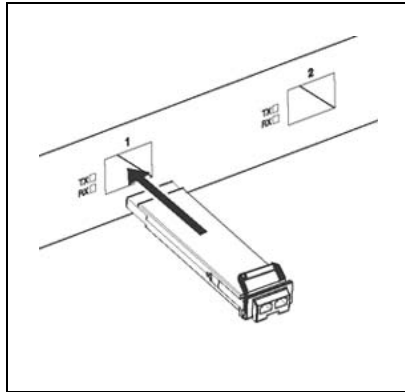
4   Remove the dust cover from the XFP optical bores and insert the fiber optic cable.
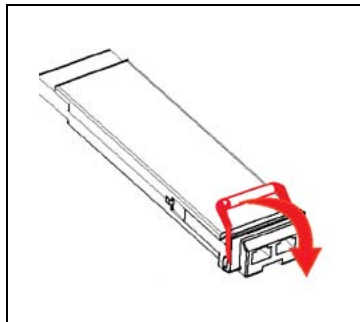

—End—

Procedure job aid: locking and extractor mechanisms
Depending on the transceiver manufacturer, your XFP transceiver can have various types of locking/extractor mechanisms.

The following figure shows a typical bail-type mechanism used on XFP transceivers. Pull the bail down to release the device.

Figure 7
XFP with bail lock and extraction mechanism

Removing an XFP

Remove an XFP to replace it or to commission it elsewhere.

For translations of the following statements, see "ESD and installation caution messages" (page 17) and "Laser safety warnings" (page 20).

> **WARNING**
> **Risk of eye injury by laser**
> 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.

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an ESD jack.

Procedure steps

Step	Action
1	Disconnect the network fiber cable from the XFP connector.
2	Affix a dust cover over the optical connector.
3	Pull the bail mechanism on the XFP to release the XFP.
4	Slide the XFP out of the module XFP slot. If the XFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the XFP from the slot.
5	Replace the port dust cover or EMI plug in the module.
6	Store the XFP in a safe place until needed.

> **ATTENTION**
> If you discard the XFP, be sure to dispose of it according to all national laws and regulations.

—End—

XFP specifications

This section provides technical specifications for the supported 10 Gigabit SFP (XFP) models. Use these specifications to aid in network design. The specifications provided here are a subset of the IEEE 802.3ae and 802.3aq specifications. For more details, see these standards documents. All Nortel XFPs meet or exceed these standards.

ATTENTION
Nortel recommends that you only use Nortel-qualified XFPs. If you do choose to use other vendor XFPs, be aware that Nortel does not support the use of other XFPs.

Navigation

XFP labels

The Nortel label on a typical XFP contains a Nortel serial number, a bar code, a manufacturer's code, an interface type, and a part number.

Figure 8
XFP label
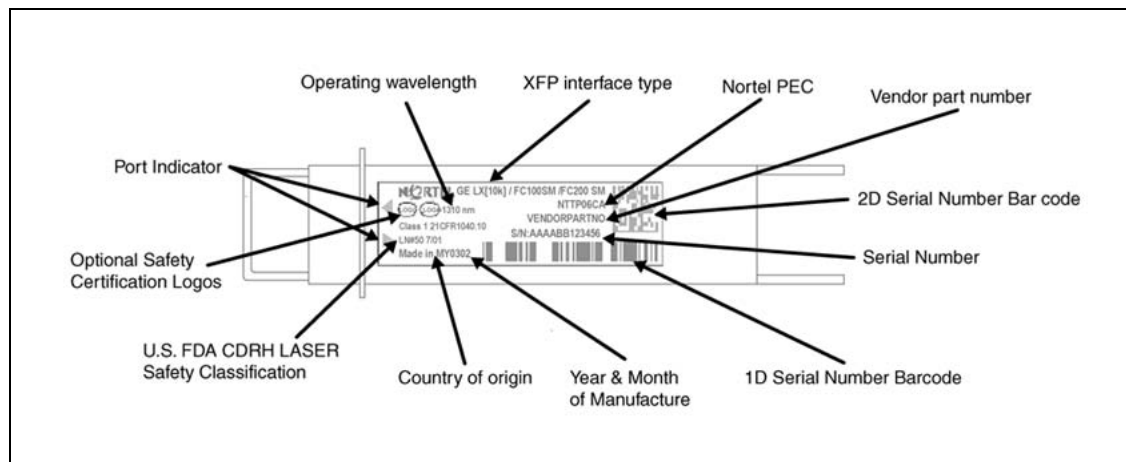
General XFP specifications

The following table describes general XFP specifications.

Table 34
General XFP specifications

Parameter	Specifications
Dimensions (H x W x D)	0.49 x 0.72 x 2.79 inches (in.)
	12.5 x 18.35 x 71.1 millimeters (mm)
Connectors	LC ultra physical contact (UPC)
Storage temperature	-40 to 85C
Operating temperature	0 to 70C

10GBASE-SR XFP specifications

The 10GBASE-SR XFP provides 10 GbE service at 850 nm.

The following table lists the specifications for the 10GBASE-SR XFP. The part number of this XFP is AA1403005-E5.

For more information about the 10GBASE-SR XFP, including test and measurement information, see the IEEE 802.3ae standard.

The 10GBASE-SR XFP is supported by the Ethernet Routing Switch 5530 (not by the 5510 or 5520).

> **CAUTION**
> **Risk of equipment damage**
> To prevent damage to the optical receiver, ensure that at least 1 dB of attenuation is present between the transmit and receive ports.

Table 35
IEEE 802.3ae 10GBASE-SR XFP specifications

Parameter	Specifications
Data rate	10.0 Gbit/s
Line rate (64B/66B code)	10.3125 gigabits per second (Gbit/s) ± 100 parts per million (ppm)
Mean Time Between Failures (MTBF)	675 000 hours
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Using 62.5 μm MMF optic cable: • 160 MHz-km fiber: 2 to 26 m • 200 MHz-km fiber: 2 to 33 m Using 50 μm MMF optic cable: • 400 MHz-km fiber: 2 to 66 m • 500 MHz-km fiber: 2 to 82 m • 2000 MHz-km fiber: 2 to 300 m
Link optical power budget	7.3 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Transmitter characteristics	
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	-7.3 to -1.0 deciBels referenced to 1 milliwatt (dBm)
Maximum average launch power of OFF transmitter	-30 dBm
Minimum extinction ratio	3.0 dB
Maximum relative intensity noise $_{12}$OMA	-128 dB per Hertz (dB/Hz)
Maximum optical return loss tolerance	-12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	-9.9 to -1.0 dBm
Maximum average receive power for damage	0 dBm

Parameter	Specifications
Maximum receiver sensitivity in OMA	-11.1 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-7.5 dBm
Receiver electrical 3 dB upper cutoff frequency	12.3 gigaHertz (GHz)

The stressed sensitivity values are for system level BER measurements, which include the effects of CDR circuits. Nortel recommends that you allocate at least 0.4 dB additional margin if you make component level measurements without the effect of CDR circuits.

10GBASE-LR/LW XFP specifications

The 10GBASE-LX SFP provides 10 GbE service at a nominal wavelength of 1310 nm. This XFP can attain link lengths of up to 10 km.

The following table lists the transmitter specifications for the 10GBASE-LR/LW XFP. The part number of this XFP is AA1403001-E5.

For more information about the 10GBASE-LX XFP, including test and measurement information, see the IEEE 802.3ae standard.

The 10GBASE-SR XFP is supported by the Ethernet Routing Switch 5530 (not by the 5510 or 5520).

ATTENTION
You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

Table 36
IEEE 802.3ae 10GBASE-LR/LW XFP specifications

Parameter	Specifications
MTBF	675 000 hours
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
Transmitter characteristics	

Parameter	Specifications
Line rate (nominal)	10GBASE-LR 10.3125 Gbit/s ±100 ppm 10GBASE-LW 9.95328 Gbit/s ±20 ppm
Average launch power	-8.2 to 0.5 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-6.2 dBm
Minimum optical modulation amplitude	-5.2 dBm
Maximum average launch power of OFF transmitter[c]	-30 dBm
Minimum extinction ratio	3.5 dB
$RIN_{12}OMA$ (maximum)	-128 dB/Hz
Maximum optical return loss tolerance	-12 dB
Maximum transmitter reflectance	-12 dB
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbit/s ± 100 ppm 10GBASE-LW 9.95328 Gbit/s ± 100 ppm
Average receive power for BER 10^{-12}	-14.4 dBm to 0.5 dBm
Maximum average receive power for damage	1.5 dBm
Maximum receiver sensitivity in OMA	-12.6 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-10.3 dBm
Receiver electrical 3 dB upper cutoff frequency	12.3 GHz

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 condition

10GBASE-ER/EW XFP specifications

The following table lists the transmitter specifications for the 10GBASE-ER/EW XFP. The reach for this XFP is up to 40 km at a wavelength of 1550 nm. The part number of this XFP is AA1403003-E5.

For more information about the 10GBASE-EX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

> **ATTENTION**
>
> You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

Table 37
IEEE 802.3ae 10GBASE-ER/EW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ER 10.3125 Gbit/s ±100 ppm 10GBASE-EW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Distance	Up to 40 km
Link optical power budget	15 dB
Transmitter and dispersion power penalty	3.0 dB at 40 km
Transmitter characteristics	
Launch power	-4.7 to 4.0 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-2.1 dBm
Minimum optical modulation amplitude	-1.7 dBm
Maximum average launch power of OFF transmitter	-30 dBm
Minimum extinction ratio	3.0 dB
Maximum $RIN_{12}OMA$	-128 dB/Hz
Maximum optical return loss tolerance	-21 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	-15.8 dBm to -1.0 dBm
Maximum receive power for damage	4.0 dBm
Maximum receiver sensitivity in OMA	-14.1 dBm
Maximum receiver reflectance	-26 dB
Stressed receiver sensitivity in OMA	-11.3 dBm
Receive electrical 3 dB upper cutoff frequency (maximum)	12.3 GHz

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.

10GBASE-ER/EW XFP specifications

The following table lists the transmitter specifications for the 10GBASE-ER/EW XFP. The reach for this XFP is up to 40 km at a wavelength of 1550 nm. The part number of this XFP is AA1403003-E5.

For more information about the 10GBASE-EX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

The 10GBASE-SR XFP is supported by the Ethernet Routing Switch 5530 (not by the 5510 or 5520).

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

Table 38
IEEE 802.3ae 10GBASE-ER/EW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ER 10.3125 Gbit/s ±100 ppm 10GBASE-EW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Distance	Up to 40 km
Link optical power budget	15 dB
Transmitter and dispersion power penalty	3.0 dB at 40 km
Transmitter characteristics	
Launch power	-4.7 to 4.0 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-2.1 dBm
Minimum optical modulation amplitude	-1.7 dBm
Maximum average launch power of OFF transmitter	-30 dBm
Minimum extinction ratio	3.0 dB

Parameter	Specifications
Maximum $RIN_{12}OMA$	-128 dB/Hz
Maximum optical return loss tolerance	-21 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	-15.8 dBm to -1.0 dBm
Maximum receive power for damage	4.0 dBm
Maximum receiver sensitivity in OMA	-14.1 dBm
Maximum receiver reflectance	-26 dB
Stressed receiver sensitivity in OMA	-11.3 dBm
Receive electrical 3 dB upper cutoff frequency (maximum)	12.3 GHz

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.

10GBASE-ZR/ZW XFP specifications

The following table lists the transmit specifications for the 10GBASE-ZR/ZW XFP. The reach is up to 80 km at a wavelength of 1550 nm. The part number of this XFP is AA1403006-E5.

For more information about the 10GBASE-ZX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 11 dB of attenuation is present between the transmit and receive ports.

Table 39
10GBASE-ZR/ZW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gbit/s ±100 ppm 10GBASE-ZW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Distance	Up to 80 km
Link optical power budget	24 dB
Maximum transmitter and dispersion penalty	3.0 dB at 80 km (G.652 fiber)
Transmitter characteristics	
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Side mode suppression ratio (minimum)	30 dB
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	-1.7 dBm
Average launch power of OFF transmitter (maximum)	-30 dBm
Extinction ratio (ER)	minimum 3.5 dB end of life maximum 7.0 dB start of life
$RIN_{12}OMA$ (maximum)	-128 dB/Hz
Maximum optical return loss tolerance	-26 dB
Maximum transmitter reflectance	-12 dB
Receiver characteristics	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
Signaling speed (nominal)	10GBASE-ZR 10.3125 Gbit/s ± 100 ppm 10GBASE-ZW 9.95328 Gbit/s ± 100 ppm
Maximum average receiver sensitivity	-24 dBm
Maximum receive power (for BER 10^{-12} and 9 dB ER)	-7.0 dBm
Maximum average receive power for damage	5.0 dBm
Receiver reflectance (maximum)	-27 dB
Receive electrical 3 dB upper cutoff frequency	9.3 GHz

10GBASE-ZR/ZW XFP specifications

The following table lists the transmit specifications for the 10GBASE-ZR/ZW XFP. The reach is up to 80 km at a wavelength of 1550 nm. The part number of this XFP is AA1403006-E5.

For more information about the 10GBASE-ZX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 11 dB of attenuation is present between the transmit and receive ports.

Table 40
10GBASE-ZR/ZW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gbit/s ±100 ppm 10GBASE-ZW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Distance	Up to 80 km
Link optical power budget	24 dB
Maximum transmitter and dispersion penalty	3.0 dB at 80 km (G.652 fiber)
Transmitter characteristics	
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Side mode suppression ratio (minimum)	30 dB
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	-1.7 dBm
Average launch power of OFF transmitter (maximum)	-30 dBm
Extinction ratio (ER)	minimum 3.5 dB end of life maximum 7.0 dB start of life
$RIN_{12}OMA$ (maximum)	-128 dB/Hz
Maximum optical return loss tolerance	-26 dB
Maximum transmitter reflectance	-12 dB
Receiver characteristics	

Parameter	Specifications
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
Signaling speed (nominal)	10GBASE-ZR 10.3125 Gbit/s ± 100 ppm 10GBASE-ZW 9.95328 Gbit/s ± 100 ppm
Maximum average receiver sensitivity	-24 dBm
Maximum receive power (for BER 10^{-12} and 9 dB ER)	-7.0 dBm
Maximum average receive power for damage	5.0 dBm
Receiver reflectance (maximum)	-27 dB
Receive electrical 3 dB upper cutoff frequency	9.3 GHz

Index

Symbols/Numerics

A

C

D

Nortel Ethernet Routing Switch 5500 Series

Installation — SFPs and XFPs

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