



PRODUCT DOCUMENTATION

BTI 7000 Series Dynamic Optical Layer Engineering Guideline

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Preface

This preface explains who should read this guide, related documentation, and documentation conventions.

Audience

This guide is intended for site planning engineers and network operators.

Features of the BTI 7000 Series

For detailed information about this release, see the *BTI 7000 Series Release Notes* for this release.

BTI 7000 Series common equipment

The following table lists the shelves and other common equipment introduced as part of the BTI 7000 Series. For detailed information, see the *BTI 7000 Series Product Guide* and the *BTI 7000 Series Common Equipment Installation Guide*.

BTI 7000 Series common equipment

Equipment	PEC
BTI 7060	BT7A50AA
BTI 7060 with rear access -48V	BT7A50AR
BTI 7060 Cooling Unit (CU)	BT7A52DA, BT7A52EA
BTI 7060 Main Shelf Interface (MSI)	BT7A53BA, BT7A53BB
BTI 7060 Expansion Shelf Interface (ESI)	BT7A54BA
BTI 7060/BTI 7200 System Control Processor (SCP)	BT7A20CA
BTI 7060 AC Power Assembly Kit	BT7A50BA
BTI 7060 AC Power Module	BT7A58AA
BTI 7060 Filler Panel Kit	BT7A55EA
2U Cover – ANSI	BT7A5070
2U Cover – ETSI	BT7A5071
BTI 7030	BT7A56AA
BTI 7030 Cooling Unit (CU)	BT7A57BA
BTI 7030 Main Shelf Interface (MSI)	BT7A53CA, BT7153CB, BT7A53BB
BTI 7030 System Control Processor (SCP)	BT7A21BA
BTI 7030 AC Power Assembly Kit	BT7A56CA
BTI 7030 AC Power Module	BT7A58BA
1U Cover – ANSI	BT7A5670
1U Cover – ETSI	BT7A5671
BTI 7020	BT7A56BA
BTI 7200	BT7A51AA

BTI 7000 Series common equipment (Continued)

Equipment	PEC
BTI 7200 with rear access -48V	BT7A51AR
BTI 7200 Cooling Unit (CU)	BT7A52EA
BTI 7200 Main Shelf Interface (MSI)	BT7A53EA
BTI 7200 Common Communication Module (CCM)	BT7A54EA
BTI 7200 ANSI shelf cover	BT7A5180
BTI 7200 ETSI shelf cover	BT7A5181
BTI 7200 Air Deflector	BT7A59EA
BTI 7200 Installation kit	BT7A5034
BTI 7200 Pack of 5 Mounting Bracket Pairs (7200)	BT7A5035
BTI 7200 Pack of 5 Center Guides	BT7A5036
Single Expansion Shelf Kit (2x 1310 SFP, 1x Dual SM Patch Cord 1.5m)	BP1A58LA-01.5
Single Expansion Shelf Kit (2x 1310 SFP, 1x Dual SM Patch Cord 2m)	BP1A58LA-02

The BTI 7000 Series shelves support a wide range of modules. For the list of modules supported, see the *BTI 7000 Series Product Guide*.

The following table lists the BTI graphical user interface management software suite. For detailed information about each application, refer to the documentation set for the application.

Management software suite

proNX Management Suite
proNX Service Manager (PSM)
proNX 900 Node Controller (proNX 900)

Equipment compliance

The following table provides agency-compliance information for BTI 7000 Series equipment.



Agency	Compliance information
FDA	This equipment is classified by the FDA under IEC 60825, parts 1 and 2, as a Class 1 laser product with a Class 1 hazard rating.
FCC	This equipment complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.
Industry Canada	This Class A digital apparatus complies with Canadian ICES-003.


Organization of the BTI 7000 Series documentation

The following guides are contained in the BTI 7000 Series documentation suite.

- *BTI 7000 Series Alarm and Troubleshooting Guide*
- *BTI 7000 Series Command Line Interface Reference Guide*
- *BTI 7000 Series Common Equipment Installation Guide*
- *BTI 7000 Series Dynamic Optical Layer Engineering Guideline*
- *BTI 7000 Series Management Communications Channel Solutions Guide*
- *BTI 7000 Series Multiplexing Solutions Guide*
- *BTI 7000 Series Muxponder Solutions Guide*
- *BTI 7000 Series Operations Solutions Guide*
- *BTI 7000 Series Optical Amplifier and DCM Solutions Guide*
- *BTI 7000 Series packetVX Solutions Guide*
- *BTI 7000 Series Product Guide*
- *BTI 7000 Series SNMP Overview Guide*
- *BTI 7000 Series Test and Turn-up Guide*
- *BTI 7000 Series TL1 Reference Guide*
- *BTI 7000 Series Transceiver InformationGuide*
- *BTI 7000 Series Transponder Solutions Guide*
- *BTI 7000 Series Upgrade Guide*
- *BTI 7000 Series Release Notes*
- BTI 7000 Series Quick Installation Notes (various)

Documentation conventions

Convention	Description
Note	Means reader take note. Notes contain helpful suggestions or background information.
 Caution	Means reader be careful. Equipment damage or loss of data can result from your actions.
 Warning	Means reader be careful. Harm to yourself or others can result from your actions.

Convention	Description
 Laser Warning	Invisible laser radiation can be emitted from the aperture ports of amplifier circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

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1.0 Dynamic Optical Layer overview

The BTI 7000 Series Dynamic Optical Layer (DOL) is an integrated component of the BTI 7000 Series packet optical platform. It is a system-oriented network foundation that combines reconfigurable optical add/drop multiplexing, reach extension, and end-to-end service management capabilities to provide simplified operations and enhanced automation. The modular architecture simplifies the design, installation, operation and optimization of metro service delivery networks.

The DOL consists of 2-and 4-degree ROADM-on-a-blade (ROB) modules for flexible, point-and-click enabled wavelength routing, and DWDM Line Amplifier (DLA) modules for reach extension in an extremely compact form factor. The common control system embedded in ROB and DLA modules enables plug-and-play operation to simplify the planning, deployment, service provisioning, ongoing optimization, and power management of the network. The solution also provides end-to-end channel performance metrics that supports comprehensive service visibility and enables rapid network troubleshooting. These elements are the foundation for packet optical service delivery networks to support up to a full 96 wavelength (960Gbps) system capacity and offer “any-wavelength anywhere” add/drop access, automated network equalization, and per-channel performance monitoring metrics.

The system-oriented nature of the DOL allows communication between modular elements through an integrated Optical Service Channel (OSC). Through the OSC, modular elements share information and automatically measure span loss, adjusts the system gain, and leverage a multi-span feedback loop that enables per-channel pre-emphasis to address wavelength tilt and ripple. The OSC enables turning up of the optical layer without any service wavelengths, and provides accurate span measurement, and robust optical shutdown capabilities.

The DOL dispersion management strategy compensates for chromatic dispersion following each span. Express wavelengths and add wavelengths on a network span are launched with minimal residual dispersion.

ROADM-on-a-Blade (ROB)

ROADM-on-a-Blade (ROB) modular elements provide per-wavelength path switching and power equalization. ROB modules offer access to up to 96 channels on each fiber pair, and services can be provisioned over a network with point-and-click simplicity that reduces operational effort and reduces network operating costs.

The DOL supports the following ROADM-on-a-blade modules:

- 2D ROADM-on-a-blade 40ch: BT7A07AA
- 4D ROADM-on-a-blade 40ch: BT7A07BA
- 4D ROADM-on-a-blade 96ch: BT7A07CA

40-channel 2D ROADM-on-a-blade (ROB2) - 100 GHz channel spacing

The ROB2 is a double-width, single-height module that provides bidirectional DWDM amplification to provide channel-level power control, and supports channel add/drop reconfigurability. It has a single, bidirectional east- or west-facing WDM line port. The client side is equipped with two bidirectional ports: C1 and C2.

The ROB2 can be used in various nodal configurations. It may be deployed at a terminal site, in which the C1 client port is connected to mux/demux equipment for access to individual WDM channels. At a line site, the ROB2 may be combined with other ROB modules to implement a 2-degree reconfigurable optical add/drop multiplexer node (ROADM node).

40-channel 4D ROADM-on-a-blade (ROB4) - 100 GHz channel spacing

The 40-channel ROB4 is a double-width, single-height module that provides four bi-directional client ports. The 40-channel ROB4 can generally be used wherever a ROB2 is used, but its main application is for reconfigurable add/drop nodes where three or four WDM network spans intersect. These configurations are referred to as 3- and 4-degree optical add/drop sites.

Ingress traffic (received on the line port and forwarded through client ports) is split into four equivalent WDM composites for forwarding to each of the client output ports. For each channel in the system, egress traffic is selected from one of four client ports.

The 40-channel ROB4 module can switch up to 40 wavelengths.

96-channel 4D ROADM-on-a-blade (ROB4) - 50 GHz channel spacing

The 96-channel ROB4 is a double-width, single-height module that provides four bi-directional client ports. Its main application is for reconfigurable add/drop nodes where three or four WDM network spans intersect. These configurations are referred to as 3- and 4-degree optical add/drop sites.

Ingress traffic (received on the line port and forwarded through client ports) is split into four equivalent WDM composites for forwarding to each of the client output ports. In the egress direction, the WSS is connected to all four client inputs, for channel selection from one of four sources.

The 96-channel ROB4 operates on 50 GHz wavelength spacing, and is therefore incompatible with existing 100 GHz wavelength spacing equipment (such as the ROB2, the 40-channel ROB4,

the 40-channel Mux/Demux, and the DLA2). The 96-channel ROB4 cannot be used to replace the ROB2 or the 40-channel ROB4 module, and can only work with the 96-channel Mux/Demux. The 96-channel ROB4 module can switch up to 96 wavelengths.

DWDM Line Amplifier

DWDM Line Amplifier (DLA) modular elements are engineered to streamline the design, deployment and operation of the optical layer. The amplifiers are fully plug-and-play, and designed to auto-configure power levels and tilt when powered on. DLA elements integrate a per-direction amplification, dynamic optical layer control system, and management connectivity within a single slot. DLAs continuously monitor the line and adjust power levels as needed and interoperate with ROB elements to ensure end-to-end wavelength power control across the entire network.

DLA elements can only work with 100 GHz channel spacing equipment, and cannot work with the 96-channel ROB4 module.

DCMs

The DOL uses DCMs that are designed specifically for compatibility with DOL configurations. DCMs provide dispersion compensation for standard single mode fiber spans (SMF), and variants are available to provide coverage for different span lengths. All (100km) DCMs include two ports— DCM and Expansion:

- DCM port: Connects to a DLA or ROB module.
- Expansion port: Connects to another DCM module to form a chain of DCM modules.

All DOL DCM modules are a single-width, single-height, and support 100 km.

Multiplexers

The DOL supports the 40-channel Mux/Demux passive shelf, the 96-channel Mux/Demux passive shelf, and the 8-channel Mux/Demux module.

40-channel Mux/Demux - 100 GHz channel spacing

The 40-channel Mux/Demux module performs channel aggregation at 100 GHz spacing for all wavelengths in the DWDM channel plan onto a single fiber. This module has a single bidirectional line port, an input and output monitor port, and 40 bi-directional channel ports. This module is a standalone, passive, rack-mounted module that does not reside in any BTI 7000 Series shelf, but is installed alongside the system and is connected only by the Line fiber. The module is not equipped with a programmed inventory record (FRU data) and provides no communications interface to the SCP. A 40-channel Mux/Demux module can be provisioned as part of a network element so that the line and channel ports can be represented as part of the DOL.

The 40-channel Mux/Demux module can only be used with the ROB2 or the 40-channel ROB4 module. It cannot be used with the 96-channel ROB4 module.

96-channel Mux/Demux - 50 GHz channel spacing

The 96-channel Mux/Demux module performs channel aggregation at 50 GHz spacing for all wavelengths in the DWDM channel plan onto a single fiber. This module has a single bidirectional line port, an input and output monitor port, and 96 bi-directional channel ports. This module is a standalone, passive, rack-mounted module that does not reside in any BTI 7000 Series shelf, but is installed alongside the system and is connected only by the Line fiber. The module is not equipped with a programmed inventory record (FRU data) and provides no communications interface to the SCP. A 96-channel Mux/Demux module can be provisioned as part of a network element so that the line and channel ports can be represented as part of the DOL.

The 96-channel Mux/Demux module can be used with the 96-channel ROB4 module. It cannot be used with the ROB2, the 40-channel ROB4 module, or the DLA2. There are different types of the 96-channel Mux/Demux module. See the *BTI 7000 Series Multiplexing Solutions Guide* for more information.

Note The 96-channel Mux/Demux is currently not NEBS-3 certified.

8-channel Mux/Demux - 100 GHz channel spacing

The 8-channel Mux/Demux module performs channel aggregation at 100 GHz spacing for all wavelengths in the DWDM channel plan onto a single fiber. Four variants of the 8-channel Mux/Demux modules are supported in DOL configurations. These modules must be installed in active BTI 7000 Series shelves, and are integrated into DOL configurations. For information about these modules, see the *BTI 7000 Series Multiplexing Solutions Guide*.

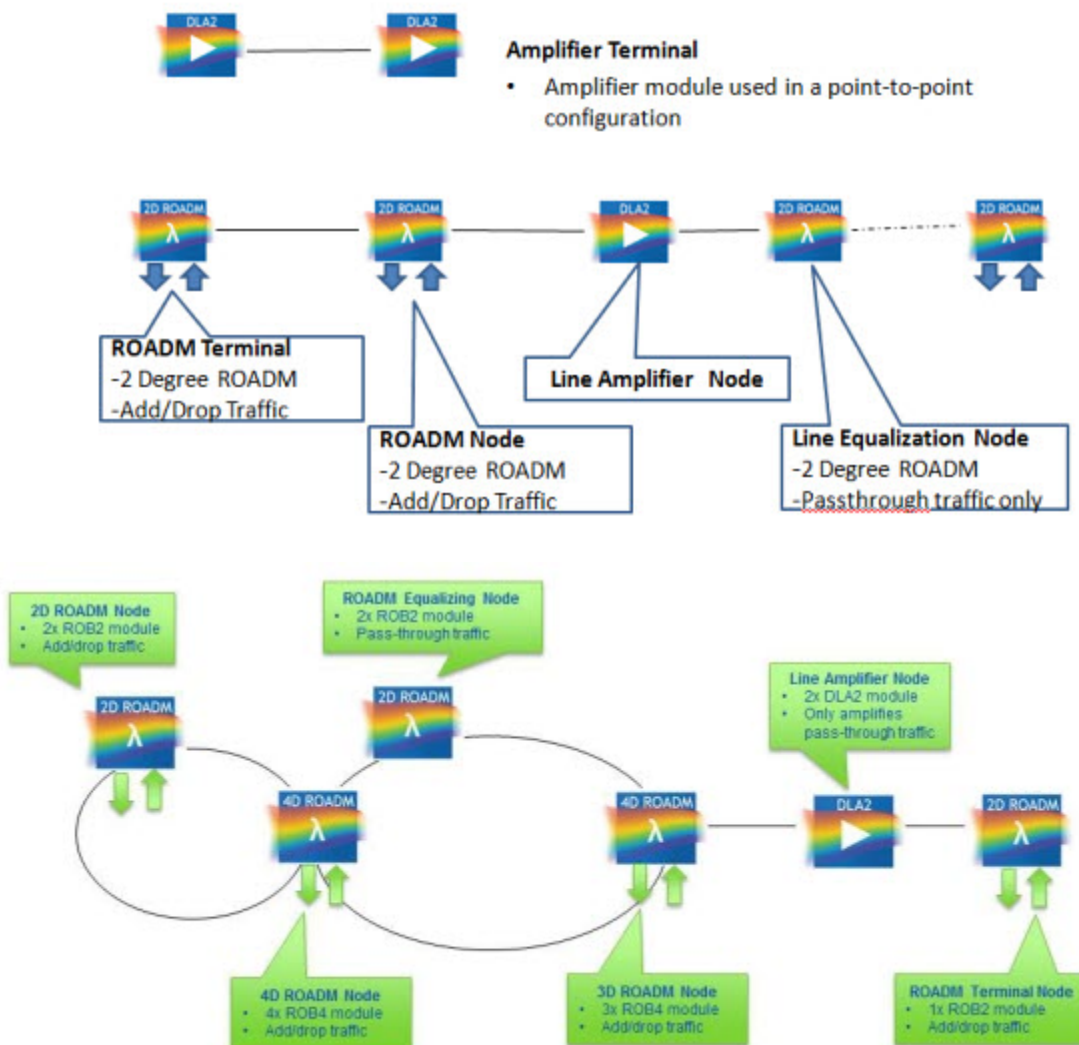
The 8-channel Mux/Demux module can only be used with the ROB2 or the 40-channel ROB4 module. It cannot be used with the 96-channel ROB4 module.

1.1 Topologies and system configurations

All ROADM and amplifier configurations can be provisioned on the same line system and interoperate over multiple spans. The only exception is the amplifier terminal node. This application is fully described in the application note *BTI-APN003-2011 - DLA Terminal Application*.

The following example shows the function of the different nodal configurations, on the BTI ROADM-on-a-blade modules:

Figure 1-1 Nodal Configurations



Since all modules in the DOL require interoperability of the control messaging, each span must be bookended by DOL network elements. An amplifier module only has visibility of composite power levels, and does not have visibility of per-channel powers. Nodes using DLA modules include:

- line amplifier node
- amplifier terminal node

In multi-span networks, ROADM nodes are used to provide channel add/drop, line amplifier nodes are used to extend optical reach, and line equalization nodes amplify and balance channel power.

- ROADM terminal NE
- ROADM add/drop NE
- Line Equalization NE

Note	A 4D ROADM-on-a-blade must be used to provision three and four degree network environments.
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Alien Wavelength Support

There are two supported configurations in which alien wavelengths can be connected to the DOL:

- Connected to individual DWDM Mux/Demux ports and transported across the DOL. This method is the same as adding BTI 7000 wavelengths to the DOL.
- A line fiber with multiplexed DWDM wavelengths can be interconnected to the C2 port in a ROADM terminal configuration. Local add/drop wavelengths and the alien wavelengths are equalized and launched on the DWDM Line Out port.

When a site is configured as a ROADM terminal node, the C1 port is automatically created for managing local add/drop wavelengths. To use the C2 port for composite alien wavelengths, this port object can be added to the node.

1.2 Network element nodal configurations

DOL modules may be grouped and linked together in certain ways to provide an overall nodal function with respect to the optical network to which it is a part. Five specific nodal configurations are supported:

- ROADM Node
- ROADM Terminal
- Line Equalizing Node
- Line Amplifier Node
- Amplifier Terminal

This section describes the five supported nodal configurations, and the networking application they implement. A given configuration specifies the modules, how these modules are connected to each other, and which sort of traffic flows can be provided by the node.

1.2.1 ROADM node

Configuring a ROADM add/drop node requires that you group two or more ROADM-on-a-blade modules together to support passthrough connections between network spans, and add/drop connections between a network span and the local mux/demux equipment.

The sections that follow describe the following two add/drop nodal configurations although several other configurations are possible.

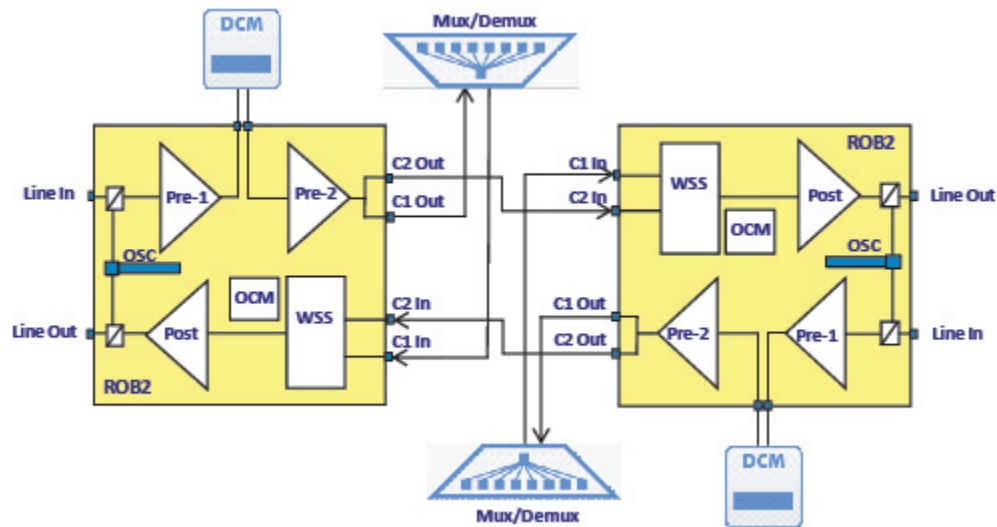
- 2-degree add/drop node
- 4-degree add/drop node

1.2.1.1 2-degree add/drop node

This section describes a 2-degree (2D) add/drop nodal configuration at a site between two spans, in which optical add/drop and passthrough capability is required.

The following example consists of:

- A pair of 2D ROADM-on-a-blade modules (ROB2)
- One or two daisy-chained DCM modules connected to each of the ROB modules. In some applications, dispersion compensation may not be required for one or both ROB2s, in which case the ROB DCM port is fiber looped-back.
- One 40-channel or one 8-channel Mux/Demux connected to each of the ROB C1 ports. The different degrees do not need to have matching mux/demux modules.
- The ROB C2 ports are interconnected.

Figure 1-2 2D ROADM Node

In the 2D ROADM network element, a passthrough wavelength can be provisioned between east and west fiber pairs. The received wavelength traverses the first ROADM where it is amplified, compensated for dispersion, amplified and then passed to the C2 express port. The second ROADM includes the WSS that routes this wavelength to the post-amp and then to the transmit line.

An add/drop wavelength can be provisioned on each ROADM module. A 2D ROADM has two Mux/Demux modules - one for each degree. A wavelength can only be connected to the Mux/Demux port that is on the same degree. For example, a wavelength received on the east facing ROADM module can only be terminated on the east facing Mux/Demux module. The signal path followed by an add/drop channel is as follows:

- The receive wavelength is amplified, compensated for dispersion, amplified and then passed to the C1 drop port to the Mux/Demux, and to the receive port of the DWDM SFP/XFP module.
- The SFP/XFP DWDM transmitted signal is connected to the Mux/Demux to the C1 add port, through the WSS that routes the wavelength to the post-amp, and to the transmit line.

The ROADM node configuration is described as a "broadcast drop, select add". The WSS on the ROADM controls which add/drop or express wavelengths are routed to the line-out port. All wavelengths received on the line-in port are visible on the drop port, as well as, the C2 interconnect port. Changing between pass-through to add/drop channels is done, dynamically, and involves only the configuration of the WSS on the ROB modules.

When a channel is configured for passthrough, the same channel cannot be configured for add/drop on either of the ROB modules. If not configured for passthrough, channels of the same wavelength, from each of the lines, can be configured for add/drop on both ROB modules, provided that the connected Mux/Demux module on each ROB supports the targeted channel wavelength.

40 wavelengths are supported for add/drop channels, and 44 channels are supported for passthrough. See [1.5, "Dynamic Optical Layer wavelength plans"](#) for the list of supported add/drop and passthrough channel wavelengths.

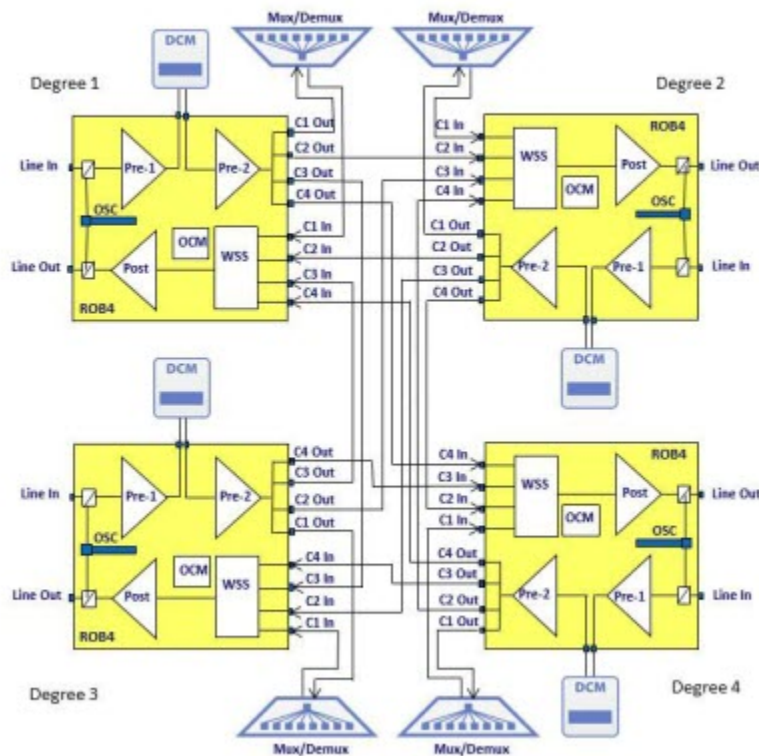
1.2.1.2 4-degree add/drop node

This section describes a 4-degree (4D) add/drop node configuration at a site where four DWDM lines intersect, in which a channel add/drop and passthrough capability is required.

The following example consists of:

- Four 40-channel 4D ROADM-on-a-blade modules (ROB4)
- One or more daisy-chained DCMs connected to each of the ROB4 modules. In some applications, dispersion compensation may not be required for one or more ROB4s, in which case the ROB4 DCM port would be fiber looped-back.
- One 40-, or 8-channel Mux/Demux connected to each of the 40-channel ROB4 Client 1 ports. These do not need to be matching Mux/Demuxes, and may be omitted from any of the ROB4 modules.
- The ROB4 client ports C2-C4 are used for interconnection to the other ROB4 packs in the node.

Figure 1-3 4D ROADM Node



The 4-degree ROADM offers similar DWDM channel routing on the node as does the 2-degree ROADM node, since passthrough connections can be routed between any two of the four optical lines that terminate on the node. The C2-C4 client ports on each ROB4 are used for interconnection to the other three ROB4 modules in the node, allowing for full passthrough channel routing flexibility.

The 4-degree ROADM node, local add/drop channels are supported only between the line and the Mux/Demux equipment connected to the same ROB4 modules:

- The C1 client port is always reserved for interconnection to the Mux/Demux module for add/drop channels.
- The C2 port cannot be used for add/drop to an alien DWDM in the DOL ROADM group configuration.

Note	A 3-degree ROADM node configuration is realized if only three of the four ROB4 modules are deployed. In this configuration, one of the client ports is unused on each of the three ROB4 modules.
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Additional considerations when using the 96-channel 4D ROADM-on-a-blade (ROB4) module

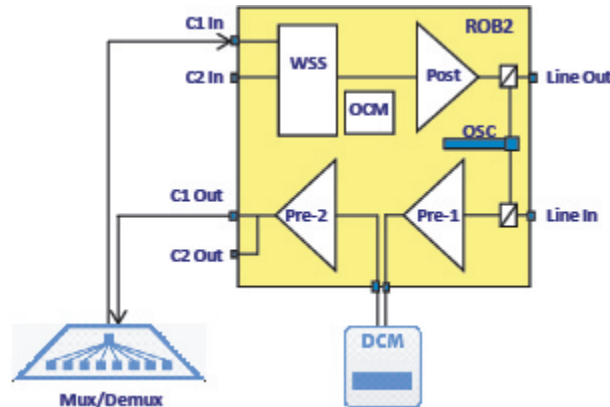
The 96-channel ROB4 module works with channels at a 50 GHz spacing. When using the 96-channel ROB4 module, be aware of the following constraints:

- All ROB4 modules in a ROADM group must be 96-channel ROB4 modules. A mix of 40-channel ROB4 and 96-channel ROB4 modules is not supported.
- Only the 96-channel Mux/Demux can be connected to the 96-channel ROB4 modules. Add/dropping to a 40-channel or an 8-channel Mux/Demux is not supported.

1.2.2 ROADM Terminal

This configuration is used at the terminal end of a linear fiber span. This site provides add/drop access to wavelengths terminating at this node. Up to 40 channels are supported on a line using the 40 channel Mux/Demux, and up to 96 channels are supported on a line using the 96-channel Mux/Demux with the 96-channel ROB4 module. Channel equalization is applied to the multiplexed channels before they are transmitted from the line port. Either a ROB2 or a ROB4 module can be used in this configuration, although the 96-channel ROB4 module must be used when terminating 96 channels.

Note	A ROB2 or a 40-channel ROB4, which operates at a 100 GHz spacing, can connect to a 40-channel or an 8-channel Mux/Demux, but cannot connect to a 96-channel Mux/Demux. A 96-channel ROB4, which operates at a 50 GHz spacing, can connect to a 96-channel Mux/Demux, but cannot connect to a 40-channel or an 8-channel Mux/Demux.
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Figure 1-4 ROADM Terminal

The typical configuration consists of:

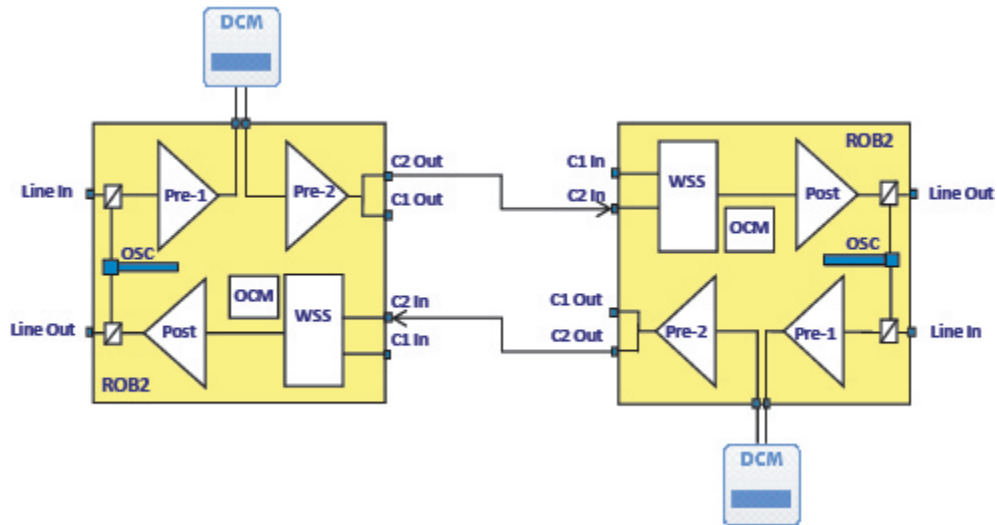
- one ROB2 module
- one or two daisy-chained DCMs connected to the ROB module. In some applications, dispersion compensation may not be required, and the ROB DCM port may be fiber looped-back.
- a 40-channel or one 8-channel Mux/Demux module connected to the ROB module C1 port.
- By default, the ROB module C2 port is not used.

Interconnection to composite alien DWDM wavelengths

For the ROADM Terminal configuration, the ROADM Node configuration supports the optional use of C2 to connect to non-DOL multiplexed DWDM wavelengths, such as from legacy BTI DWDM networks. Such interconnections are supported only on the C2 port of the ROB module and not on the other C1 client port nor on the line port. When an alien DWDM composite signal is connected to the ROB module in this way, channels originating from the alien DWDM composite signal can only be routed to the Line port of the same ROB module, and cannot be routed to the add/drop port on the same NE.

1.2.3 Line Equalizing Node

This configuration amplifies DWDM channels and equalizes the individual wavelengths. This is deployed where future add/drop capability may be required, or to support extended reach systems by eliminating channel power disparity. All channel connections are passthrough from one span to the opposite span and Mux/Demux modules are not configured in this configuration. Either a ROB2 or a ROB4 module can be used in this configuration, although the 96-channel ROB4 module must be used when carrying 96 channels.

Figure 1-5 Line Equalizing Node

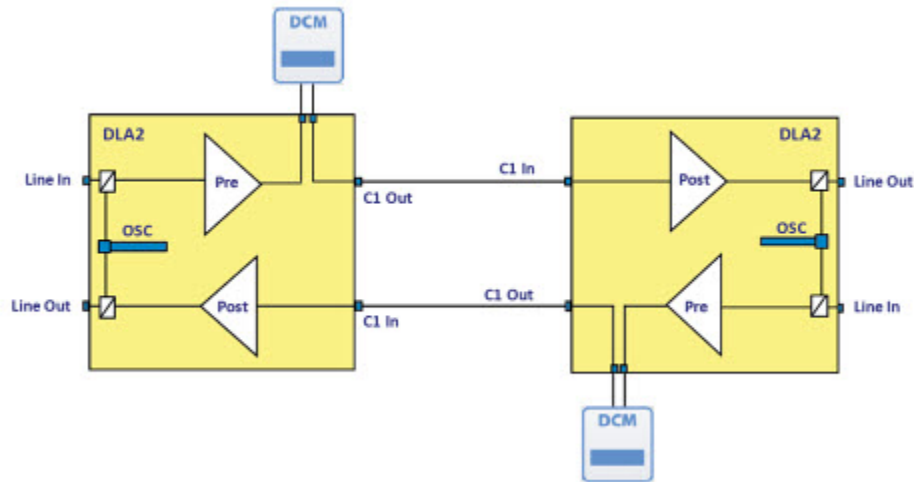
The typical configuration consists of:

- a pair of 2D ROADM-on-a-blade (ROB2) modules.
- one or two daisy-chained DCMs connected to each of the ROB modules. In some applications, dispersion compensation may not be required for one or both ROB in which case the ROB DCM port is fiber looped-back.
- the ROB C2 ports are interconnected.
- the ROB C1 ports are unused.

Note A line equalizing node can be changed to a ROADM terminal node.

1.2.4 Line Amplifier Node

This configuration is used at an optical amplification site between two spans.

Figure 1-6 Line Amplifier Node

There are two DWDM network lines that interface to the NE. For each line, the input signal is passed through one of the DLA2 Line input ports, where it is passed through the pre-amplification and DCM stages. It is then forwarded through the C1 output port to the C1 input port of the second DLA2, where it is passed through the post-amplification stage, before it is transmitted out the opposing line. Optical amplification is applied to all constituent channels of the WDM traffic received through the two amplification stages.

The configuration consists of:

- a pair of DLA2 modules
- one or two daisy-chained DCMs connected to each of the DLA2 modules. In some applications, dispersion compensation may not be required for one or both DLA2s, in which case the DLA2 DCM port is fibered in a through configuration. This allows the composite signal to flow through the ROB unidirectional from the output of the pre-amplifier to the C1 out port..
- the DLA2 C1 ports are interconnected

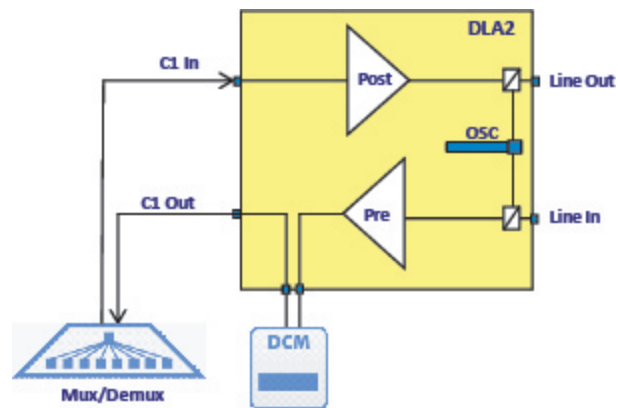
Note The DLA2 module can only be used to amplify signals on lines with up to 44 channels (100 GHz channel spacing). Therefore its line ports cannot be connected directly or indirectly to the 96-channel ROB4 module.

1.2.5 Amplifier Terminal

This configuration is used at the terminal NE of a linear DOL network of one span.

Because channel equalization is not performed at this NE, this configuration is limited to a single span point-to-point network deployment with amplifier terminal NEs on either end of the span.

Figure 1-7 Amplifier Terminal



The configuration consists of:

- a DLA2 module
- one DCM connected to the DLA2. In some applications, dispersion compensation may not be required, and the DLA2 module C1 port.
- a 40-channel or one 8-channel Mux/Demux module connected to the DLA2 module C1 port. This configuration may require the use of optical attenuators.

There is one network line that interfaces to the NE. Up to 40 channels are mux/demuxed into the line and single stage amplification is performed on ingress and egress DWDM composites.

Note The DLA2 module can only be used to amplify signals on lines with 40 channels. Therefore its line ports cannot be connected directly or indirectly to the 96-channel ROB4 module, nor can its client ports be connected to the 96-channel Mux/Demux.

1.3 Network design

Designing a DOL network, and the NEs in it, is performed using the proNX 9010 Network Designer. The proNX 9010 is an Optical Link Engineering and Quotation application that is used to create network solutions using the BTI 7000 Series product portfolio.

With the proNX 9010, you can:

- create linear or ring ROADM network architectures using the Network Wizard which automates the placement of network elements, filters, and fiber connections
- create protected or unprotected services between the NEs using the Service Demand Wizard using any of the available client service modules available from BTI
- perform automated ROADM and DCM placement
- define strategies for shelf layouts (active/passive, platform dependencies)
- generate high level drawings of the network design
- generate Quotation reports including shelf layouts and per site Bill of Materials
- generate Installation and Turn up reports for each site that aid installation and provide a permanent record of the status of the network at turn-up

For more information on designing DOL networks, contact your BTI representative.

1.4 Management interfaces

The DOL supports the following management interfaces:

- proNX 900 Node Controller (proNX 900)
- proNX Service Manager (PSM)
- TL1 (Transaction Language 1)
- SNMP (Simple Network Management Protocol)

The procedures in this guide use the proNX 900 or the PSM. TL1 commands are listed in the *TL1 Reference Guide*.

1.5 Dynamic Optical Layer wavelength plans

The DOL network is based on a DWDM channel plan that is aligned with the ITU C-Band grid. The DOL uses a channel nomenclature based on the last three digits of the channel frequency. For example, the channel with frequency **192.10 THz** is identified as channel **210**. This channel nomenclature is used throughout the DOL model including channel provisioning and channel alarms, and provides a consistent future-proof channel numbering plan that supports both a 100 GHz band plan and a 50 GHz band plan.

Table 1-1 44-channel DWDM Wavelength Plan

DOL Channel Number	Frequency (THz)	Wavelength (nm)
610 (supported on C2)	196.10	1528.77
600	196.00	1529.55
590	195.90	1530.33
580	195.80	1531.12
570	195.70	1531.90
560	195.60	1532.68
550	195.50	1533.47
540	195.40	1534.25
530	195.30	1535.04
520	195.20	1535.82
510	195.10	1536.61
500	195.00	1537.40
490	194.90	1538.19
480	194.80	1538.98
470	194.70	1539.77
460	194.60	1540.56
450	194.50	1541.35
440	194.40	1542.14
430	194.30	1542.94
420	194.20	1543.73
410	194.10	1544.53
400	194.00	1545.32
390	193.90	1546.12
380	193.80	1546.92
370	193.70	1547.72
360	193.60	1548.51
350	193.50	1549.32
340	193.40	1550.12
330	193.30	1550.92

Table 1-1 44-channel DWDM Wavelength Plan (Continued)

DOL Channel Number	Frequency (THz)	Wavelength (nm)
320	193.20	1551.72
310	193.10	1552.52
300	193.00	1553.33
290	192.90	1554.13
280	192.80	1554.94
270	192.70	1555.75
260	192.60	1556.55
250	192.50	1557.36
240	192.40	1558.17
230	192.30	1558.98
220	192.20	1559.79
210	192.10	1560.61
200 (supported on C2)	192.00	1561.42
190 (supported on C2)	191.90	1562.23
180 (supported on C2)	191.80	1563.05

Table 1-2 96-channel DWDM Wavelength Plan

DOLChannel Numbers	Frequency (THz)	Wavelength (nm)
610	196.10	1528.77
605	196.05	1529.16
600	196.00	1529.55
595	195.95	1529.94
590	195.90	1530.33
585	195.85	1530.72
580	195.80	1531.12
575	195.75	1531.51
570	195.70	1531.90
565	195.65	1532.29
560	195.60	1532.68
555	195.55	1533.07
550	195.50	1533.47
545	195.45	1533.86
540	195.40	1534.25
535	195.35	1534.64
530	195.30	1535.04
525	195.25	1535.43
520	195.20	1535.82

Table 1-2 96-channel DWDM Wavelength Plan (Continued)

DOLChannel Numbers	Frequency (THz)	Wavelength (nm)
515	195.15	1536.22
510	195.10	1536.61
505	195.05	1537.00
500	195.00	1537.40
495	194.95	1537.79
490	194.90	1538.19
485	194.85	1538.58
480	194.80	1538.98
475	194.75	1539.37
470	194.70	1539.77
465	194.65	1540.16
460	194.60	1540.56
455	194.55	1540.95
450	194.50	1541.35
445	194.45	1541.75
440	194.40	1542.14
435	194.35	1542.54
430	194.30	1542.94
425	194.25	1543.33
420	194.20	1543.73
415	194.15	1544.13
410	194.10	1544.53
405	194.05	1544.92
400	194.00	1545.32
395	193.95	1545.72
390	193.90	1546.12
385	193.85	1546.52
380	193.80	1546.92
375	193.75	1547.32
370	193.70	1547.72
365	193.65	1548.11
360	193.60	1548.51
355	193.55	1548.91
350	193.50	1549.32
345	193.45	1549.72
340	193.40	1550.12
335	193.35	1550.52
330	193.30	1550.92

Table 1-2 96-channel DWDM Wavelength Plan (Continued)

DOLChannel Numbers	Frequency (THz)	Wavelength (nm)
325	193.25	1551.32
320	193.20	1551.72
315	193.15	1552.12
310	193.10	1552.52
305	193.05	1552.93
300	193.00	1553.33
295	192.95	1553.73
290	192.90	1554.13
285	192.85	1554.54
280	192.80	1554.94
275	192.75	1555.34
270	192.70	1555.75
265	192.65	1556.15
260	192.60	1556.55
255	192.55	1556.96
250	192.50	1557.36
245	192.45	1557.77
240	192.40	1558.17
235	192.35	1558.58
230	192.30	1558.98
225	192.25	1559.39
220	192.20	1559.79
215	192.15	1560.20
210	192.10	1560.61
205	192.05	1561.01
200	192.00	1561.42
195	191.95	1561.83
190	191.90	1562.23
185	191.85	1562.64
180	191.80	1563.05
175	191.75	1563.45
170	191.70	1563.86
165	191.65	1564.27
160	191.60	1564.68
155	191.55	1565.09
150	191.50	1565.50
145	191.45	1565.91
140	191.40	1566.31

Table 1-2 96-channel DWDM Wavelength Plan (Continued)

DOLChannel Numbers	Frequency (THz)	Wavelength (nm)
135	191.35	1566.72

1.6 Dynamic Optical Layer management communications

The DOL management communications functionality consists of the following components:

- 1.6.1, “DOL Optical supervisory channel”
- 1.6.2, “DOL Optical Data Communications Channel ”

1.6.1 DOL Optical supervisory channel

Optical supervisory channel (OSC) is the integrated, bi-directional channel that provides management and control communications to the DOL. OSC links are terminated on the line port of the DLA2, and ROB modules. The DOL OSC is operated independently of the OSC communication channels in the shelf processor (SCP) units.

OSC is automatically provisioned when the DLA2 or ROB modules are provisioned.

The OSC administrative state is configurable to one of:

- Auto-in-service (AINS)
- In-service
- Out-of-service

When automatically provisioned, the administrative status of the OSC is set to out-of-service (OOS) if the administrative state of the supporting DLA2 or ROB equipment is out-of-service; otherwise it is set to auto-in-service.

When the OSC state is in-service or auto-in-service, the OSC link is enabled in both receive and transmit directions.

When the OSC state is out-of-service, the OSC transmit signal is shut down.

OSC supports the following additional state-related attributes:

- Operation status
- Operation status qualifier
- Auto-in-service Timer
- Active Auto-in-service Timer

OSC supports the following attributes for read-write access:

- ID
- Custom1
- Custom2
- Custom3

The configuration and status attributes supported by OSC are listed in the following table.

Table 1-3 OSC supported configuraion and status attributes

Attribute	Range	Default	Access	Can be edited when:	
				In-service	Out-of-service
Admin Status	IS, OOS, AINS	Same as admin status of supporting equipment	read-write	Y	Y
Operational Status	IS, OOS	NA	read	NA	NA
Operational Status Qualifier	NR, ANR, FLT, MT, SGEO	NA	read	NA	NA
AINS Timer	Time value from 0 to 96 hours	8 hours (applies only if AINS provisioned)	read-write	Y	Y
Active AINS Timer	Time value from 0 to 96 hours	NA	read	NA	NA
ID, Custom1, Custom2, Custom3	Text string	""	read-write	Y	Y

OSC links are automatically deprovisioned when the equipment to which they are connected is de-provisioned.

Manual provisioning and de-provisioning of OSC is not supported.

OSC supports WDM, and its administrative status cannot be set to Out-of-service if the supported WDM entity is In-service.

1.6.1.1 DOL management communications

A number of additional attributes are supported by OSC to report the identification of the DOL NE connected at the far end of the span section:

- Actual System Name (TID)
- Actual NMS IP Address
- Actual DOL Group
- Actual DOL Degree
- DOL Group Type
- DOL Grid Profile

If OSC is operationally out-of-service, the following default values are reported for each of the far end attributes:

- Actual System Name (TID): "" (Empty string)
- Actual NMS IP Address: 0.0.0.0 - This default setting also applies if the IP address at the far end node has not been assigned.

- **Actual DOL Group: 0** - This default setting also applies if the OSC's supporting equipment is not assigned to a DOL group and degree.
- **Actual DOL Degree: 0** - This default setting also applies if the OSC's supporting equipment is not assigned to a DOL group and degree.
- **DOL Group Type: none** - This default setting also applies if the far end NE is not configured as a DOL NE or if the OSC's supporting equipment is not assigned to a DOL group and degree.

The grid profiles of the near end NE and the far end NE must match.

The inter-NE connection attributes are listed in the following table.

Attribute	Range	Default	Access	Editable when:	
				In-service	Out-of-service
Actual Far-end System Name	Text string	""	read	NA	NA
Actual Far-end NMS IP Address	IP address	0.0.0.0	read	NA	NA
Actual Far-end DOL Group	1 to 255	0	read	NA	NA
Actual Far-end DOL Degree	1 to 2	0	read	NA	NA
Far-end Group Type	Unknown ROADM terminal Line amplifier node ROADM node Line equalizing node Amplifier terminal	NA	read	NA	NA
Grid Profile	50GHZ, 100GHZ	NA	read	NA	NA

1.6.2 DOL Optical Data Communications Channel

The Optical Data Communications Channel (ODCC) is an OSC data link between DOL network elements (NE) which is used for management communications. The ODCC can be configured to be part of a management communications network to support remote access to management interfaces of an NE that is not directly connected to the management LAN.

The ODCC can be manually provisioned provided that the supporting OSC link exists.

The ODCC supports a configurable administrative status attribute (primary state), which can be set to In-service (IS) or Out-of-service (OOS).

When provisioned, if the administrative status of the ODCC is not specified, it is set to Out-of-service if the administrative status of the supporting OSC link is Out-of-service. Otherwise it is set to In-service.

When In-service, the ODCC is enabled to serve as an unnumbered interface to the external-facing network management IP stack.

When Out-of-service, the ODCC is disabled.

If OSPF is provisioned on the NE, the ODCC can be added as an OSPF interface.

The administrative status of the ODCC can be set to In-service or Out-of-service while configured as an OSPF interface.

The ODCC can be removed as an OSPF interface.

The ODCC can be manually de-provisioned.

De-provisioning of the ODCC object is not permitted if the ODCC is still provisioned as an OSPF interface.

The ODCC does not support auto-provisioning or auto-deprovisioning.

1.7 Laser Safety (Automatic Power Shutdown)

Due to the potential safety hazard that is posed by the high power optical outputs of the DLA and ROB modules, the DOL has an automatic power shutdown (APSD) mechanism that guards against the risk of direct human exposure to dangerous high-powered lasers.

APSD applies only to spans between adjacent DOL NEs as it is only on these spans that optical amplifier outputs may reach dangerously high power levels. APSD does not apply to intra-NE fiber connections as the optical outputs on intra-NE connections do not reach the same levels as on inter-NE spans.

The highest powered optical signals are generated by the Post Amplifier on the DLA and ROB modules for transmission over the optical span to the next downstream NE. The automatic power shutdown mechanism acts to detect a suspected fiber disconnection or fiber cut along this span, and upon doing so, causes the shutdown of the high-powered WDM composite signal in both directions of the span. Whether one or both optical fibers of an inter-NE span are disconnected, the APSD mechanism shuts down the WDM output from both ends of the span. Once the span fibers are re-connected, WDM traffic is automatically restored.

APSD behaves as follows:

- The output WDM composite signal from a DLA or ROB module Line port is automatically shutdown, or disabled from turn-up, if both of the following conditions are detected:
 - A Loss of Light fault is active against the input WDM on the same line port
 - A Loss of Light fault is active against the input OSC on the same line port
- When an automatic power shutdown has been triggered on a DLA or ROB module, the output OSC signal remains enabled. The module signals the far-end NE through the OSC to force a shutdown of its output WDM, and continue to do so for as long as its local APSD condition is in effect.
- When a DLA or ROB module receives a signal on the input OSC from the far-end NE to shut down its output WDM, it does so, and continues to do so as long as it receives the shutdown signal. The output OSC signal remains enabled.

Single fiber-cut span scenario

Starting with span fibers connected and with WDM and OSC operationally in-service, the following sequence of events occurs after a fiber is cut:

- 1 A WDM Loss of Light fault is raised on the far end Line port. An OSC Receive Loss of Light fault is also raised on the port.
- 2 An automatic power shutdown occurs on the far end Line port. The post-amp facing the span is shut down. At the same time, a signal is sent in the OSC transmitted from the far end to inform the near end to shut down its WDM output into the span.
- 3 The near end receives the signal in the OSC requiring it to shut down its WDM output onto the span. It shuts down the post-amp, but leaves the OSC enabled.

- 4 The fiber that has been cut or disconnected is no longer illuminated, and the safety hazard is avoided

When the fiber cut is repaired, or if the disconnected fiber is reconnected, the recovery proceeds as follows:

- 1 The OSC Receive Loss of Light fault on the far end Line port is cleared.
- 2 The automatic power shutdown is no longer enabled on the far end. The far end stops APSD signaling to the near end through the OSC.
- 3 The near end stops receiving the APSD signal in the OSC, and enables the WDM to be re-enabled.
- 4 Both the near end and the far end restore the WDM traffic on the span.

1.8 Maintenance signal indication

There are two types of maintenance signal indications:

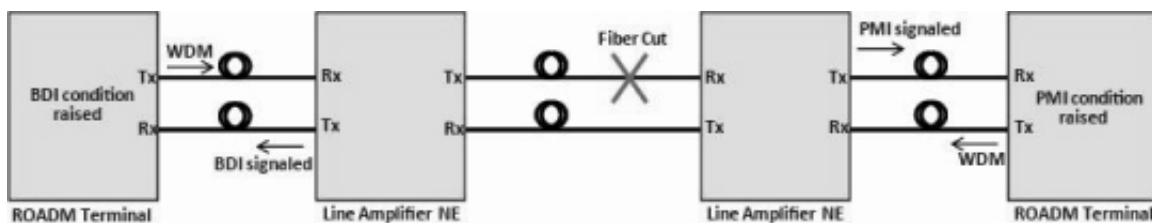
- Payload Missing Indication (PMI)
- Backward Defect Indication (BDI)

The "Payload Missing Indication" is raised against the Line port of an NE that is downstream from an NE where a WDM failure condition is detected, and that is within the same equalization section as where the WDM failure is detected. The following illustration shows a single fiber cut in the span between two non-equalizing line NEs. The fiber cut results in the detection of Receive Loss of Light faults against the incoming OSC and WDM Composite signals. Because this NE detected the WDM composite signal failure, and raises the critical alarm for the fault, it sends a Payload Missing Indication signal to downstream NEs towards which the failed WDM composite signal would have been transmitted.

In the direction opposite of the detected OSC and WDM composite signal Loss of Light faults, the NE initiates an Automatic Power Shutdown (APSD) condition. As a result of the APSD the WDM composite signal is shut down towards the opposing line-equalizing NE, and since this NE did not initiate the APSD, it forwards a Backward Defect Indication to NEs towards which the shut-down WDM composite signal would have been transmitted.

Although the following illustration shows only one NE raising a PMI and one NE raising a BDI, if additional NEs are part of the equalization section, they will all raise either a PMI or BDI fault. All additional downstream non-equalizing line NEs between the NE with the cut line port Rx fiber and the next equalizing NE raise a PMI condition. Any additional non-equalizing line NEs between the Ne that is sent the APSD signal and the equalizing NE on the upstream side raise a BDI condition.

Figure 1-8 PMI and BDI Signaling



In addition to APSD scenarios, the PMI condition is raised on NEs downstream from an NE on which any WDM composite signal loss of light is detected. For example, if the DCM port is disconnected, or a uni-directional client inter-connection fiber patch is disconnected on a non-equalizing line NE, a PMI condition is raised on all NEs downstream from this failure that are within the same equalization section. However, since no APSD is activated for such scenarios, and WDM traffic continues in the opposite direction, no BDI condition is raised on NEs that are upstream from such WDM failures.

2.0 DOL hardware

The following sections list the DOL supported platforms, specifications, and module installation instructions.

- [2.1, “Supported platforms and modules”](#)
- [2.2, “Hardware specifications”](#)
- [2.3, “Hardware installation”](#)

2.1 Supported platforms and modules

The DOL supports the following platforms. For more information about system configurations refer to [1.2, “Network element nodal configurations”](#).

Table 2-1 DOL supported platforms

Shelf	PEC	Configuration
BTI 7060	BT7A50AA	Line amplifier node ROADM terminal
BTI 7060 with rear access -48V	BT7A50AR	Line amplifier node ROADM terminal
BTI 7060 Shelf plus BTI 7060 Expansion Or BTI 7060 Shelf plus BTI 7200 Expansion	BT7A50AA plus BT7A54BA Or BT7A50AA plus BT7A51AA	Line amplifier node ROADM node ROADM terminal
BTI 7200	BT7A51AA	ROADM node ROADM terminal Amplifier terminal Line equalizing node
BTI 7200 with rear access -48V	BT7A51AR	ROADM node ROADM terminal Amplifier terminal Line equalizing node
BTI 7200 plus BTI 7200 Expansion	BT7A51AA	ROADM node ROADM terminal Amplifier terminal Line equalizing node

- ROADM terminal and Line equalization node configurations are supported on only the 2D ROADM-on-a-blade
- ROADM degrees can be in the same main or expansion shelf.
- ROADM degrees can be split between the main and expansion shelves.
- Replacing a failed 2D ROADM-on-a-blade with a 40-channel 4D ROADM-on-a-blade (BT7A07BA) is supported in any configuration.
- Replacing a 2D ROADM-on-a-blade or a 40-channel 4D ROADM-on-a-blade (BT7A07BA) with a 96-channel 4D ROADM-on-a-blade (BT7A07CA) is not supported.

The DOL supports the following modules:

Table 2-2 DOL modules

Module	PEC	System software introduced
Dispersion Compensation Modules (Expandable)		
Dispersion Compensation Module - SMF 5 km	BT7A13AA	9.1
Dispersion Compensation Module - SMF 10 km	BT7A12AA	9.1
Dispersion Compensation Module - SMF 15 km	BT7A13BA	9.1
Dispersion Compensation Module - SMF 20 km	BT7A12BA	9.1
Dispersion Compensation Module - SMF 30 km	BT7A12CA	9.1
Dispersion Compensation Module - SMF 40 km	BT7A12DA	9.1
Dispersion Compensation Module - SMF 50 km	BT7A12EA	9.1
Dispersion Compensation Module - SMF 60 km	BT7A12FA	9.1
Dispersion Compensation Module - SMF 70 km	BT7A12GA	9.1
Dispersion Compensation Module - SMF 80 km	BT7A12HA	9.1
Dispersion Compensation Module - SMF 90 km	BT7A12JA	9.1
Dispersion Compensation Module - SMF 100 km	BT7A12KA	9.1
DWDM Line Amplifier		
DLA2 (line/pre+booster)	BT7A06CA	9.1
DWDM - ROADM-on-a-Blade		
2D ROADM-on-a-Blade	BT7A07AA	9.1
40-channel 4D ROADM-on-a-Blade	BT7A07BA	10.1
96-channel 4D ROADM-on-a-Blade	BT7A07CA	11.2

2.2 Hardware specifications

This section describes the specifications for DOL modules. For DCM specifications, see [2.2.5, “SMF \(Expandable\) Dispersion Compensation Module specifications”](#).

2.2.1 2D ROADM-on-a-blade optical specifications

Table 2-3 2D ROADM-on-a-blade

Parameter	Min	Max	Units
Wavelength	1528.77	1563.05	nm
Number of Channels (100GHz spacing)	-	44	Channels
Supported Span Loss	0	35	dB
Maximum Supported Span Loss with 1 Channel	-	30	dB
Maximum Supported Span Loss with 2 Channels	-	33	dB
Maximum Supported Span Loss with 4 Channels	-	35	dB
Monitor Port Loss	16	18	dB
Per Channel Input Power - C1	-8	1	dBm
Per Channel Input Power - C2	-11	-3	dBm
Power Monitor Accuracy - composite	-	0.6	dB
Power Monitor Accuracy - per channel	-	1	dB
Line Launch Power	0	20	dBm
Module Dimensions	2Wx1H		
Power Consumption	65W		
Environmental	-5 to +50C		
Product Code	BT7A07AA		

2.2.2 40-Channel 4D ROADM-on-a-blade optical specifications

Table 2-4 40-Channel 4D ROADM-on-a-blade

Parameter	Min	Max	Units
Wavelength ¹	1529.55	1560.61	nm
Number of Channels (100GHz spacing)	-	40 + 4	Channels
Supported Span Loss	0	35	dB
Maximum Supported Span Loss with 1 Channel	-	30	dB
Maximum Supported Span Loss with 2 Channels	-	33	dB
Maximum Supported Span Loss with 4 Channels	-	35	dB
Monitor Port Loss	16	18	dB
Per Channel Input Power - C1	-8	1	dBm
Per Channel Input Power - C2	-11	-3	dBm
Per Channel Input Power - C3	-11	-3	dBm

Table 2-4 40-Channel 4D ROADM-on-a-blade (Continued)

Parameter	Min	Max	Units
Per Channel Input Power - C4	-11	-3	dBm
Power Monitor Accuracy - composite	-	0.6	dB
Power Monitor Accuracy - per channel	-	1	dB
Line Launch Power	0	20	dBm
Module Dimensions	2Wx1H		
Power Consumption	65W		
Environmental	-5 to +50C		
Product Code	BT7A07BA		

¹The range including the C2 channels is 1528.77 nm to 1563.05 nm.

2.2.3 96-Channel 4D ROADM-on-a-blade optical specifications

Table 2-5 96-Channel 4D ROADM-on-a-blade

Parameter	Min	Max	Units
Wavelength	1528.77	1566.72	nm
Number of Channels (50 GHz spacing)	-	96	Channels
Supported Span Loss	0	31	dB
Maximum Supported Span Loss with 1 Channel	-	26	dB
Maximum Supported Span Loss with 2 Channels	-	29	dB
Maximum Supported Span Loss with 4 Channels	-	31	dB
Monitor Port Loss	16	18	dB
Per Channel Input Power - C1	-8	1	dBm
Per Channel Input Power - C2	-11	-3	dBm
Per Channel Input Power - C3	-11	-3	dBm
Per Channel Input Power - C4	-11	-3	dBm
Power Monitor Accuracy - composite	-	0.6	dB
Power Monitor Accuracy - per channel	-	1	dB
Line Launch Power	-3	20	dBm
Module Dimensions	2Wx1H		
Power Consumption	65W		
Environmental	-5 to +50C		
Product Code	BT7A07CA		

2.2.4 DWDM Optical Line Amplifier (DLA) optical specifications

Table 2-6 DWDM Optical Line Amplifier (DLA) optical specifications

Parameter	Min	Max	Units
Wavelength	1528.77	1563.05	nm
Supported Span Loss	0	30	dB
Monitor Port Loss	16	18	dB
Power Monitor Accuracy - composite	-	0.6	dB
Line Launch Power	0	20	dBm
Module Dimensions	1Wx1H		
Power Consumption	40W		
Environmental	-5 to +50C		
Product Code	BT7A06CA		

Note This module is not compatible with the 96-channel 4D ROADM-on-a-blade or the 96-channel mux/demux modules.

2.2.5 SMF (Expandable) Dispersion Compensation Module specifications

This section lists the specifications for the following Dispersion Compensation Modules (DCMs):

Table 2-7 Dispersion Compensation Modules

Module	PEC
Dispersion Compensation Module - SMF 5 km	BT7A13AA
Dispersion Compensation Module - SMF 10 km	BT7A12AA
Dispersion Compensation Module - SMF 15 km	BT7A13BA
Dispersion Compensation Module - SMF 20 km	BT7A12BA
Dispersion Compensation Module - SMF 30 km	BT7A12CA
Dispersion Compensation Module - SMF 40 km	BT7A12DA
Dispersion Compensation Module - SMF 50 km	BT7A12EA
Dispersion Compensation Module - SMF 60 km	BT7A12FA
Dispersion Compensation Module - SMF 70 km	BT7A12GA
Dispersion Compensation Module - SMF 80 km	BT7A12HA
Dispersion Compensation Module - SMF 90 km	BT7A12JA
Dispersion Compensation Module - SMF 100 km	BT7A12KA

Table 2-8 DCM module specifications (BT7A13AA/13BA, BT7A12AA to BT7A12KA)

Distance	Dispersion ps/nm	Relative Dispersion Slope nm ⁻¹	Insertion Loss (IL) dB	Polarization Mode Dispersion ps	Polarization Dependent Loss dB	Loopback loss dB	Expansion connection loss dB
5 km	-85 ±2%	0.0035 ±20%	0.5<IL< 1.4	0.2	0.1	0.2<IL<1.0	0<IL<0.6
10 km	-170 ±2%	0.0035 ±20%	0.8<IL< 1.8	0.2	0.1	0.2<IL<1.0	0<IL<0.6
15 km	-255 ±2%	0.0035 ±20%	1.0<IL< 2.1	0.3	0.1	0.2<IL<1.0	0<IL<0.6
20 km	-340 ±2%	0.0035 ±20%	1.2<IL< 2.5	0.3	0.1	0.2<IL<1.0	0<IL<0.6
30 km	-510 ±2%	0.0035 ±20%	1.7<IL< 3.2	0.4	0.1	0.2<IL<1.0	0<IL<0.6
40 km	-680 ±2%	0.0035 ±20%	2.3<IL< 4.0	0.4	0.1	0.2<IL<1.0	0<IL<0.6
50 km	-850 ±2%	0.0035 ±20%	3.0<IL< 4.8	0.5	0.1	0.2<IL<1.0	0<IL<0.6
60 km	-1020 ±2%	0.0035 ±20%	3.7<IL<5.4	0.5	0.1	0.2<IL<1.0	0<IL<0.6
70 km	-1190 ±2%	0.0035 ±20%	4.4<IL< 6.1	0.6	0.1	0.2<IL<1.0	0<IL<0.6
80 km	-1345 ±2%	0.0035 ±20%	5.0<IL< 6.7	0.6	0.1	0.2<IL<1.0	0<IL<0.6
90 km	-1530 ±2%	0.0035 ±20%	4.3<IL< 7.1	0.6	0.1	0.2<IL<1.0	0<IL<0.6
100 km	-1700 ±2%	0.0035 ±20%	4.8<IL< 7.5	0.7	0.1	0.2<IL<1.0	0<IL<0.6

Note Dispersion and Relative dispersion slopes are specified at a wavelength of 1550 nm.

Note Insertion Loss is specified at room temperature. An additional 0.5 dB must be added to account for worst case loss variation due to temperature over the entire operational range.

Note Relative Dispersion Slope (RDS) is calculated as follows:

$$\text{RDS} = \frac{\text{Dispersion Slope of DCF}}{\text{Dispersion of DCF}} = \frac{\text{Dispersion Slope of Fiber}}{\text{Dispersion of Fiber}}$$

2.2.6 40-Channel DWDM Mux/Demux specifications

The 40-Channel DWDM Mux/Demux supports the multiplexing of 40 ITU DWDM wavelengths onto a single fiber. This module integrates a line in and line out monitor port, an optical isolator, and a 40-channel DWDM Mux/Demux filter.

Table 2-9 40-Channel DWDM Mux/Demux (BT7A37AA/CA) specifications

Parameter	Mux	Demux	Units
Wavelength Range	1529.55 to 1560.61		nm
Channel Wavelength	ITU 100 GHz Grid		
Channel Wavelength Accuracy	±0.06		nm
Channel Spacing	100		GHz
Channel Pass Band	±12.5		GHz
Channel Ripple	≤0.6		dB
Insertion Loss (IL)	3.1 ≤ IL ≤ 6.5	3.4 ≤ IL ≤ 7.0	dB
Insertion Loss Uniformity	≤1.5		dB
Chromatic Dispersion (CD)	-20 ≤ CD ≤ 20		ps/nm
Adjacent Channel Isolation	–	≥25	dB
Non-Adjacent Channel Isolation	–	≥30	dB
Directivity	≥45		dB
Return Loss	≥45	≥40	dB
Polarization Dependent Loss	≤0.6		dB
Polarization Mode Dispersion	≤0.6		dB
Latency	≤15		ns

Note All insertion loss values include connector losses.

2.2.7 96-Channel DWDM Mux/Demux specifications

The 96-Channel DWDM Mux/Demux supports the multiplexing of 96 ITU DWDM wavelengths onto a single fiber. This module can support 1610 nm OSC add/drop management through a passthrough port to which you can connect a pre-amplifier and booster-amplifier; this eliminates the need for a separate 1610 nm filter.

Table 2-10 96-Channel DWDM Mux/Demux (BT8A96MD01-I02/MD02-I02) specifications

Parameter	Mux		Demux		Units
Wavelength Range	1566.72 to 1528.77				nm
Channel Wavelength	ITU 50 GHz Grid				
Channel Frequency	196.10 to 191.35				THz
Channel Spacing	50				GHz
ITU Band	± 6.25				GHz
Channel Ripple	≤ 0.5				dB
OSC Wavelength	1600 to 1640				nm
Insertion Loss (IL) - Mux	C-Band	CH _{ADD} to Line _{OUT}	$3.0 \leq IL \leq 6.2$		dB
	C-Band	PT _{IN} to Line + 1610 _{OUT}	0.6 typical 0.8 maximum		dB
	C-Band	MON _{OUT} to Line _{OUT}	$18.0 \leq IL \leq 22.0$		dB
	1600-1640nm	OSC _{IN} to Line + OSC _{OUT}	≤ 1.0		dB
Insertion Loss (IL) - Demux	C-Band		Line _{IN} to CH _{DROP}	$3.0 \leq IL \leq 6.8$	dB
	C-Band		Line + 1610 _{IN} to PT _{OUT}	0.6 typical 0.9 maximum	dB
	C-Band		Line _{IN} to MON _{IN}	$18.0 \leq IL \leq 22.0$	dB
	1600-1640nm		Line + 1610 _{IN} to OSC _{OUT}	≤ 1.3	dB
Insertion Loss Uniformity	≤ 1.5				dB
Chromatic Dispersion (CD)	$-42 \leq CD \leq +42$				ps/nm
Adjacent Channel Isolation	≥ 23		≥ 23		dB

Table 2-10 96-Channel DWDM Mux/Demux (BT8A96MD01-I02/MD02-I02) specifications (Continued)

Parameter		Mux	Demux	Units
Non-Adjacent Channel Isolation		≥30	≥30	dB
Directivity		≥40		dB
Return Loss		≥40	≥40	dB
Polarization Dependent Loss		≤0.65		dB
Polarization Mode Dispersion		≤0.85	≤0.9	ps
Passband	0.5 dB down	20.0		GHz
	1.0 dB down	24.5		GHz
	3.0 dB down	35.0		GHz

Note All insertion loss values include connector losses.

2.2.8 96-Channel Fixed Mux/Demux Specifications

Table 2-11 FMD96 (BT8A78MD03) Specifications

Parameters	Range		
Physical			
Width	438 mm		
Height	88 mm		
Depth	280 mm		
Weight			
Environmental			
Power Consumption	Not applicable, passive		
Optical	Minimum	Typical	Maximum
Central Wavelengths (C-Band)	1528.77 nm		1566.72 nm
Number of channels (50GHz spacing)			96 channels
Insertion Loss (client in to line out)	4.0 dB		6.5 dB
Insertion Loss (line in to client out)	4.0 dB		6.5 dB
Monitor In Port Loss ¹	19.6 dB		22.3 dB
Monitor Out Port Loss ²	17.9 dB		21.2 dB
L1 Composite Input Signal Power			23 dBm
Client Input Signal Power			5 dBm/port ³
Wavelength (OSC, Line Port) ⁴	1266 nm	1310nm	1360 nm
Fiber Type	SMF-28 or equivalent		

Table 2-11 FMD96 (BT8A78MD03) Specifications (Continued)

Parameters	Range
Connector	LC/UPC
¹ Relative to L1 In.	
² Relative to L1 Out.	
³ The input power per client port must not exceed this limit to ensure that the optical safety on line output is within Class 1M requirements.	
⁴ For connection to ROADM client ports.	

2.3 Hardware installation

The following sections give instructions for installing DOL modules.

- 2.3.1, “Installing a ROADM-on-a-blade (ROB)”
- 2.3.2, “Installing DLA modules”
- 2.3.3, “Installing Expandable Dispersion Compensation Modules”
- 2.3.4, “Installing a 40-Channel DWDM Mux/Demux”
- 2.3.5, “Installing a 96-Channel DWDM Mux/Demux (BT8A96MD01-I02, BT8A96MD02-I02)”
- 2.3.6, “Installing a 96-Channel Fixed Mux/Demux (BT8A78MD03)”

2.3.1 Installing a ROADM-on-a-blade (ROB)

Use this procedure to install a ROADM-on-a-blade.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- 2D (ROB2) and/or 4D (ROB4) ROADM-on-a-blade
- Isopropyl alcohol and lint-free pads
- Shelf must have an available double-width, single-height slot.

Important See the *BTI 7000 Series Common Equipment Installation Guide* for information about preparing the slot configuration for a shelf.

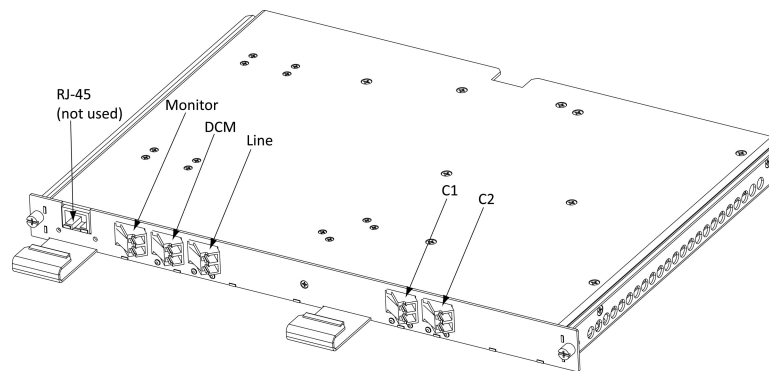


Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

Key installation features

The following figure shows the ROB2 and indicates the key installation features. The difference between a ROB2 and ROB4 is the ROB4 includes two additional client ports—C3 and C4.

Figure 2-1 ROADM-on-a-blade**Installation procedure**

Follow these steps to install a ROB :

Step 1 Insert the Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the ROB with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the first support screw.
 - Partially tighten the other screw.
 - Fully tighten the first support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Inspect and clean the Ends of the Fiber Optic Cables

Use an optical fiber scope to inspect the fiber. Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables if required.

Step 4 Connect the Optical Cables

Connect the input and output cables to the faceplate of the module.

Step 5 Replace the Cables

If any cables were moved to access the ROB, replace the cables to their original locations.

You have successfully completed this procedure.

2.3.2 Installing DLA modules

Use this procedure to install DLA modules.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- DLA module
- Isopropyl alcohol and lint-free pads
- Fiber scope to verify that the fiber ends are clean

Prerequisites

- DLA modules cannot be installed in slot 6 of a BTI 7060 shelf, unless the shelf is equipped with Cooling Unit (CU) BT7A52EA.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).



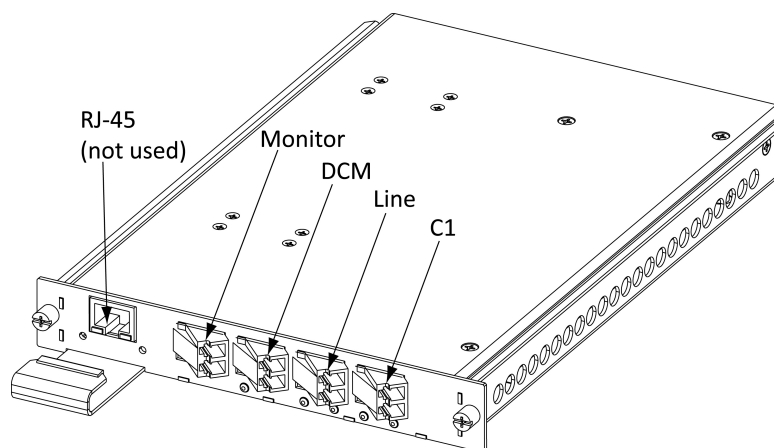
Laser

Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Key installation features

The following figures show typical amplifiers and indicate the key features for installation.

Figure 2-2 DLA module



Installation procedure

Follow these steps to install a DLA module:

Step 1 Insert the Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on and the faceplate of the module matches the position of the adjacent module.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Inspect and clean the Ends of the Fiber Optic Cables

Use an optical fiber scope to inspect the fiber. Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables if required.

Step 4 Connect the Optical Cables

Connect the input and output cables to the faceplate of the module.

Step 5 Replace Cables

If any cables were moved to access the slot, replace the cables to their original locations.

You have successfully completed this procedure.

2.3.3 Installing Expandable Dispersion Compensation Modules

Use this procedure to install any Expandable Dispersion Compensation Module (DCM).

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Dispersion Compensation module
- Isopropyl alcohol and lint-free pads

- 1.25mm and 2.5mm HUXcleaners (recommended)

Prerequisites

- None



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).



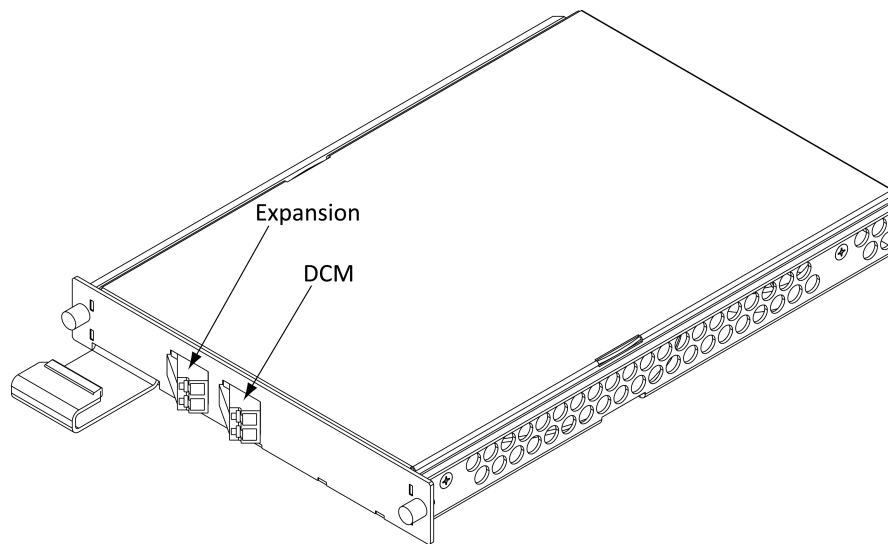
Laser

Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Key installation features

The following figure shows a DCM and indicates the key features for installation.

Figure 2-3 Expandable Dispersion Compensation Module



Installation procedure

Follow these steps to install an Expandable Dispersion Compensation Module:

Step 1 Insert the Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on and the faceplate of the module matches the position of the adjacent module.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Clean the Ends of the Optical Cables

Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables.

Step 4 Connect the Optical Cables

According to the deployment configuration, connect the input and output optical cables to the faceplate of the module.

Step 5 Replace the Cables

If any cables were moved to access the slot, replace the cables to their original locations.

You have successfully completed this procedure.

2.3.4 Installing a 40-Channel DWDM Mux/Demux

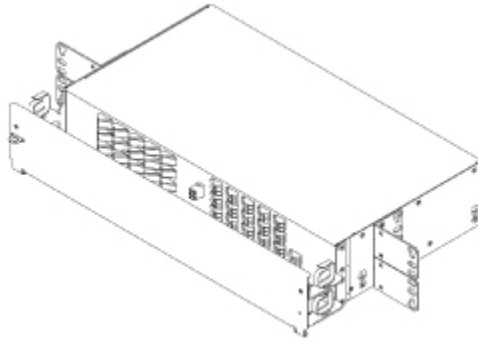
The 40-Channel DWDM Mux/Demux is a standalone passive module that is designed to be installed in the following types of racks:

- 23-inch ANSI equipment rack, mid-mount with front cover
- 19-inch ANSI equipment rack, mid-mount with front cover
- 19-inch (450 mm) ETSI equipment rack, front-mount without front cover
- 19-inch (410 mm) ETSI equipment rack, front-mount with front cover
- 21-inch (500 mm) ETSI equipment rack, front-mount without front cover
- 21-inch (500 mm) ETSI equipment rack, front-mount with front cover

What you need

The shelf is shipped with a combination mounting bracket that accommodates both 21-inch and 23-inch rack installations, depending on the orientation of the bracket.

- To install the shelf in a 19-inch rack: Installation kit BT7A5031, containing the 19-inch mounting bracket and hardware.
- To install the shelf in a 19-inch or 21-inch ETSI rack with a front cover: Mounting bracket (19-inch and 21-inch), which is part of the front cover assembly.

Figure 2-4 40-Channel DWDM Mux/Demux**Installation procedure**

Follow these steps to install a 40-Channel DWDM Mux/Demux in a rack:

- Step 1** Arrange the mounting brackets next to the sides of the shelf.
- The 40-Channel DWDM Mux/Demux require two mounting brackets, one for each side of the shelf.
- Step 2** Attach the mounting brackets to each side of the shelf chassis using the screws provided. Use two screws for each clamp bracket on the shelf, and tighten to a torque that is no more than 65 in-lbs.
- On a 19-inch or 21-inch ETSI rack with a front cover, the mounting bracket (19-inch and 21-inch) is part of the front cover assembly and is pre-configured for a 21-inch installation. To change the bracket to a 19-inch installation, remove the extension.
- Step 3** With one person at each side of the shelf, lift the shelf into position in the equipment frame.
- Step 4** Align the mounting holes in the mounting bracket with the mounting holes in the equipment frame.
- Step 5** Use the M6 Trilobe mounting bolts shipped with the shelf installation kit to mount the shelf in the equipment frame. Use one M6 Trilobe mounting bolt for each mounting bracket on the shelf. Tighten to a torque that is no more than 65 in-lbs.
- Step 6** Connect fiber optic cables.

You have successfully completed this procedure.

2.3.5 Installing a 96-Channel DWDM Mux/Demux (BT8A96MD01-I02, BT8A96MD02-I02)

The 96-Channel DWDM Mux/Demux (BT8A96MD01-I02, BT8A96MD02-I02) is a standalone passive shelf that is designed to be installed in the following types of racks:

Note The 96-Channel DWDM Mux/Demux is currently not NEBS-3 certified.

- 23-inch ANSI equipment rack, mid-mount with front cover
- 19-inch ANSI equipment rack, mid-mount with front cover
- 19-inch (410 mm) ETSI equipment rack, front-mount with front cover
- 21-inch (500 mm) ETSI equipment rack, front-mount with front cover

Note We do not recommend installing the module without the front cover, since the inside of the cover includes the channel plan labeling.

What you need

Brackets: The shelf is shipped with 19-inch brackets in the mid-mount position. The combination 21- and 23-inch brackets are shipped with the installation kit— BT8A7860. These combination brackets allow you to install the module into any of the rack types listed above.

Figure 2-5 96-Channel DWDM Mux/Demux with 19-inch bracket

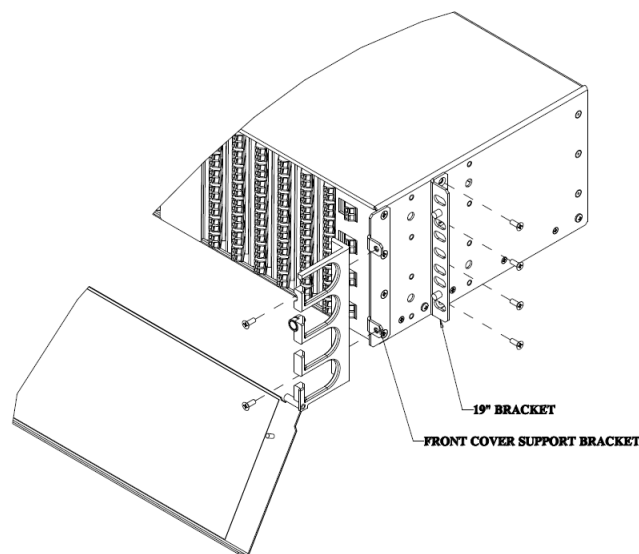
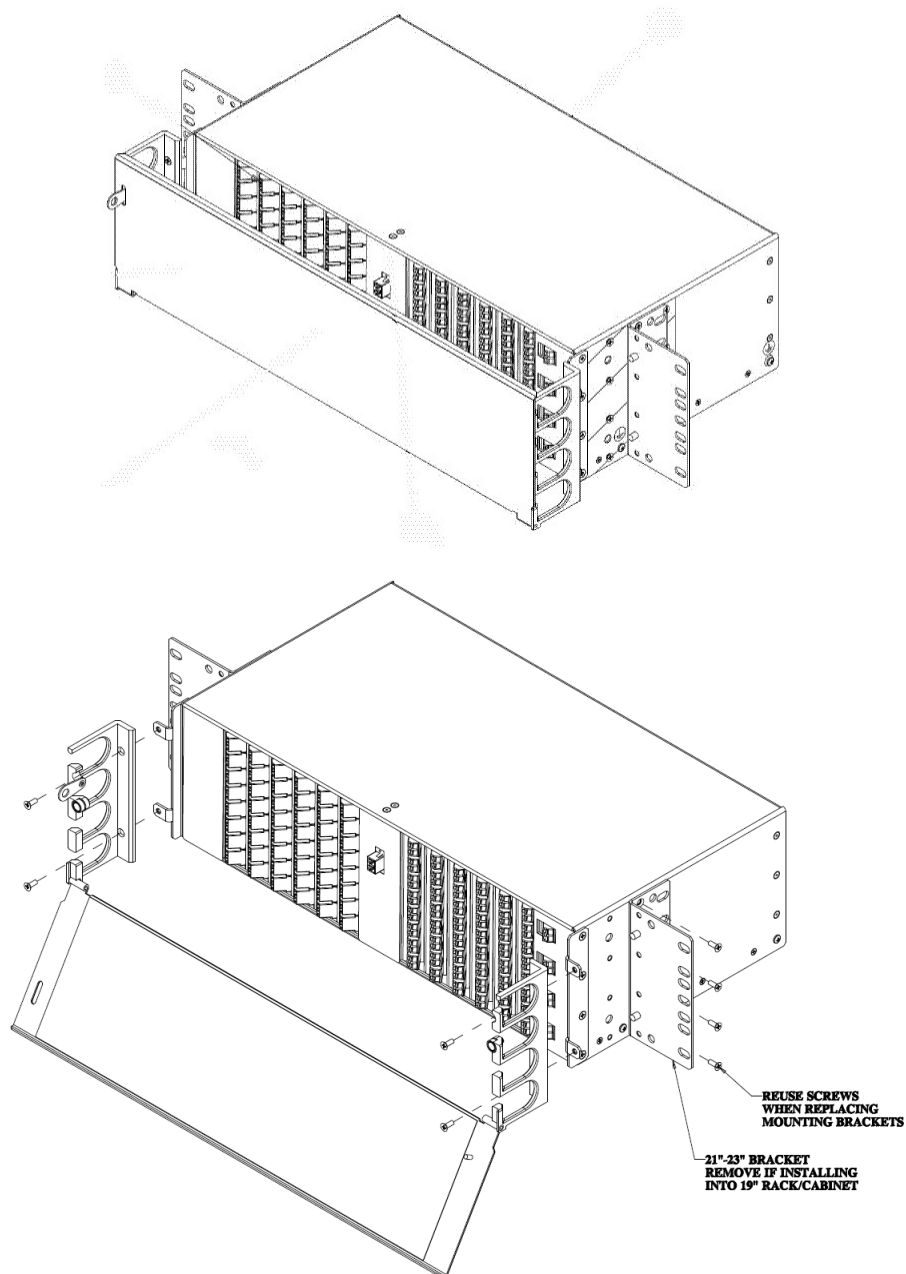


Figure 2-6 96-Channel DWDM Mux/Demux with 23-inch bracket

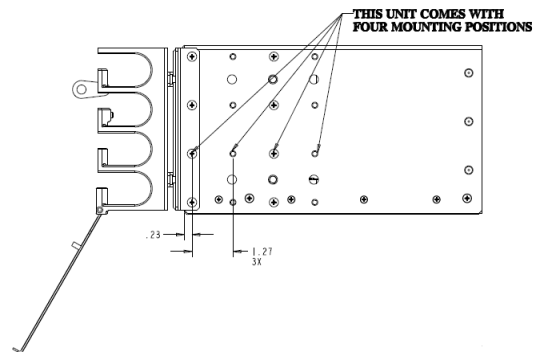
Installation procedure

Follow these steps to install a 96-Channel DWDM Mux/Demux:

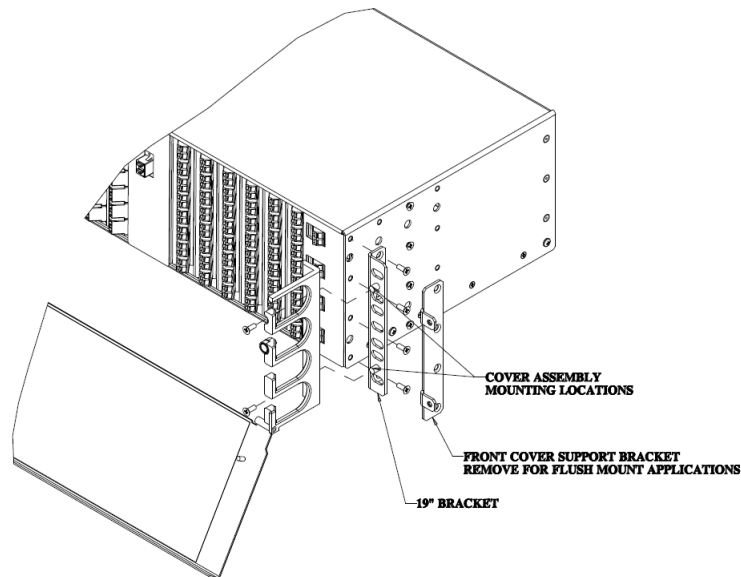
Step 1 Arrange the mounting brackets next to the sides of the shelf.

The 96-Channel DWDM Mux/Demux requires two mounting brackets, one for each side of the shelf.

Note When using the rear three positions for mounting the shelf, the front cover support bracket remains at the front of the shelf.



Note When mounting the shelf flush with the front surface, replace the front cover support brackets with the mounting brackets.



Step 2 Attach the mounting brackets to each side of the shelf using the screws provided.

The front cover and its brackets are attached to the front side of the mounting bracket if center mounting, or the cover mount brackets if mid-mounting. using the 6-32 screws provided. Torque the 6-32 screws to no more than 8.0 in-lbs.

Step 3 With one person at each side of the shelf, lift the shelf into position in the equipment frame.

Step 4 Align the mounting holes in the mounting bracket with the mounting holes in the equipment frame.

Step 5 Use the M6 Trilobe mounting bolts shipped with the shelf installation kit to mount the shelf in the equipment frame. Use one M6 Trilobe mounting bolt for each mounting bracket on the shelf. Tighten to a torque that is no more than 65 in-lbs.

Step 6 Connect fiber optic cables.

You have successfully completed this procedure.

2.3.6 Installing a 96-Channel Fixed Mux/Demux (BT8A78MD03)

Use this procedure to install a 96-Channel Fixed Mux/Demux (FMD96).

The FMD96 is a standalone, passive module that is designed to be installed directly into the following types of racks:

- 23-inch ANSI equipment rack
- 19-inch ANSI equipment rack
- 19-inch (410 mm) ETSI equipment rack
- 21-inch (500 mm) ETSI equipment rack

Note The FMD96 is not NEBS-3 certified.

The FMD96 is shipped as a complete unit with hinged cover and latch, fiber support, and 21/23-inch mounting bracket attached. An installation kit with a 19-inch mounting bracket and installation hardware is included with the FMD96.

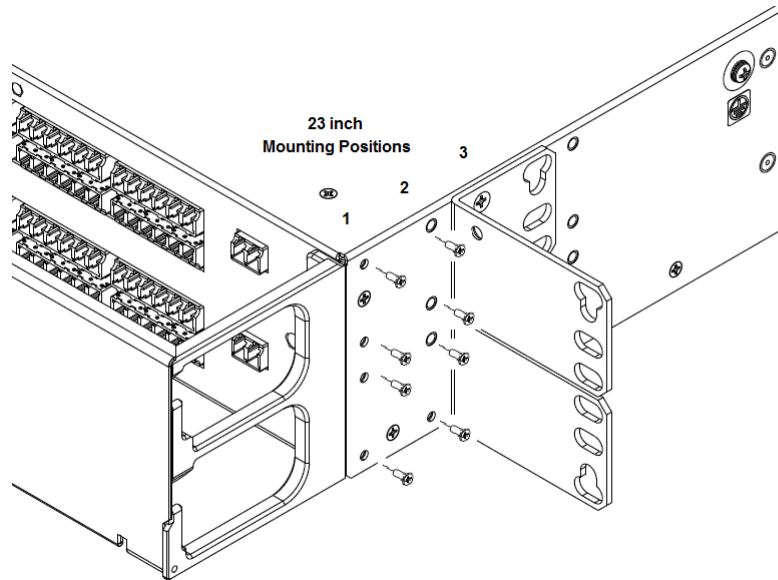
Tools Required

- Installation kit (included)
- Grounding cable
- Grounding cable connector to ground source
- #2 Phillips screwdriver (for ground screw)
- #2 Robertson screwdriver or hex wrench (for fasteners that attach the module to the frame)

Two L-shaped mounting brackets are installed on each side of the FMD96. The mounting brackets attached to the FMD96 are dual-function with the 21 and 23-inch configuration governed by orientation. Three mounting positions are available. Choose the mounting position that ensures the FMD96 is flush with the adjacent . The FMD96 is shipped with the mounting brackets installed in the 23-inch orientation and mounted in the mid position.

Step 1 To install the mounting brackets, choose one of the following options based on the frame requirements and the mounting position.

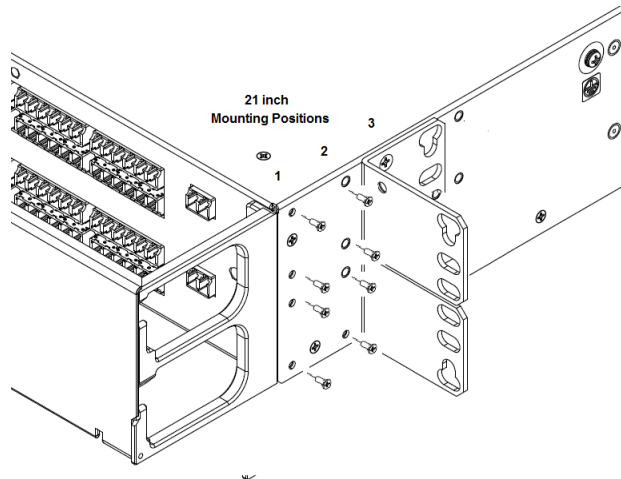
a) To install the 23-inch brackets:

Figure 2-7 23-inch bracket mounting positions

Choose the mounting positions which enable the module to be installed flush with the adjacent .

If required remove the mounting brackets and attach the brackets to the new mounting positions.

b) To install the 21-inch brackets:

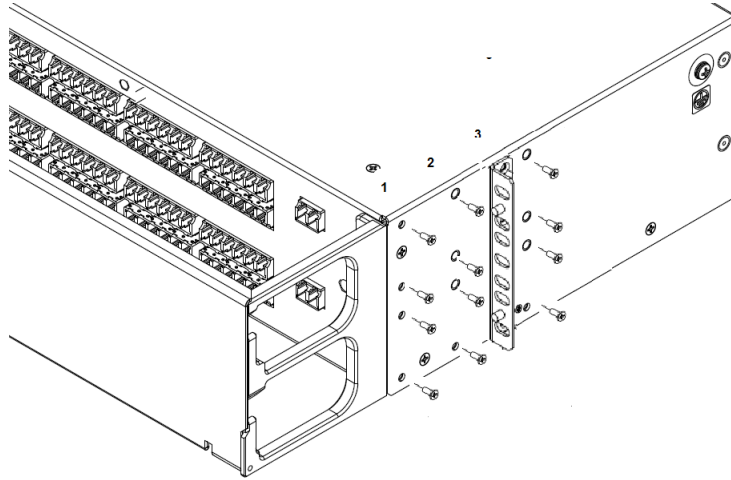
Figure 2-8 21-inch bracket mounting positions

Remove the screws from the 23-inch mounting brackets if installed. Choose the mounting position that enables the module to be installed flush with the adjacent .

Reuse the mounting bracket screws to fasten the 21-inch mounting bracket to the module.

- c) To install the 19-inch brackets:

Figure 2-9 19-inch bracket mounting positions



Remove the 23-inch mounting brackets if installed. Choose the mounting position that enables the module to be installed flush with the adjacent .

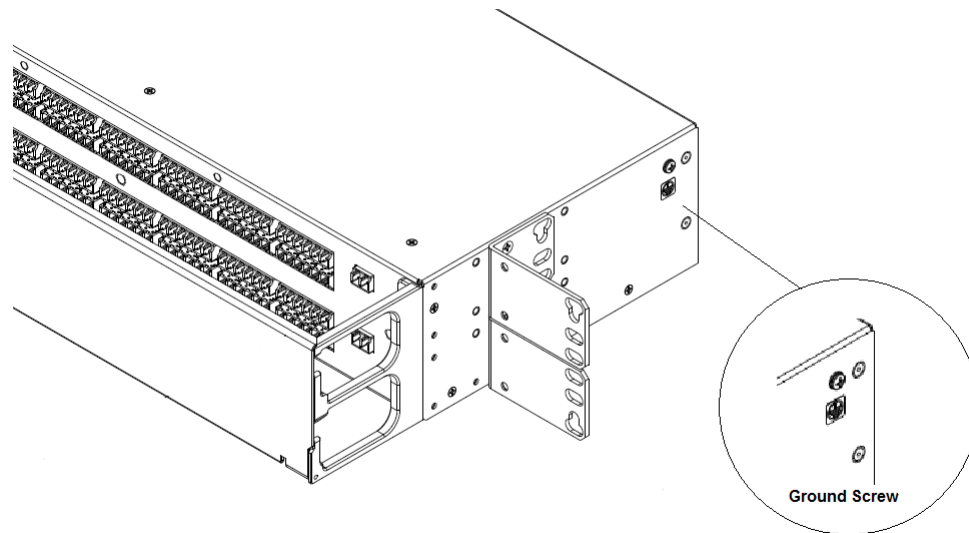
Reuse the mounting bracket screws to fasten the 19-inch mounting bracket to the module.

Step 2 Perform the following to mount the module on the frame or the rack.

- a) With one person at each side of the module, lift the module into position in the equipment frame.
- b) Align the mounting holes in the mounting bracket with the mounting holes in the equipment frame.
- c) Choose the set of mounting screws from the installation kit to mount the shelf into the equipment frame. Use one mounting screw and washer for each mounting bracket attachment. No locking nuts are required as the mounting screws fasten into the threaded screw inserts on the frame.

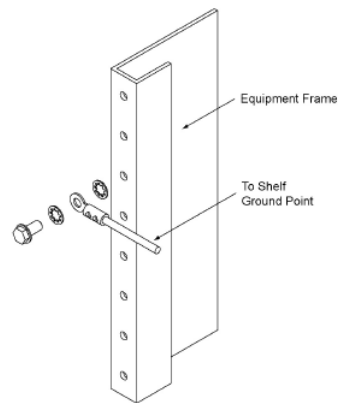
Step 3 Perform the following to ground the module.

- a) Attach the ground cable (not supplied) to the grounding lug supplied in the installation kit.



- b)** Loosen the grounding screw and attach the lug over the ground screw.
- c)** Secure the lug by fastening the ground screw.
- d)** Attach the other end of the ground cable to ground.

The other end is connected to the frame using a biting star lock washer between the lug and the frame, and between the lug and the screw head.



Step 4 Open the cover and connect fibers. The fibers should be routed between the front panel and the front cover to allow for the cover to be opened and closed.

Caution When the ports are optically connected, the module is capable of passing light from all client and line ports at all times. The client and line port connections must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

Step 5 Close the cover after connecting the fibers.

You have successfully completed this procedure.

3.0 Provisioning the DOL hardware

This section gives an overview of the process of setting up a dynamic optical layer on a BTI 7000 Series network element (NE). The initial setup is to define the function of the optical node as a line amplifier node, ROADM node, ROADM terminal, amplifier terminal, or line equalization node. This is done by defining an Optical Group. When a group is defined, it automatically creates Optical Degrees that define the components associated with a single fiber pair or direction. Modules are then assigned to a specific degree. This process defines the collective function of all the modules, how they are interconnected, and the capabilities of the nodes.

Groups

An optical group associates a set of DOL modules that collectively implement a single dynamic optical layer network element configuration. The management of optical groups is supported as follows:

- Optical groups are manually provisioned, and can be manually de-provisioned.
- A network element can contain one or more optical groups.
- The identifier for each group is a unique number in the range of 1-255.
- When a group is provisioned, the group's configuration type must also be specified. For a description of the configuration types refer to [1.2, “Network element nodal configurations”](#).

Supported configuration types are:

- ROADM terminal
- line amplifier node
- ROADM node
- line equalizing node
- amplifier terminal

Provisioning considerations

Following are guidelines to consider when provisioning DOL hardware:

- The optical group supports the following attributes for read-write access: ID, Custom1, Custom2, and Custom3.
- De-provisioning of the group is not permitted if there is any dynamic optical layer equipment assigned to the group.
- Optical groups do not have state attributes.
- We recommend provisioning one group at a time, since connection validation does not ensure fiber connections to wrong DOL groups.

Once an optical group is provisioned, editing the group's configuration type is permitted for only the following cases:

- Changing a ROADM terminal node to a ROADM node.
- Changing a ROADM terminal to a ROADM node. This type of group reconfiguration is not permitted if the C2 port of the assigned ROB module is provisioned for composite alien DWDM signal inter-connection.
- Changing a ROADM node to a line equalizing node. This type of group reconfiguration is permitted, as follows:
 - if there are no modules assigned to degrees 3 or 4
 - if there are no add/drop cross-connects in degrees 1 and 2
 - all Mux/Demux modules are removed from the optical group
- Changing a ROADM node to a ROADM terminal. This type of group reconfiguration is permitted if there are no add/drop or express channels on any degree other than 1, and if there are no modules assigned to any degree other than 1.
- When a group configuration type edit is performed, all other provisioning for that group is preserved.
- Upgrading from a ROB2 module or a 40-channel ROB4 module to a 96-channel ROB4 module is not supported.
- Upgrading from a 96-channel ROB4 module to a ROB2 module or a 40-channel ROB4 module is not supported.

Degrees

A DOL group consists of one or more degrees depending on the group's configuration type. There is a degree in the group for every WDM line that interfaces into the group. Degrees are used when assigning equipment modules to the group as a means of specifying the module's location within the group. Managing degrees is supported as follows:

- Degree identifier consists of the group number and the degree number.
- The range of valid degree numbers for a group depends on the configuration type of the group, as listed in the following table.

- All degrees are automatically created by the system. Manual provisioning and de-provisioning of degrees is not supported.
- In some cases, the degrees are automatically created when the DOL group is provisioned. In other cases the degree objects are automatically created when the first module is assigned to the degree. Refer to the following table:

Table 3-1 Degree objects and auto-creation method

Configuration Type	Valid degrees	Auto-created by group provisioning	Auto-created By module assignment
ROADM terminal	1	1	
Line amplifier node	1-2	1, 2	
ROADM node	1-4	NA	1-4
Line equalizing node	1-2	1, 2	
Amplifier terminal	1	1	

- Degrees, which are automatically created by DOL group provisioning, are auto-deleted when the particular group is de-provisioned.
- Degree objects, which are automatically created by equipment assignment to the degree, are automatically deleted when the last module assigned to the degree is removed from assignment to the degree.

Assignments

Provisioned modules are assigned to a specific degree in a DOL group to establish the DOL network element (NE) configuration. Depending on the DOL group's configuration type, DLA2 or ROADM-on-a-blade (ROB) modules are required to be assigned to the group before traffic can be enabled. DCMs may be assigned as required by the network planning process, and Mux/Demux modules are required to support add/drop capability. A Mux/Demux must be manually added to the system using the proNX 900 Node Controller.

The list of DOL modules applicable to all group configuration types is identified in the following table. The table shows which types of DOL modules may be assigned for each degree of each of the supported DOL group types. Note the following about the table:

- ROB2 or ROB4: Indicates a choice of modules, not both modules.
- DCM: Indicates the assignment of one or more expandable DCM modules is valid.
- 40-, 96-, or 8-channel Mux/Demux: Indicates a choice of the 40-channel Mux/Demux, the 96-channel Mux/Demux, or any variant of the 8-channel Mux/demux module set.
- NA: Indicates the assignment is not valid for the configuration type.
- Asterisk: Indicates a valid assignment.

Table 3-2 Valid DOL module assignments

Configuration Type	Degree	DLA2	ROB2 (Degrees 1 and 2) or ROB4 (Degrees 1 to 4)	DCM	40- or 96- or 8-channel Mux/Demux
ROADM terminal	1	NA	*	*	*
Line amplifier node	1	*	NA	*	NA
	2	*	NA	*	NA
ROADM node	1	NA	*	*	*
	2	NA	*	*	*
	3	NA	only ROB4	*	*
	4	NA	only ROB4	*	*
Line equalizing node	1	NA	*	*	NA
	2	NA	*	*	NA
Amplifier terminal	1	*	NA	*	*

Note The DLA2 (BT7A06CA) module is not compatible with the 96-channel 4D ROADM-on-a-blade or any of the 96-channel multiplexer/demultiplexers.

Management of equipment module assignments to DOL groups works as follows:

- Provisioned modules are manually assigned to degrees.
- Only module types identified as valid for a given DOL configuration type and degree number can be assigned to the degree.
- Only a single module of each valid type may be assigned to a degree, with the exception of DCM modules. Up to two DCM modules can be used in a degree.
- A module cannot be assigned for more than one degree.
- Modules can be assigned to DOL configurations in any order.
- Modules can be manually removed from a degree. Removal from a degree is not permitted if the DOL module is supporting any provisioned cross-connection.
- Removal of a DLA2 module from a degree is not permitted if the WDM object supported by the module is administratively In-Service.
- The assignment of a module to a degree cannot be edited. To change the assignment, the module assignment must be deleted, and then a new assignment can be provisioned.

DOL optical ports

Each DOL module contains a number of ports for optical traffic inputs and outputs. The DLA2 and ROB modules each have a line port for connection to the inter-nodal span. The rest of the ports are used for inter-connections to other DOL modules within a group, or to connect to non-

DOL equipment at the same site. The following table lists the ports on each DOL module. All DOL optical ports are bi-directional.

Table 3-3 DOL optical ports

Module	Port type	Port number
DLA2	Line	1
	Client	1
	DCM	1
ROB2	Line	1
	Client	1-2
	DCM	1
ROB4	Line	1
	Client	1-4
	DCM	1
DCM	DCM	1
	Expansion	1
40-ch Mux/Demux (D40MD)	Line	1
	Channel	210-600
96-ch Mux/Demux (D96MD)	Line	1
	Channel	135-610
8-ch Mux/Demux (D32MD1, D32MD2, D32MD3, D32MD4)	Line	1
	Channel	220-290 (D32MD1)
		320-390 (D32MD2)
		420-490 (D32MD3)
		520-590 (D32MD4)

Some optical ports are automatically created when their module is assigned to a degree. The table, below, indicates which optical ports are automatically created for each of the DOL group configurations. For groups with two or more degrees, the indicated set of automatically created ports applies to each of the modules assigned to each degree. The following points apply to the table:

- For those ports indicated with a ‘Y’ against a group configuration, the port is auto-created when the supporting module is assigned to the group.
- For those ports indicated with a ‘Y*’ against a group configuration, the port is auto-created when:
 - the supporting module is assigned to the group, and
 - the inter-connecting module is assigned to the group.
- For those ports indicated with a ‘Y’ against a group configuration, the port is auto-deleted when its module is removed from the group.
- For those ports indicated with a ‘Y*’ against a group configuration, the port is auto-deleted when either its module or the inter-connecting module is removed from the group.

Table 3-4 Auto-created optical ports

Module	Port	ROADM terminal	Line amplifier node	ROADM node	Line equalizing node	Amplifier terminal
DLA2	Line	NA	Y	NA	NA	Y
	C1	NA	Y	NA	NA	Y
	DCM	NA	Y	NA	NA	Y
ROB2	Line	Y	NA	Y	Y	NA
	C1	Y	NA	Y	NA	NA
	C2	NA	NA	Y	Y	NA
	DCM	Y	NA	Y	Y	NA
ROB4	Line	Y	NA	Y	Y	NA
	C1	Y	NA	Y	NA	NA
	C2	NA	NA	Y	Y	NA
	C3-C4	NA	NA	Y	NA	NA
	DCM	Y	NA	Y	Y	NA
DCM	DCM	Y	Y	Y	Y	Y
	Expansion	Y	Y	Y	Y	Y
40-ch Mux/ Demux	Line	Y	NA	Y	NA	Y
	Channels	Y	NA	Y	NA	Y
96-ch Mux/ Demux	Line	Y	NA	Y	NA	Y
	Channels	Y	NA	Y	NA	Y
8-ch Mux/ Demux	Line	Y	NA	Y	NA	Y
	Channels	Y	NA	Y	NA	Y

Optical ports for Line and Client ports on DLA and ROB modules support the configuration attribute DWDM Type for read-write access which indicates if the port is configured for inter-connection to a non-DOL DWDM source. The DWDM Type attribute is not defined for channel ports.

Optical ports for Line and Client ports on ROB modules and for Mux/Demux ports support the configuration attribute Grid Spacing. This attribute is read-only for all ports except for those with DWDM Type set to non-DOL, in which case the attribute is read-write. The only value supported for Grid Spacing on the 96-channel ROB4 module and the 96-channel Mux/Demux port is 50 GHz. The only value supported for Grid Spacing on all other ROB modules and Mux/Demux ports is 100 GHz.

Optical ports for Channel ports on Mux/Demux modules support the informational attribute Wavelength for read-only access. The Wavelength attribute provides the actual wavelength of the channel in nanometers.

Optical ports for Channel ports on Mux/Demux modules support the informational attribute Frequency for read-only access. The Frequency attribute provides the actual frequency of the channel in terahertz.

Optical Ports do not have an administrative state that is directly configurable. The administrative state of optical ports on DLA and ROB packs is tied to the administrative state of the WDM managed object.

Optical port objects on DLA and ROB packs support the following additional state-related attributes: Operation status, Operation status qualifier

Optical Port objects on DCM and Mux/Demux equipment do not have an administrative or operational state.

Optical port objects support the following attributes for read-write access: ID, Custom1, Custom2, and Custom3.

Intra-NE fiber connections

As part of the DOLcommissioning process, modules are physically installed, and the appropriate fiber connections between the ports of these modules must be made. For DOL deployments, an inter-port optical connection strategy is employed, in which double-ended, straight-duplex, or cross-over duplex fiber patch cables are used where applicable. The exception for using duplex patch cables is on the DCM port of DLA and ROB modules, where no further DCM module is attached. In these cases, an LC loopback connector is attached to the port.

Fiber connections are automatically created by the system. DOL modules must be interconnected according to the fiber connections that are auto-created. Operators may retrieve the list of auto-created fiber connection objects to validate that the installed DOL equipment is inter-connected as required.

Fiber connection objects are identified by an ordered pairing of optical port objects, which represent the endpoints of the connection.

Fiber connections have a connection type attribute, which has one of LC Loopback or LC Duplex.

For fiber connections with connection type LC Loopback, both endpoints of the pairing are the same optical port.

Specific fiber connection objects that may be automatically created are listed in the following tables, along with the DOL configuration types to which they apply.

Fiber connections with endpoints that are not on a DCM module or DCM port are automatically created when the modules supporting the source port and the destination port of the connection are both assigned to the DOL group.

Table 3-5 Intra-degree fiber connections

Configuration	Source Module/Port	Destination Module/Port	Connection Type	Attenuator Requirements	Notes
ROADM Node	ROB / C1	40ch M/D / Line In/Out	Straight-Duplex	None	
	ROB / C1	96ch M/D / Line In/Out	Straight-Duplex	None	
	ROB / C1	8ch M/D / Line In/Out	Straight-Duplex	None	

Table 3-5 Intra-degree fiber connections (Continued)

Configuration	Source Module/Port	Destination Module/Port	Connection Type	Attenuator Requirements	Notes
ROADM Terminal	8ch M/D / Channel port	10G XFP	Crossover Duplex	None	
	8ch M/D / Channel port	2.5G SFP	Crossover Duplex	None	
	40ch M/D / Channel port	10G XFP	Straight-Duplex	None	
	40ch M/D / Channel port	2.5G SFP	Straight-Duplex	None	
	96ch M/D / Channel port	10G XFP	Straight-Duplex	None	
	ROB / Line	C1, C2, C3, C4	-	None	
	ROB / DCM	DCM / DCM	Crossover Duplex	None	If no DCM, loopback on ROB-DCM port
	ROB / DCM	ROB / DCM	Loopback	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	Only required when cascading 2 DCMs
	DCM / Expansion	DCM / Expansion	Loopback	None	
ROADM Terminal	ROB / C1	40ch M/D / Line In/Out	Straight-Duplex	None	
	ROB / C1	96ch M/D / Line In/Out	Straight-Duplex	None	
	ROB / C1	8ch M/D / Line In/Out	Straight-Duplex	3dB on C1 line out, 3dB on C1 line in	
	8ch M/D / Channel Port	10G XFP	Crossover Duplex	None	
	8ch M/D / Channel Port	2.5G SFP	Crossover Duplex	Measure the power from the Demux drop port with a power meter: <ul style="list-style-type: none"> If the power is below -15 dBm no pad is required. If the power is greater than -15 dBm, place a fixed pad attenuator to bring the power into the range -17 to -15 dBm. 	

Table 3-5 Intra-degree fiber connections (Continued)

Configuration	Source Module/Port	Destination Module/Port	Connection Type	Attenuator Requirements	Notes
	40ch M/D / Channel Port	10G XFP	Straight-Duplex	as required to meet composite power input specifications	
	40ch M/D / Channel Port	2.5G SFP	Straight-Duplex	None	
	96ch M/D / Channel Port	10G XFP	Straight-Duplex	None	
	ROB / C2	Alien DWDM line	-	None	
	ROB / Line	System fiber	-	None	
	ROB / DCM	DCM / DCM	Crossover Duplex	None	If no DCM, loopback on ROB-DCM port
	ROB / DCM	ROB / DCM	Loopback	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	Only required when cascading 2 DCMs
	DCM / Expansion	DCM / Expansion	Loopback	None	
	ROB / C1	none	-	None	
Line Equalization Node	ROB / Line	System fiber	-	None	
	ROB / DCM	DCM / DCM	Crossover Duplex	None	If no DCM, loopback on ROB-DCM port
	ROB / DCM	ROB / DCM	Loopback	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	Only required when cascading 2 DCMs
	DCM / Expansion	DCM / Expansion	Loopback	None	
	DLA / DCM	DCM / DCM	Straight-Duplex	None	If no DCM, loopback on ROB-DCM port
	DLA / Line	System fiber		None	
Line Amplifier Node	DLA / DCM	DLA / DCM	Loopback	None	
	DLA / DCM	DCM / DCM	Straight-Duplex	None	
	DCM / Expansion	DCM / Expansion	Loopback	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	

Table 3-5 Intra-degree fiber connections (Continued)

Configuration	Source Module/Port	Destination Module/Port	Connection Type	Attenuator Requirements	Notes
Amplifier Terminal	DLA / C1	40ch ¹ M/D / Line In/Out	Straight-Duplex	None	
	DLA / C1	8ch M/D / Line In/Out	Straight-Duplex	None	
	DLA / DCM	DLA / DCM	Loopback	None	
	DLA / DCM	DCM / DCM	Straight-Duplex	None	
	DCM / Expansion	DCM / Expansion	Loopback	None	
	DCM / Expansion	DCM / DCM	Straight-Duplex	None	

¹The DLA2 (BT7A06CA) module is not compatible with the 96-channel 4D ROADM-on-a-blade or any of the 96-channel multiplexer/demultiplexers.

Table 3-6 Inter-degree fiber connections

Configuration Type	Source Module/Port	Destination Module/Port	Connection Type	Attenuator Requirements	Notes
ROADM Node	Degree-1 ROB C2	Degree-2 ROB C2	Straight-Duplex	None	
	Degree-1 ROB C3	Degree-3 ROB C3	Straight-Duplex	None	
	Degree-1 ROB C4	Degree-4 ROB C4	Straight-Duplex	None	
	Degree-2 ROB C4	Degree-4 ROB C2	Straight-Duplex	None	
	Degree-2 ROB C3	Degree-3 ROB C2	Straight-Duplex	None	
	Degree-3 ROB C4	Degree-4 ROB C3	Straight-Duplex	None	
Line Amplifier Node	Degree-1 DLA C1	Degree-2 DLA C1	Straight-Duplex	None	
Line Equalization Node	Degree-1 ROB C2	Degree-2 ROB C2	Straight-Duplex	None	

Fiber connections, with endpoints that are not on a DCM module or DCM port, are automatically deleted when the module supporting either the source port or the destination port of the connection is removed from the DOL group.

In the case of a ROB module in a reconfigurable add/drop NE configuration on which the C2 port has been manually provisioned or edited to set the inter-connection type to non-DOL, no fiber connection to this port is created even if the inter-connecting ROB module has been assigned to the group.

For fiber connections with endpoints on a DCM module, the set of fiber connections that are created depends on the full set of DCM modules that have been assigned to the degree. For either a DLA or ROB module, the combination of DCM modules that might be assigned to the degree to subtend from the DCM port are:

- no DCM module
- single DCM module
- two DCM modules

Of the defined fiber connections involving a DCM module or the DCM-port on a DLA or ROB module, whether or not they are auto-created depends on which combination of DCM modules has been assigned to the degree, as indicated in the following table. These connections apply to all degrees of all DOL group configuration types.

Table 3-7 DCM fiber connections

Fiber connection		DCM module combination
Source port	Destination port	
DLA with no DCM		DLA DCM (loopback)
DLA with 1 DCM	DLA-DCM to DCM-DCM	DCM (loopback)
DLA with 2 DCMs	DLA-DCM to DCM-DCM	DCM to 2 DCMs; 2 DCMs (loopback)
ROB with no DCM		ROB to DCM (loopback)
ROB with 1 DCM	ROB-DCM to DCM-DCM	DCM (loopback)
ROB with 2 DCMs	ROB-DCM to DCM-DCM	DCM to DCM-DCM; DCM (loopback)

When DLA, ROB, and DCM modules are assigned to or removed from a degree, all applicable fiber connections are auto-created, and all existing fiber connections that no longer apply are auto-deleted.

Manual provisioning, de-provisioning or editing of fiber connection objects is not supported.

3.1 Configuration rules

Configuration actions on a managed object, such as provisioning, de-provisioning, and administrative state changes, are subject to restrictions. The following list of rules and behaviors apply to all DOL managed objects, unless stated otherwise in the specification of the object:

- Managed object provisioning and all attribute configuration settings are persistent in the configuration database and survive restarts.
- The management interface supports the retrieval of provisioned managed object information, which includes all applicable configuration and status attributes and state information.

Provisioning and deprovisioning

The following rules apply to managed objects that support provisioning and de-provisioning:

- An object can be provisioned only if all its supporting objects are already provisioned.
- An object can be de-provisioned only if it is not supporting objects that are still provisioned.
- In the TL1 interface, an object must be administratively out-of-service before it can be deprovisioned, unless the forced command mode is selected.
- A database change notification and an SNMP notification is generated when a managed object is provisioned or auto-created.
- A database change notification and an SNMP notification is generated when a managed object is de-provisioned or auto-deleted.

Administrative state changes

The following rules apply to managed objects that support administrative state and/or operational state:

- An object can be put administratively in-service only if all of its supporting objects are already administratively in-service or auto-in-service.
- An object can be put administratively out-of-service only if all of the objects it is supporting are administratively out-of-service.
- When a managed object is administratively put in-service or out-of-service, an administrative state change notification is generated for TL1, and a database change notification is generated for SNMP.
- A state change notification is generated when a managed object's operational status changes from in-service to out-of-service, or vice-versa.

3.2 Auto-provisioning the DOL

When a DOL module is inserted into a valid slot, which is not yet provisioned, the module may be auto-provisioned depending on the setting of the system-wide, auto-provisioning enable state parameter (AUTOP), as follows:

- auto-provisioning enable state parameter set to OFF - auto-provisioning does not occur.
- auto-provisioning enable state parameter set to In-service - module is auto-provisioned with state In-service.
- auto-provisioning enable state parameter set to Out-of-service - module is auto-provisioned with state Out-of-service.
- auto-provisioning enable state parameter set to Auto-in-service - module is auto-provisioned with state In-service.

Auto-provisioning considerations

- Auto-provisioning is not supported on the ports of the DOL modules.
- Auto-provisioning is supported on the 8-channel Mux/Demux and its passive ports.

3.3 Padding Requirements

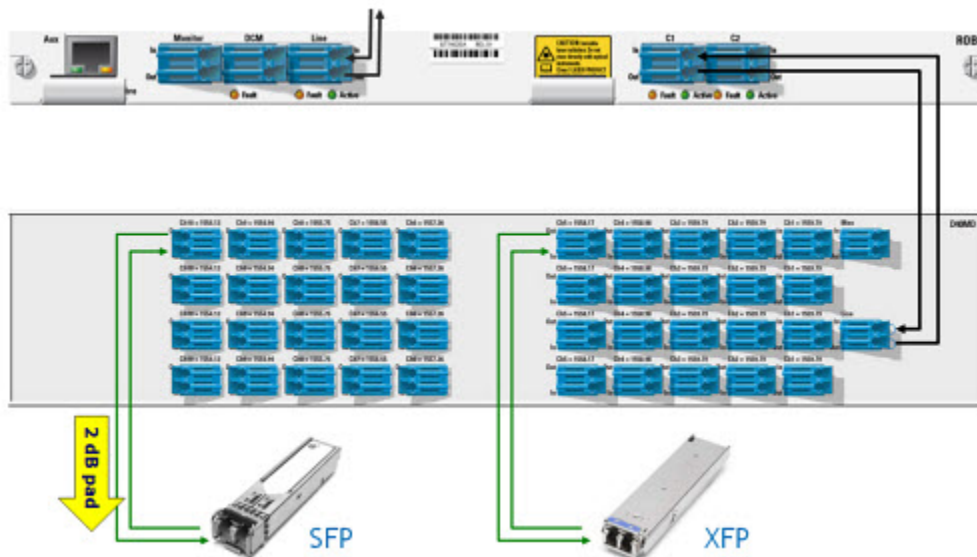
The DOL has been optimized around 10G DWDM services with 40-channel and 96-channel Mux/Demux modules.

When deploying 2.5G DWDM wavelengths (BP3AM1DE-xx), an attenuator is required on the DWDM SFP receiver. Since the receiver power for DWDM SFPs are about 2dB less than DWDM XFPs (BP3AM4DL-xx), a fixed pad is required.

When deploying 8 channel Mux/Demux modules, attenuators are required on the line in/line out ports of the 8 channel Mux/Demux to ensure the loss is similar to the 40 channel Mux/Demux.

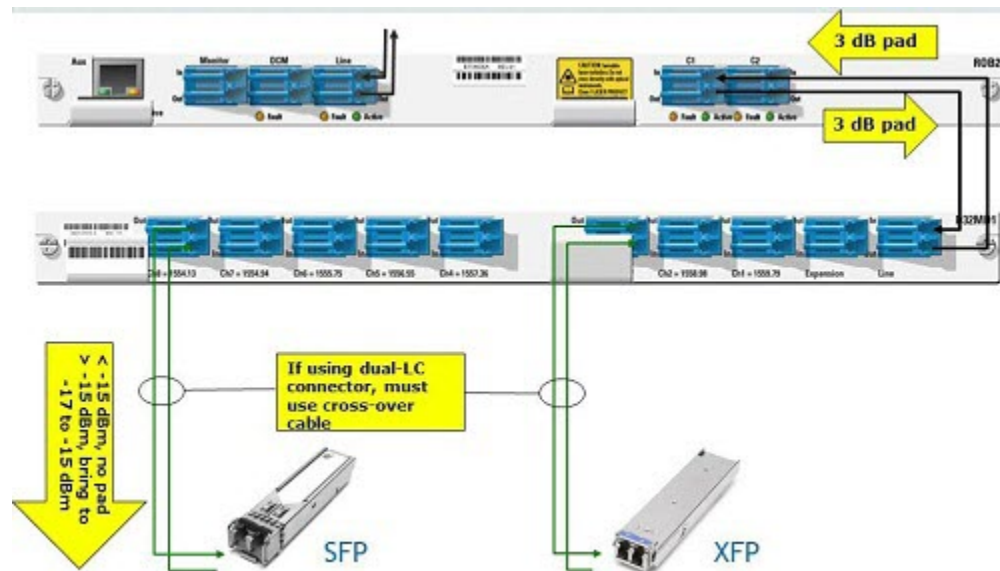
The following diagrams show the required attenuators for these configurations.

Figure 3-1 40 Channel Mux/Demux Padding Requirements



Using a 40 channel Mux/Demux

- C1 to Mux/Demux – no pad required
- Mux/Demux to XFP – no pad required
- Mux/Demux to 2.5G SFP – 2dB pad required on SFP rx port

Figure 3-2 8 Channel Mux/Demux Padding Requirements

Using a 8 channel Mux/Demux

- C1 to Mux/Demux – 3dB pad on C1 out; 3dB pad on C1 in
- Mux/Demux to XFP – no pad required
- Mux/Demux to 2.5G SFP – Ports 1 to 3, and 4 to 8: Measure the power from the Demux drop port with a power meter:
 - If the power is below -15 dBm no pad is required.
 - If the power is greater than -15 dBm, place a fixed pad attenuator to bring the power into the range -17 to -15 dBm

3.4 AINS behavior

Automatic in-service (AINS) capability is supported for the OSC, WDM and wavelength channels.

Fault reporting behavior for an AINS entity is the same as for an Out-of-service entity. When all faults clear for an entity, this initiates the automatic-in-service timer for the entity to count down. If no faults are raised for the entire duration of the countdown, the state of the object automatically transitions to In-service. Otherwise, if a fault is raised before the timer expires; the timer is reset to its original value and is held there until all faults clear.

The following sections list the AINS behaviors.

AINS for OSC

The administrative status setting of the OSC is dependent on the administrative status of the supporting DLA2 and ROB2 modules and on the setting of the system auto-provisioning attribute as shown in the following table.

Table 3-8 OSC admin status

Supporting module admin state	System auto-provisioning attribute		
	In-service	AINS/OFF	Out-of-service
In-service	IS	AINS	OOS
AINS	IS	AINS	OOS
Out-of-service	OOS	OOS	OOS

When the OSC admin state in-service or auto-in-service, the OSC link is enabled in both receive and transmit directions.

When the OSC admin state is out-of-service, the OSC transmit signal is shut down.

OSC supports the following state-related attributes:

- Operation status
- Operation status qualifier
- Auto-in-service Timer
- Active Auto-in-service Timer

AINS for WDM

The administrative status setting of the OSC is dependent on the administrative status of the supporting OSC link and on the setting of the system auto-provisioning attribute as shown in the following table.

Table 3-9 WDM Admin status

Supporting OSC admin state	System auto-provisioning attribute		
	In-service	AINS/OFF	Out-of-service
In-service	IS	AINS	OOS
AINS	IS	AINS	OOS
Out-of-service	OOS	OOS	OOS

The WDM managed object acts as a single point of control for all WDM traffic and amplification on the DLA2 or ROB modules. It also is used to access a number of attributes related to the line span that terminates on the pack. When WDM is In-service or Auto-in-service, bi-directional WDM traffic is enabled on all optical ports of the module. The WDM's operational status depends on additional factors, such as the status of supporting equipment and WDM fault status.

When WDM is Out-of-service, bi-directional WDM traffic is disabled and all amplifiers are shut down. No WDM traffic is transmitted from any optical ports on the module.

WDM traffic carried by the supported ports of a module is supported by OSC. The WDM administrative status cannot be set to In-service or Auto-in-service if the supporting OSC link or supporting DLA2 or ROB module is Out-of-service.

The administrative status of WDM can be set to Out-of-service even if it is supporting provisioned wavelength channels that are in-service.

When the administrative status of WDM is Auto-in-service (AINS), the active AINS timer for the WDM does not begin to count down until all faults are cleared against both WDM and all of its supported optical ports.

When the WDM active AINS timer expires, the administrative status of the WDM and all supported optical ports transitions to In-service.

WDM supports the following state-related attributes:

- Operation status
- Operation status qualifier
- Auto-in-service Timer
- Active Auto-in-service Timer

AINS for Wavelength channel

The administrative status setting of the OSC is dependent on the administrative status of the supporting WDM and on the setting of the system auto-provisioning attribute as shown in the following table.

Table 3-10 Wavelength channel admin status

Supporting module admin state	System auto-provisioning attribute		
	In-service	AINS/OFF	Out-of-service
In-service	IS	AINS	AINS
AINS	IS	AINS	AINS
Out-of-service	AINS	AINS	AINS

When a Wavelength Channel on the Line port of a ROB module is In-service or Auto-in-service, the channel is enabled for transmission in the egress direction from the Line port.

When a Wavelength Channel on the Line port of a ROB module is Out-of-service, the channel is disabled for transmission in the egress direction from the Line port.

Wavelength Channels on the client ports of a ROB pack are enabled for transmission in the egress direction from the client port regardless of administrative state of the channel.

The administrative status of the Wavelength Channel can be set to In-service or Auto-in-service even if the supporting WDM is Out-of-service.

When the administrative status of the Wavelength Channel on the Line port is Auto-in-service (AINS), the active AINS timer for the channel does not begin to count down until all faults are cleared against both the Line port Wavelength Channel and its mate Wavelength Channel on one of the client ports.

When the Wavelength Channel active AINS timer expires, the administrative status of both the Line port and Client port Wavelength Channel objects transitions to In-service.

The Wavelength Channel supports the following state-related attributes:

- Operation status
- Operation status qualifier
- Auto-in-service Timer
- Active Auto-in-service Timer

3.5 DOL hardware provisioning tasks

This section describes the following provisioning tasks:

- 3.5.1, “Provisioning a ROADM Terminal”
- 3.5.2, “Provisioning a line amplifier node”
- 3.5.3, “Provisioning a ROADM node”
- 3.5.4, “Provisioning a line equalizing node”
- 3.5.5, “Provisioning an amplifier terminal”
- 3.5.6, “Adding the 40-channel or 96-channel Mux/Demux”
- 3.5.7, “Re-provisioning a ROADM terminal to a ROADM node”
- 3.5.8, “Re-provisioning a ROADM node to a ROADM terminal”
- 3.5.9, “Re-provisioning a Line Equalizing node to a ROADM node”
- 3.5.10, “Re-provisioning a ROADM node to a Line Equalizing node ”

3.5.1 Provisioning a ROADM Terminal

Use this procedure to provision settings for a ROADM Terminal.



Prerequisites

- Equipment must be provisioned prior to beginning this procedure. For detailed information about equipment and configuration requirements, refer to [Chapter 3, “Provisioning the DOL hardware”](#) in this guide.

Provision a ROADM terminal

Follow these steps to provision settings for a ROADM terminal:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, right-click **Optical Groups** and choose **Create New Group**.

Step 3 On the **Group Info** tab of the **Create New Group** dialog, type a unique Group ID.

Step 4 From the **Group Type** drop-down menu, choose **ROADM Terminal**. Click **OK**.

Step 5 In the Navigation pane expand **Optical Groups**. Right-click the new group and click **Assign Equipment**.

Step 6 From the **Add Equipment** dialog, assign the ROB module to this group. Choose the degree from the **Degree Id** pull-down menu.

Step 7 Click **OK**.

The new equipment is listed, by degree, in the Navigation pane. For information about activating services, refer to [8.1, “Activating optical services using proNX 900”](#).

You have successfully completed this procedure.

3.5.2 Provisioning a line amplifier node

Use this procedure to provision settings for a line amplifier node.



Prerequisites

- Equipment must be provisioned prior to beginning this procedure. For detailed information about equipment and configuration requirements, refer to [Chapter 3, “Provisioning the DOL hardware”](#) in this guide.

Provision line amplifier nodes

Follow these steps to provision settings for a line amplifier node:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, right-click **Optical Groups** and choose **Create New Group**.

Step 3 From **Group Info**, type a unique Group ID.

Step 4 From the **Group Type** drop-down menu, choose **Line Amplifier Node**. Click **OK**.

Step 5 In the Navigation pane expand **Optical Groups**. Right-click the new group and click **Assign Equipment**.

Step 6 From the **Add Equipment** dialog, assign the equipment to the **Line Amplifier Node** Group. Choose a degree from the **Degree Id** pull-down menu.

Step 7 Click **OK**.

The new equipment is listed in the Navigation pane. For information about activating services, refer to [8.1, “Activating optical services using proNX 900”](#).

You have successfully completed this procedure.

3.5.3 Provisioning a ROADM node

Use this procedure to provision settings for a ROADM node.



Prerequisites

- Equipment must be provisioned prior to beginning this procedure. For detailed information about equipment and configuration requirements, refer to [Chapter 3, “Provisioning the DOL hardware”](#) in this guide.

Provision ROADM nodes

Follow these steps to provision settings for a ROADM node:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, right-click **Optical Groups** and choose **Create New Group**.

Step 3 On the **Group Info** tab of the **Create New Group** dialog, type a unique Group ID.

Step 4 From the **Group Type** drop-down menu, choose **ROADM Node**. Click **OK**.

Step 5 In the Navigation pane expand **Optical Groups**. Right-click the new group and click **Assign Equipment**.

Step 6 From the **Add Equipment** dialog, assign the equipment to this group. Choose a degree from the **Degree Id** pull-down menu.

Step 7 Click **OK**.

The new equipment is listed in the Navigation Tree. For information about activating services, refer to [8.1, “Activating optical services using proNX 900”](#)

You have successfully completed this procedure.

3.5.4 Provisioning a line equalizing node

Use this procedure to provision settings for a line equalizing node.



Prerequisites

- Equipment must be provisioned prior to beginning this procedure. For detailed information about equipment and configuration requirements, refer to [Chapter 3, “Provisioning the DOL hardware”](#) in this guide.

Provision line equalizing nodes

Follow these steps to provision settings for a line equalizing node:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, right-click **Optical Groups** and choose **Create New Group**.

Step 3 On the **Group Info** tab of the **Create New Group** dialog, type a unique Group ID.

Step 4 From the **Group Type** drop-down menu, choose **Line Equalizing Node**. Click **OK**.

Step 5 In the Navigation pane expand **Optical Groups**. Right-click the new group and click **Assign Equipment**.

Step 6 From the **Add Equipment** dialog, assign the equipment to this group. Choose a degree from the **Degree Id** drop-down menu.

Step 7 Click **OK**.

The new equipment is listed in the Navigation pane. For information about activating services, see [8.1, “Activating optical services using proNX 900”](#)

You have successfully completed this procedure.

3.5.5 Provisioning an amplifier terminal

Use this procedure to provision settings for an amplifier terminal.



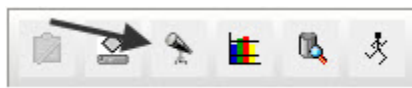
Prerequisites

- Equipment must be provisioned prior to beginning this procedure. For detailed information about equipment and configuration requirements, refer to [Chapter 3, “Provisioning the DOL hardware”](#) in this guide.

Provisioning amplifier terminals

Follow these steps to provision settings for an amplifier terminal:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, right-click **Optical Groups** and choose **Create New Group**.

- Step 3** On the **Group Info** tab of the **Create New Group** dialog, type a unique Group ID.
- Step 4** From the **Group Type** drop-down menu, choose **Amplifier Terminal**. Click **OK**.
- Step 5** In the Navigation pane expand **Optical Groups**. Right-click the new group and click **Assign Equipment**.
- Step 6** From the **Add Equipment** dialog, assign the equipment to this group. Choose a degree from the **Degree Id** pull-down menu.
- Step 7** Click **OK**.

The new equipment is listed in the Navigation pane. For information about activating services, see [8.1, “Activating optical services using proNX 900”](#)

You have successfully completed this procedure.

3.5.6 Adding the 40-channel or 96-channel Mux/Demux

Use this procedure to add the 40-channel or 96-channel Mux/Demux.



Prerequisites

- Equipment must be provisioned prior to beginning this procedure.

Provisioning amplifier settings

Follow these steps to provision settings for an amplifier terminal:

- Step 1** In the toolbar, click the Optical Layer button.



- Step 2** In the Navigation pane, right-click **Optical Groups** and choose **View Mux/Demux**.
- Step 3** From the **Mux/Demux Equipment** dialog, click **Add Mux/Demux**.
- Step 4** From the **Provision Mux/Demux** dialog, add the slot number and choose a **PEC Code** from the drop-down menu . Click **OK** .
- Step 5** Repeat Steps 3 and 4 until all Mux/Demux units are added.
- Step 6** Click **OK**.

You have successfully completed this procedure.

3.5.7 Re-provisioning a ROADM terminal to a ROADM node

Use this procedure to provision BTI ROADM-on-a-blade (ROB) modules when you change the nodal configuration from a ROADM terminal to a ROADM node.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- These steps assume you are using the proNX 900 Node Controller to perform provisioning tasks.
- The ROADM Terminal is provisioned with DOL hardware assigned to Degree 1 in the Group.
- A ROADM node configuration requires two ROB modules. You should have, on hand, a ROB module that is ready to be installed.
- You should be familiar with installing ROB modules. Refer to the section "Installing ROADM-on-a-blade modules," in this guide.

Note Existing traffic on provisioned channels is not affected by this procedure. However, if a C2 port is provisioned on the ROB module, the port must first be deleted before continuing.

Re-provision a ROADM terminal

Follow these steps to change a ROADM terminal configuration to a ROADM node configuration:

Step 1 Install a ROB module.

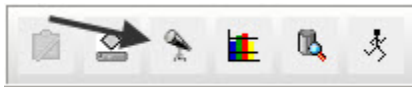
Refer to the section "Installing ROADM-on-a-blade modules," in this guide.

Step 2 Attach the ROB fibers:

- a) Line fibers to the appropriate downstream card.
- b) C1 fibers to the appropriate Mux/Demux.
- c) C2 fibers to the ROB module in Degree 1.
- d) If applicable, DCM fibers to the appropriate DCM module, otherwise, loopback the DCM fibers.

Step 3 Open a proNX 900 session.

In the toolbar, click the Optical Layer icon.



Step 4 Navigate to the ROADM Terminal group that includes the ROB module you are re-provisioning.

Expand the group navigational tree and locate the module.

Step 5 Verify that the administrative state of the ROB is Auto-in-service (AINS) or In-Service (IS).

Right-click on the ROB module and select **View OSC Info**. Click the **General** tab to view the administrative status.

Step 6 Edit the ROADM Terminal group to change the settings to a ROADM node.

- a) Navigate to the group name and right-click. Select **Edit Group** to open the **Provision Group** dialog.
- b) Change the **Group Type** to ROADM Node. Click **Update**.
- c) Click **Add** to open the **Add Equipment** dialogue. From the **Equipment Id** drop-down menu, choose the ROB module that you installed for the ROADM node.
- d) From the **Degree Id** drop-down menu, choose 2. Click **OK**. You are brought back to the **Provision Group** dialog.
- e) Click **Add**. From the **Equipment Id** drop-down menu, choose the appropriate Mux/Demux module for Degree 2. Click **OK**.
- f) From the **Degree Id** drop-down menu, choose 2. Click **OK**. You are brought back to the **Provision Group** dialog.
- g) Optional. If you are adding DCMs, follow the steps, above, for adding equipment to the group.

Step 7 When you complete adding equipment, from the **Provision Group** dialog click **OK**, to close the dialog and complete editing the group.

Step 8 If required, provision ODCC, including OSPF interfaces, or GCC to communicate with downstream network elements (NEs). Refer to the *BTI 7000 Series Management Communication Channels Solution Guide*.

Step 9 Provision the cross-connects on Degree 2 and downstream NEs, as required. Refer to the chapter "Activating services using the proNX 900 Node Controller," in this guide.

Step 10 Verify that the administrative state of the Mux/Demux modules are Auto-in-service (AINS) or In-Service (IS).

Right-click on the ROB module and select **View WDM Info**. Click the **Admin** tab to view the administrative status.

Step 11 Check the traffic integrity.

You have successfully completed this procedure.

3.5.8 Re-provisioning a ROADM node to a ROADM terminal

Use this procedure to provision BTI 2D ROADM-on-a-blade (ROB2) modules when you change the nodal configuration from a ROADM node to a ROADM terminal.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

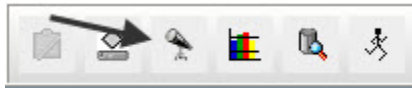
- These steps assume you are using the proNX 900 Node Controller to perform provisioning tasks.
- The ROADM Terminal is provisioned with DOL hardware assigned to Degrees 1 and 2 in the group.

Re-provision a ROADM node

Follow these steps to change a ROADM node configuration to a ROADM terminal configuration:

Step 1 Open a proNX 900 session.

In the toolbar, click the Optical Layer icon.



Step 2 Delete the cross-connects.

- a) Navigate to the ROADM node group that you are re-provisioning. Right-click on the group and select **Provision Cross Connects**, to open the **Optical Cross Connects** dialog.
- b) Right-click in the row of a cross-connect and select **Delete**. Click **OK**.
- c) Repeat this step for each cross-connect in the group.

Step 3 Edit the ROADM Node group to change the settings to a ROADM Terminal.

- a) Navigate to the group name and right-click. Select **Edit Group** to open the **Provision Group** dialog.
- b) From the **Equipment** tab, right-click in the row of a Degree 2 module. Select **Remove from Group** and click **OK**.
- c) Repeat the same procedure for the Degree 2 Mux/Demux module in the group.
- d) If applicable, repeat the same procedure for associated Degree 2 DCMs.

Step 4 Change the **Group Type** to ROADM Terminal. Click **Update**.

Step 5 Click **OK** to close the **Provision Group** dialog.

Step 6 Check the traffic integrity.

Step 7 If required, remove ODCC, including OSPF interfaces, or GCC to communicate with downstream network elements (NEs). Refer to the *BTI 7000 Series Management Communication Channels Solution Guide*.

You have successfully completed this procedure.

3.5.9 Re-provisioning a Line Equalizing node to a ROADM node

Use this procedure to provision BTI ROADM-on-a-blade (ROB) modules when you change the nodal configuration from a Line Equalizing node to a ROADM node.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- These steps assume you are using the proNX 900 Node Controller to perform provisioning tasks.
- The Line Equalizing node is provisioned with DOL hardware assigned to Degrees 1 and 2 in the Group.

Note Existing traffic on provisioned channels is not affected by this procedure.

Re-provision a Line Equalizing node

Follow these steps to change a Line Equalizing node configuration to a ROADM node configuration:

Step 1 Attach the C1 fibers to the appropriate Mux/Demux.

Step 2 Open a proNX 900 session.

In the toolbar, click the Optical Layer icon.



Step 3 Navigate to the Line Equalizing group that includes the ROB module you are re-provisioning.

Expand the group navigational tree and locate the module.

Step 4 Edit the Line Equalizing group to change the settings to a ROADM node.

- Navigate to the group name and right-click. Select **Edit Group** to open the **Provision Group** dialog.
- Change the **Group Type** to ROADM Node. Click **Update**. Click **Add** to open the **Add Equipment** dialog.
- From the **Equipment Id** drop-down menu, choose the appropriate Mux/Demux module for Degree 1.
- From the **Degree Id** drop-down menu, choose 1. Click **OK**. You are brought back to the **Provision Group** dialog.
- Click **Add**. Repeat sub-steps c. and d. to choose the appropriate Mux/Demux module for Degree 2. Click **OK**.

- Step 5** When you complete adding equipment, from the **Provision Group** dialog click **OK**, to close the dialog and complete editing the group.
- Step 6** Provision the cross-connects on Degrees 1 and 2, and downstream NEs, as required. Refer to the chapter "Activating services using the proNX 900 Node Controller," in this guide.
- Step 7** Check the traffic integrity.

You have successfully completed this procedure.

3.5.10 Re-provisioning a ROADM node to a Line Equalizing node

Use this procedure to provision BTI ROADM-on-a-blade (ROB) modules when you change the nodal configuration from a ROADM node to a Line Equalizing node.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- These steps assume you are using the proNX 900 Node Controller to perform provisioning tasks.
- The ROADM Node is provisioned with DOL hardware assigned to Degrees 1 and 2 in the Group.

Note Existing ROADM Node traffic on Add/Drop provisioned channels is affected by this procedure.

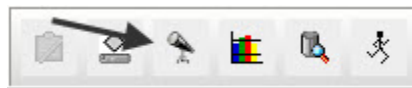
Re-provision a ROADM node

Follow these steps to change a ROADM node configuration to a node configuration:

- Step 1** De-provision the add/drop cross-connects on Degrees 1 and 2, and downstream NEs, as required. Refer to the chapter "Activating services using the proNX 900 Node Controller," in this guide.

- Step 2** Open a proNX 900 session.

In the toolbar, click the Optical Layer icon.



- Step 3** Navigate to the ROADM node group that includes the ROB module you are re-provisioning.

Expand the group navigational tree and locate the module.

- Step 4** Edit the ROADM node group to change the settings to a Line Equalizing node.

- a) Navigate to the group name and right-click. Select **Edit Group** to open the **Provision Group** dialog.
- b) Remove the appropriate Mux/Demux from Degree 1. Right-click in the row that includes the Mux/Demux for Degree 1, and click **Remove from Group**.
- c) Remove the appropriate Mux/Demux from Degree 2. Right-click in the row that includes the Mux/Demux for Degree 2 and click **Remove from Group**.
- d) From the **Group Type** drop-down menu, choose Line Equalizing Node. Click **Update**.

Step 5 Click **OK** to close the **Provision Group** dialog and complete editing the group.

Step 6 Check the traffic integrity.

You have successfully completed this procedure.

3.6 Converting the ROADM network to a different ROADM degree

This section describes how to change your ROADM network environment to a different ROADM degree, using the proNX 900 Node Controller.

Note You cannot convert from a ROB2 or a 40-channel ROB4 module to a 96-channel ROB4 module, or vice versa.

Converting to a different ROADM degree involves:

- Installing and replacing ROADM-on-a-blade (ROB) modules.
- Migrating the fiber connections from the existing to the new ROB module, one degree at a time.
- Provisioning the existing and additional degrees on the new ROB module.

Conversion considerations

As the number of degrees in a specific DOL (dynamic optical layer) node increases, the chances of errors connecting degrees also increase. The BTI implementation involves a communications mechanism, whereby, the actual inter-connected degree number is transmitted between inter-connected ROB modules .

When degrees are added, ensure that each client port is inter-connected to the correct degree in the ROADM node. Refer to **Provisioning the hardware** in this guide.

3.6.1 Convert a two degree to a four degree ROADM network

Use this procedure to change your network from a two degree ROADM to a four degree ROADM network.

Before you begin

Before you begin to convert the network, you should be familiar with the following processes:

- General ROADM-on-a-blade module replacement procedures. Refer to the *BTI 7000 Series Alarm and Troubleshooting Guide*.
- Auto-provisioning the BTI dynamic optical layer. Refer to **Auto-provisioning the DOL**, in this guide.
- Dynamic optical layer provisioning tasks, including inter-nodal fiber connection rules. Refer to **Provisioning the hardware**, in this guide.
- Protection switching guidelines of the service modules. Refer to the *BTI 7000 Series Product Guide*.

Note You cannot convert from a ROB2 or a 40-channel ROB4 module to a 96-channel ROB4 module, or vice versa.

Conversion procedure

Follow these steps to convert a two degree to a four degree ROADM network:

Note Conversion is done one degree at a time.

Step 1 Starting with degree one, reroute all add/drop or pass through traffic away from this ROADM degree.

Verify that traffic is flowing error free on the protecting link.

Step 2 Remove the 2D ROADM-on-a-blade (ROB2) module in degree one from the shelf.

Confirm traffic is still flowing error free across the protecting link.

Step 3 While the 4D ROADM-on-a-blade (ROB4) is unseated, move fiber connections from ROB2 to ROB4, as follows:

- a) ROB2 C1 > ROB4 C1
- b) ROB2 C2 > ROB4 C2
- c) ROB2 Line > ROB4 Line
- d) ROB2 DCM > ROB4 DCM

Step 4 Install the ROB4 module into the same slot in which the ROB2 was seated.

The circuit pack mismatch—REPLUNITMEA—alarm is raised.

Note The ROB module automatically upgrades to the same software release that is running on the shelf. Wait until the "Circuit Pack Upgrade in Progress" alarm clears before proceeding to the next step.

Step 5 Set the PEC code for the new ROB4 module.

- a) Using proNX 900, click the **System Configuration** icon.
- b) Navigate to the system, shelf and slot to which the module is installed.
- c) Right-click on the module and select **Provision Module**.
- d) Click the **Settings** tab. Within the **General** section go to **PEC/CLEI Code:** and choose the PEC code—BT7A07BA—from the drop-down menu.

Step 6 Convert degree two. Repeat steps 1 through 5.

Step 7 Re-route all original traffic paths back to degree one and two.

Step 8 Verify that the ROB4 automatically receives the provisioning settings from the ROB2, and that the power levels on the ROB4 and all associated client transceivers for degree one and two are within the expected range.

Verify that all traffic is flowing error free.

Step 9 Add degrees three and four.

Install the ROB4 modules. Verify that both modules auto-provisioned correctly.

Step 10 Interconnect the nodes of the four degrees.

Follow the inter-degree fiber connection rules. Refer to **Network element nodal configurations**, in this guide.

Step 11 Assign degrees three and four to the existing ROADM Node group. Refer to "Provisioning a ROADM node," in the section **DOL hardware provisioning tasks**, in this guide.

You have successfully completed this procedure.

4.0 Turning up the network

This section includes the following topics:

- 4.1, “Monitoring the OSC using proNX 900”
- 4.1.1, “Viewing the OSC general settings”
- 4.1.2, “View fiber patchcords”
- 4.1.3, “Validate inter-nodal line span connection”
- 4.1.4, “Check span loss and length”

4.1 Monitoring the OSC using proNX 900

This section provides information about monitoring the OSC for the DOL.

4.1.1 Viewing the OSC general settings

Use this procedure to view the OSC general settings for DOL equipment.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Equipment must be provisioned prior to viewing the OSC general settings.

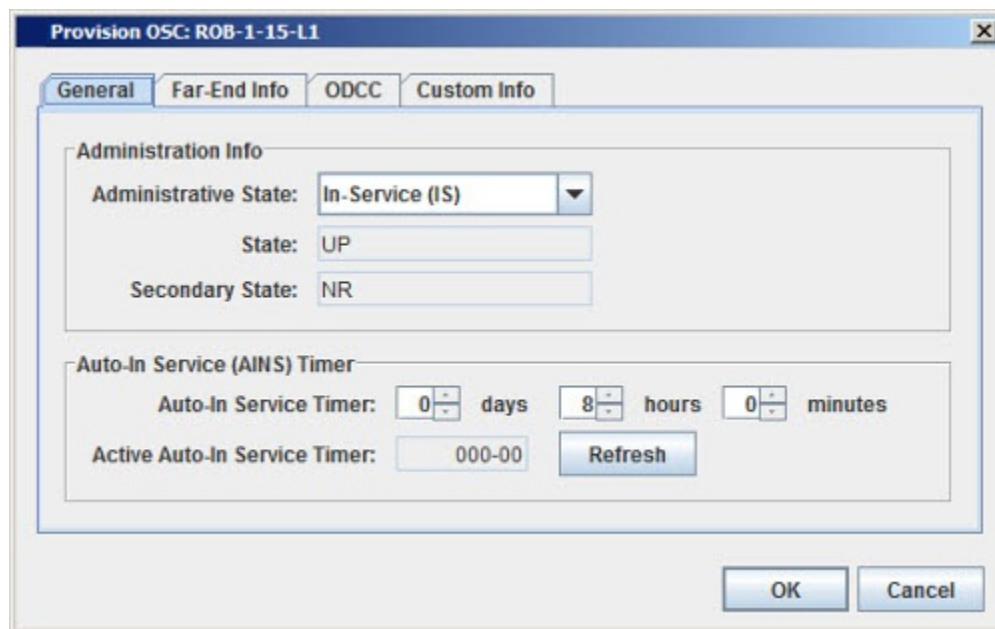
View OSC settings

Follow these steps to view the OSC general settings:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, expand **Optical Groups**, right-click an optical module and choose **View OSC Info**. Alternatively right-click the module in the shelf view and choose **View OSC Info**.



The **Provision OSC** dialog opens. The Administrative State is dependent on the system-wide settings.

Step 3 To change the administrative state of the module, select the Administrative State pull-down menu and choose your desired option.

Step 4 Click **OK**.

You have successfully completed this procedure.

4.1.2 View fiber patchcords

Use this procedure to view fiber patchcords.



Prerequisites

- Equipment must be provisioned prior to viewing fiber patchcords.

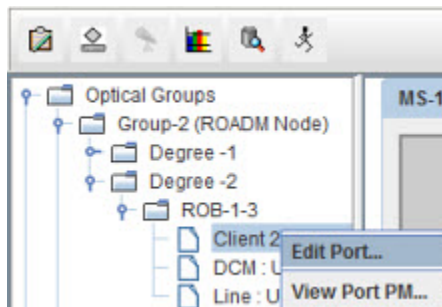
Viewing fiber patchcords

Follow these steps to view fiber patchcords:

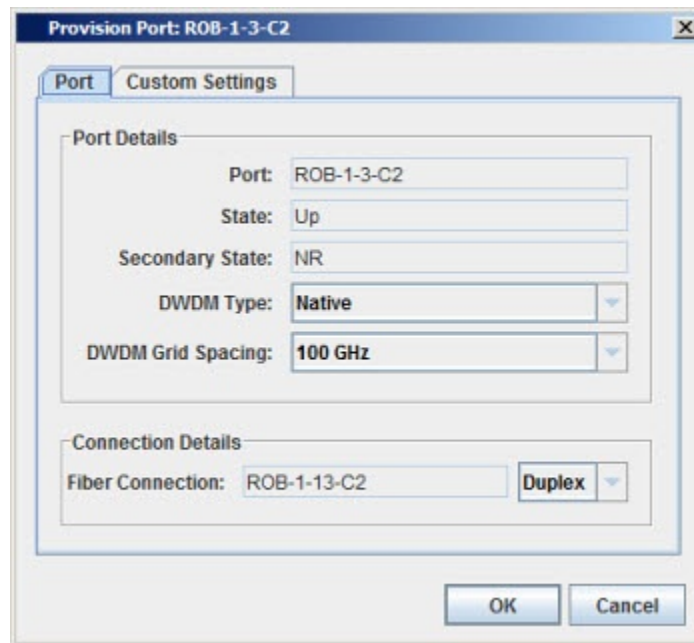
Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, fully expand **Optical Groups**. Right-click a port and choose **Edit Port**.



Step 3 On the **Provision Port** information dialog, the port AID is recorded under **Port Details**, and the Fiber Connection is recorded under **Connection Details**.



The **Fiber Connection** information specifies where the selected port should be connected and whether it is a simplex or duplex connection. This information can be used to verify that the physical fibers are connected as intended.

Step 4 Click **OK**.

You have successfully completed this procedure.

4.1.3 Validate inter-nodal line span connection

Use this procedure to validate that the line port of the DLA or ROB module is connected to the expected far-end node over the line span.



Prerequisites

- Equipment must be provisioned prior to validating fiber connections.

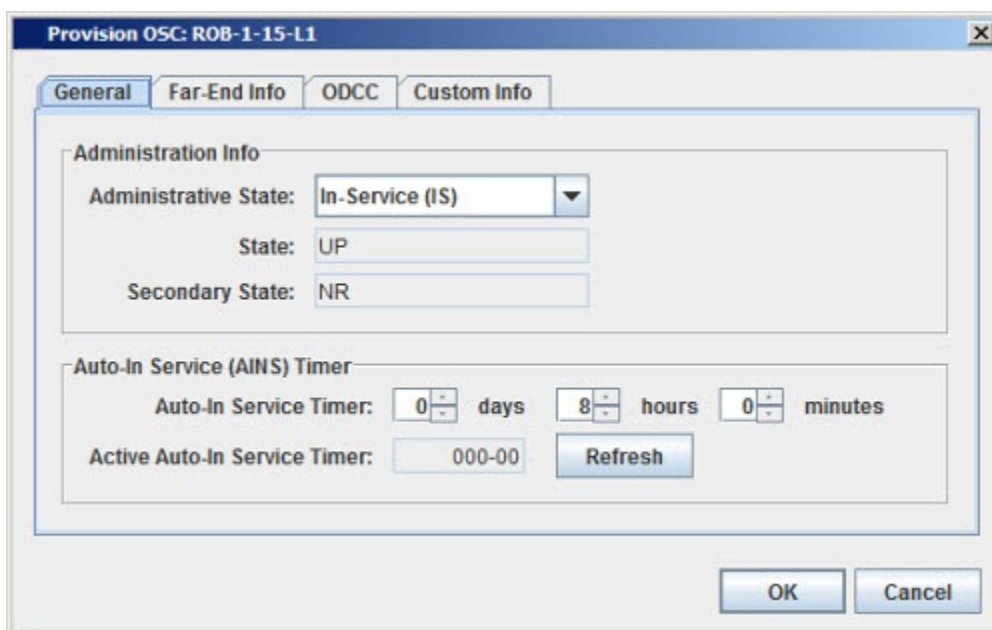
Validating line port connections

Follow these steps to validate fiber connections:

Step 1 In the toolbar, click the Optical Layer button.

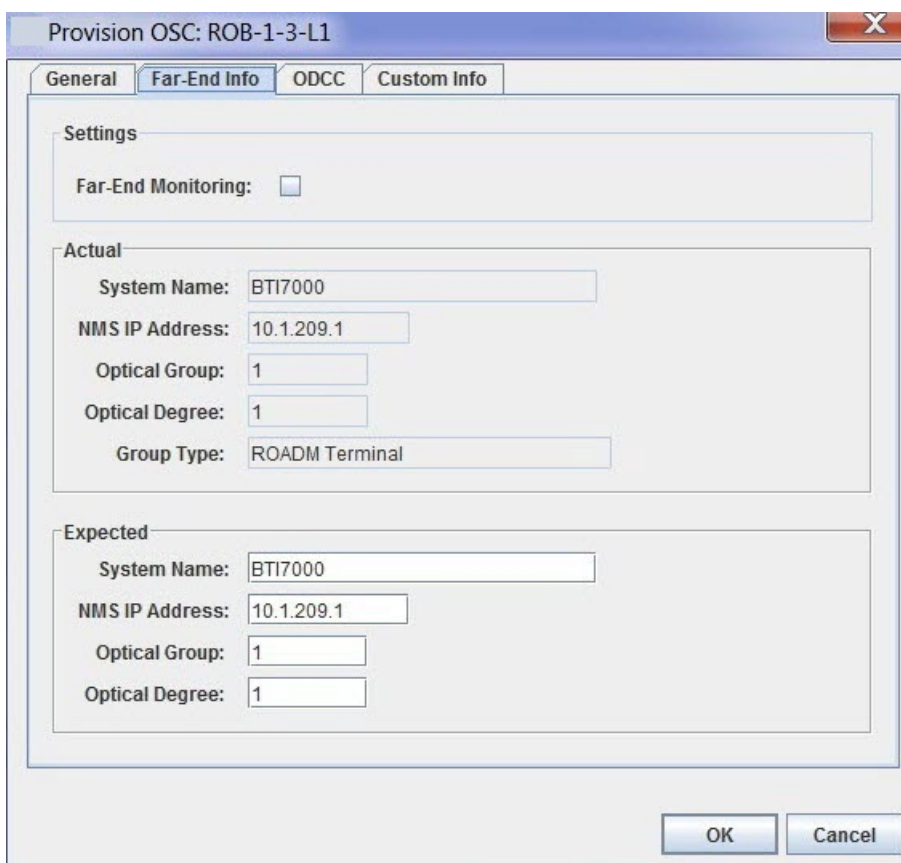


Step 2 In the Navigation pane, expand **Optical Groups**, right-click an optical module and choose **View OSC Info**.



The image shows the 'Provision OSC: ROB-1-15-L1' dialog box with the 'General' tab selected. The 'Administration Info' section contains a dropdown for 'Administrative State' set to 'In-Service (IS)', a text field for 'State' with 'UP', and a text field for 'Secondary State' with 'NR'. The 'Auto-In Service (AINS) Timer' section has a timer set to 0 days, 8 hours, and 0 minutes, with an 'Active Auto-In Service Timer' field showing '000-00' and a 'Refresh' button. 'OK' and 'Cancel' buttons are at the bottom right.

Step 3 On the **Provision OSC** dialog, select the **Far-End Info** tab.



The image shows the 'Provision OSC: ROB-1-3-L1' dialog box with the 'Far-End Info' tab selected. The 'Settings' section has a 'Far-End Monitoring' checkbox. The 'Actual' section contains fields for 'System Name' (BTI7000), 'NMS IP Address' (10.1.209.1), 'Optical Group' (1), 'Optical Degree' (1), and 'Group Type' (ROADM Terminal). The 'Expected' section contains fields for 'System Name' (BTI7000), 'NMS IP Address' (10.1.209.1), 'Optical Group' (1), and 'Optical Degree' (1). 'OK' and 'Cancel' buttons are at the bottom right.

Step 4 Review the values in the Actual and Expected sections.

Step 5 Click **OK**.

You have successfully completed this procedure.

4.1.4 Check span loss and length

Use this procedure to validate fiber connected to the optical module line. The span length is measured when the span is initially turned up, and is updated when the span is re-initiated following an optical span shutdown, or pack coldstart.



Prerequisites

- Equipment must be provisioned prior to validating fiber connections.

Check span loss and length

Follow these steps to validate fiber connections to the optical module line:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, expand **Optical Groups**, right-click an optical module and choose **View WDM Info**.

The screenshot shows a software window titled "Provision WDM: ROB-1-15-L1". It has two tabs: "Admin" (selected) and "Custom Info".

Administration Info

- Administrative State: In-Service (IS) (dropdown menu)
- State: UP (text field)
- Secondary State: NR (text field)

Auto-In Service (AINS) Timer

- Auto-In Service Timer: 0 days 0 hours 1 minutes (spinners)
- Active Auto-In Service Timer: 000-00 (text field)
- Refresh button

Span Info

- Fiber Type: SMF (dropdown menu)
- Measured Span Length: 0 km (text field)
- Measured Span Loss: 10.3 dB (text field)
- Max. Supported Span Loss: 35.0 dB (text field)
- Max. Span Loss Alarm Threshold: 0.0 dB (text field)
- Provisioned Channels: 0 (text field)
- Enable Alarm checkbox (unchecked)
- Refresh button (next to Measured Span Loss)

At the bottom right are "OK" and "Cancel" buttons.

Step 3 On the **Provision WDM** dialog, review the **Admin** tab.

The **Span Info** section shows the measured span length and loss between modules. If the measured values differ significantly from the expected values, you need to identify the sources of the loss or of the length discrepancy.

Step 4 Verify that **Administrative State** is set to **In-Service (IS)**.

Step 5 Click **OK**.

You have successfully completed this procedure.

5.0 DOL performance management

The following performance monitoring (PM) statistics are collected for a number of DOL (DOL) managed objects on DLA2 and ROADM-on-a-blade (ROB) modules:

- OSC PM metrics are collected for both physical and counter-based monitored types for OSC objects.
- Port PM is performed on the optical ports of the DLA and ROB modules, to provide PM for the WDM composite signal traffic passing through those ports. The port PMs include externally observed measurements, such as, received and transmitted optical power and loss values.
- Wavelength channel PM provides data for individual channels observed on ROB modules.

Performance monitoring support for DOL managed objects follows typical PM conventions, including collecting data at 15-minute and 24-hour intervals, and supporting current and historical data.

Some of the PM metrics provide a measurement of optical power in dBm to one decimal place accuracy. The system determines a total loss of power, when the measured power is below the threshold used to signify a total loss of optical power, similar to an input optical source disconnected from a port. As a convention, the value returned for this case is -99.9dBm.

Other performance monitoring metrics provide an optical power loss value, which is a ratio of power values between two power reference points. When there is a disconnection between the two points involved in the loss calculation, the loss is assumed to be infinite. As a convention, the value returned for this case is +99.9dB.

5.1 OSC performance monitoring

OSC performance monitoring (PM) is supported against OSC managed objects that are auto-created on the DLA2 and ROADM-on-a-blade (ROB) modules. OSC supported physical monitored types, for current and historical retrieval, are listed in the following table. These monitored types are supported regardless of the administrative state of OSC.

Table 5-1 OSC physical PMs

Monitored type	Units	Precision	Description
Optical Power Received	dBm	nearest tenth	OSC power received measured by photo-diode
Optical Power Transmitted	dBm	nearest tenth	OSC power transmitted measured by photo-diode
Optical Power Back-reflected	dB	nearest tenth	OSC back reflected power ratio
1			

¹The Optical Power Back-Reflected parameter is only measurable (and updated) upon OSC synchronization with the far-end line port. This new measured and updated Optical Power Back-Reflected value updates the PM value only after fiber reconnect or DOL card cold restart. Once the OSC synchronization is completed, the OBR PM value displayed will be the last measured OBR value updated during OSC synchronization.

OSC also supports threshold crossing alerts (TCA), which are listed in the following table. Counting occurs only when OSC is administratively in-service. In addition to support for current and historical PM retrieval, OSC counter PMs support initialization, TCA autonomous notifications, and threshold configuration and retrieval.

Table 5-2 OSC threshold crossing alerts

Monitored type	Range	Default TCA threshold		Description
		15-mins	24-hrs	
Coding Violations	32-bit	382	3820	Number of B1 BIP errors
Errored Seconds	32-bit	25	250	Number of seconds in which one or more BIP errors are detected
Severely Errored Seconds	32-bit	4	40	Number of seconds in which the number of BIP errors detected exceeds the SES level (155), or OSC Loss of Signal or Severely Errored Frame fault detected
Severely Errored Frame Seconds	32-bit	2	8	Number of seconds in which a Severely Errored Frame fault is detected.
Unavailable Seconds	32-bit	10	10	Number of seconds in which the signal is unavailable; for example: <ul style="list-style-type: none"> A signal is considered unavailable at the onset of 10 consecutive seconds counted as severely errored. A signal is no longer considered unavailable after 10 consecutive seconds that are not severely errored.

5.2 Optical port performance monitoring

Optical port performance monitoring is supported for optical ports that are auto-created on the DLA2 and ROADM-on-a-blade (ROB) modules.

Supported physical monitored types are listed in the following table. The monitored types dealing with optical power measure the power for the entire WDM composite signal received on or transmitted from the port. The loss-related monitored types provide measurements of power loss calculated at a port. For Line and Client ports, the Loss PMs measure the power loss over the span fiber or inter-connecting patch fiber respectively. For DCM ports, the Loss PM reports the measured loss of the attached DCM module array.

These monitored types are supported for current and historical retrieval, and are supported regardless of the administrative state of the optical port. (Optical port administrative state is tied to the administrative state of the WDM entity on the same module.). Monitored types which report a minimum, maximum, mean or standard deviation of a value are calculated over a PM interval, and can be manually initialized. Other monitored types are instantaneous readings and cannot be initialized.

Table 5-3 Optical port monitored types

Monitored type	Units	Precision	Description
Optical Power Received - Instantaneous	dBm	nearest tenth	The instantaneous optical power received on the port. For line port, this measures the power of the received WDM composite only (excluding OSC power).
Optical Power Received - Minimum	dBm	nearest tenth	The minimum value measured for optical power received on the port over the duration of the interval period.
Optical Power Received - Maximum	dBm	nearest tenth	The maximum value measured for optical power received on the port over the duration of the interval period.
Optical Power Received - Average	dBm	nearest tenth	The average value measured for optical power received on the port over the duration of the interval period.
Optical Power Received – Standard Deviation	dB	nearest tenth	The standard deviation from the average value of the optical power received on the port over the duration of the interval period.
Optical Power Transmitted - Instantaneous	dBm	nearest tenth	The instantaneous optical power transmitted on the port. For the line port, this measures the power of the transmitted WDM composite signal only (excluding OSC power).
Optical Power Transmitted - Minimum	dBm	nearest tenth	The minimum value measured for optical power transmitted on the port over the duration of the interval period.
Optical Power Transmitted - Maximum	dBm	nearest tenth	The maximum value measured for optical power transmitted on the port over the duration of the interval period.

Table 5-3 Optical port monitored types (Continued)

Monitored type	Units	Precision	Description
Optical Power Transmitted - Average	dBm	nearest tenth	The average value measured for optical power transmitted on the port over the duration of the interval period.
Optical Power Transmitted – Standard Deviation	dB	nearest tenth	The standard deviation from the average value of the optical power transmitted on the port over the duration of the interval period.
Loss - Receive	dB	nearest tenth	Loss of the receive fiber on the port. For DCM ports, this is equivalent to DCM loss.
Loss - Transmit	dB	nearest tenth	Loss of the transmit fiber on the port.

The availability of each optical port monitored type depends on the configuration in which the DLA or ROB module is used, as seen in the following table.

Table 5-4 Optical port PM availability

Module/ NE configuration	Port	Optical power Rx			Optical power Tx			Loss	
		Inst	Min	Max	Avg	StDv	Inst	Min	Max
DLA2 /	Line	*	*	*	*	*	*	*	*
Non-equalizing	DCM								
Client	Client	*	*	*	*	*	*	*	*
Terminal NE									
DLA2 /	Line	*	*	*	*	*	*	*	*
Line Amplifier NE	DCM								
	Client	*	*	*	*	*	*	*	*
ROB2, ROB4/Channel Equalizing	Line	*	*	*	*	*	*	*	*
	DCM								
	C1	*	*	*	*	*	*	*	*
	C2	*	*	*	*	*	*	*	*
Terminal NE									
ROB2, ROB4/Channel Equalizing	Line	*	*	*	*	*	*	*	*
	DCM								
	C2	*	*	*	*	*	*	*	*
ROB2, ROB4/Channel Equalizing	Line	*	*	*	*	*	*	*	*
	DCM								
	C2	*	*	*	*	*	*	*	*
ROB2, ROB4/Channel Equalizing	Line	*	*	*	*	*	*	*	*
	DCM								
	C1	*	*	*	*	*	*	*	*
	C2-C4	*	*	*	*	*	*	*	*
NE									

¹Loss-Rx reported for DCM accounts for the measured loss from the DCM port output to the Client port input on the mate DLA.

5.3 Wavelength channel performance monitoring

Performance monitoring (PM) is supported for wavelength channels that are automatically created on the line and client ports of DOLROADM-on-a-blade (ROB) modules, as a result of the provisioning of channel cross-connections. For example:

- When an add-drop cross-connection is provisioned to route a channel from a Mux/Demux to the ROB module line port, PM is conducted for the channel on the line port, as well as, for the same channel on the Client 1 (C1) port of the same ROB module.
- When a pass-through cross-connection is provisioned to route a channel from the line port of one ROB module to the line port of another ROB module, PM is conducted on the channel of the line port of each of the ROB modules, as well as, on the client port through which the channel passes on each of the ROB modules, for a total of four sets of wavelength channel PM data.

In addition to monitoring the wavelength channels that are auto-created, as a result of the provisioning of wavelength channel cross-connections, PM data is collected for wavelength channels that are not auto-created. PM data returned for wavelength channels that have not been auto-created are called preview PMs. For each of the line and client ports on the ROB modules, optical power levels can be polled for each of the 44 (or 96) wavelength channel segments of the DWDM composite signal. When a PM query is performed for all channels on a port, full PM data is returned for auto-created wavelength channels as well as preview PM data for those channels in which the received power level is above a minimum threshold that indicates that a channel is present.

The minimum power threshold that is applied for bulk preview PM retrieval is dependent on which port the channel is located and the PM type being retrieved; refer to the minimum threshold table, below. By applying a minimum threshold level to bulk preview PM retrieval, the query response filters out any detected channels that result from only ASE noise. If the power measured for a channel does not reach the power threshold, the channel is considered non-existent, and is not reported when you query all preview port PMs.

Supported physical monitored types are listed in the following table. In the case of the monitoring of auto-created wavelength channels, these monitored types are supported for both current and historical retrieval, and are supported regardless of the administrative state of the wavelength channel, or of the supporting WDM entity. In the case of preview PMs for unprovisioned channels, retrieval of only current PMs is supported.

Monitored types which report a minimum or maximum value are calculated over a PM interval, and can be manually initialized. Other monitored types are instantaneous readings, and cannot be initialized.

Table 5-5 Wavelength channel monitored types

Monitored type	Units	Precision	Description
Optical Power Received - Instantaneous	dBm	nearest tenth	The instantaneous optical power received for the channel.
Optical Power Received - Minimum	dBm	nearest tenth	The minimum value measured for the optical power received for the channel over the duration of the interval period.

Table 5-5 Wavelength channel monitored types (Continued)

Monitored type	Units	Precision	Description
Optical Power Received - Maximum	dBm	nearest tenth	The maximum value measured for the optical power received for the channel over the duration of the interval period.
Optical Power Transmitted - Instantaneous	dBm	nearest tenth	The instantaneous optical power transmitted for the channel.
Optical Power Transmitted - Minimum	dBm	nearest tenth	The minimum value measured for the optical power transmitted for the channel over the duration of the interval period.
Optical Power Transmitted - Maximum	dBm	nearest tenth	The maximum value measured for the optical power transmitted for the channel over the duration of the interval period.

The following table lists the availability of each WCH monitored type according to DOL NE configuration types and wavelength channel location and provisioning.

Table 5-6 Wavelength channel PM availability

Circuit/NE configuration	Wavelength channel type	Optical power Rx			Optical power Tx		
		Inst	Min	max	Inst	Min	max
ROB2, ROB4 / ROADM Terminal	Line port, prov.	*	*	*	*	*	*
	C1/C2 port, prov.	*	*	*	*	*	*
	Line port, preview	*					
ROB2, ROB4 / Line Equalizing node	C1/C2 port, preview	*			*		
	Line port, prov.	*	*	*	*	*	*
	C2 port, prov.	*	*	*	*	*	*
	Line port, preview	*					
ROB2, ROB4/ ROADM node	C2 port, preview	*			*		
	Line port, prov.	*	*	*	*	*	*
	C1/C2 port, prov.	*	*	*	*	*	*
	Line port, preview	*					
	C1/C2 port, preview	*			*		
	C3/C4 port, preview				*		

Table 5-7 Minimum preview PM thresholds

Port	PM Type	Minimum preview PM value
Line	Optical Power RX	-11 dBm
Client	Optical Power RX	-14 dBm
Client	Optical Power RX	-11 dBm

5.4 Retrieving and exporting OSC PMs

Use this procedure to retrieve and export OSC performance metrics (PMs) on DLA2 or ROADM-on-a-blade (ROB) modules.



Prerequisites

- The module must be present in the shelf and provisioned.

Retrieving and exporting active PMs

Follow these steps to retrieve and export OSC PMs:

Step 1 Click on the Optical Layer icon.

Step 2 Right-click on the desired DLA2 or ROB line port, and choose **View OSC PM**.

The **PM Statistics** window is displayed.

Step 3 Use the options in the **PM Statistics** window to specify the PM data that you wish to retrieve. Click **Start** to retrieve the data.

The PM data for the parameter (or parameters) is displayed.

Note	Data can be collected for a maximum of 120 data points at different time intervals (5 seconds to 60 minutes). proNX 900 continuously polls for data at the time interval specified. The scroll bar enables you to view the most recent 120 data points collected.
-------------	---

Step 4 Optionally, click **Export** to save the data retrieved to CSV (.csv) or text (.txt) format.

Step 5 Click **Close**.

You have successfully completed this procedure.

5.5 Retrieving and exporting optical port PMs

Use this procedure to retrieve and export performance metrics (PMs) for the optical ports of DLA2 or ROADM-on-a-blade (ROB) modules.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- The module must be present in the shelf and the settings must be provisioned.

Retrieving and exporting active PMs

Follow these steps to retrieve and export optical port PMs:

Step 1 Click on the Optical Layer icon.

Step 2 Right-click on the desired DLA2 or ROB optical port (Line, DCM, or Client port) and choose **View Port PM**.

The **PM Statistics** window is displayed.

Step 3 Use the options in the **PM Statistics** window to specify the PM data that you wish to retrieve. Click **Start** to retrieve the data.

The PM data for the parameter (or parameters) is displayed.

Note	Data can be collected for a maximum of 120 data points at different time intervals (5 seconds to 60 minutes). proNX 900 continuously polls for data at the time interval specified. The scroll bar enables you to view the most recent 120 data points collected.
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Step 4 Optionally, click **Export** to save the data retrieved to CSV (.csv) or text (.txt) format.

Step 5 Click **Close**.

You have successfully completed this procedure.

5.6 Retrieving and exporting wavelength channel PMs

Use this procedure to retrieve and export wavelength channel performance metrics (PMs) for the optical ports of DLA2 or ROADM-on-a-blade (ROB) modules.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- The module must be present in the shelf and the settings must be provisioned.

Retrieving and exporting active PMs

Follow these steps to retrieve and export optical port PMs:

Step 1 Click on the Optical Layer icon.

Step 2 Right-click on the desired DLA2 or ROB optical port (Line, DCM, or Client port) and choose **View Port PM**.

The **PM Statistics** window is displayed.

Step 3 In the **PM Statistics** window, from the **Select PM** drop-down menu, choose **Wavelength Channel**.

Step 4 Use the options in the **PM Statistics** window to specify the PM data that you wish to retrieve. Click **Start** to retrieve the data.

The PM data for the parameter (or parameters) is displayed.

Note	Data can be collected for a maximum of 120 data points at different time intervals (5 seconds to 60 minutes). proNX 900 continuously polls for data at the time interval specified. The scroll bar enables you to view the most recent 120 data points collected.
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Step 5 Optionally, click **Export** to save the data retrieved to CSV (.csv) or text (.txt) format.

Step 6 Click **Close**.

You have successfully completed this procedure.

6.0 DOL fault management

This section describes the fault points, alarms, alarm clearing procedures, and threshold and hysteresis values for DOL managed objects, and includes the following topics:

- 6.1, “DOL managed objects fault hierarchy”
- 6.2, “DOL managed objects fault severity and object state”
- 6.3, “OSC fault points”
- 6.4, “WDM fault points”
- 6.5, “Optical port fault points”
- 6.6, “Wavelength channel fault points”
- 6.7, “DOL threshold and hysteresis values”
- 6.8, “DOL alarms”

Fault monitoring is automatically enabled for managed objects that are provisioned or auto-created. Fault reporting behaviour is dependent on the administrative status of the managed object, as follows:

Table 6-1 Administrative Status of Managed Objects

Status	Description
In-service (Enabled)	Active faults with critical, major or minor severity are reported with an autonomous alarm notification when the fault becomes active. Notification that the alarm is cleared when the fault is no longer active is also generated. All active faults can be polled by retrieving a list of active conditions. All active faults with critical, major or minor severity can be polled by retrieving a list of active alarms.

Table 6-1 Administrative Status of Managed Objects (Continued)

Status	Description
Out-of-service (Disabled)	No notifications are generated when faults become active or are cleared, but the faults that are active can be polled by retrieving a list of active conditions.
Auto-in-service (Auto Enabled)	Fault reporting behaviour is the same as for an Out-of-service object. When all object faults clear, the automatic-in-service timer is initiated, for the object to count down. If no faults are raised for the entire duration of the countdown, the state of the object automatically transitions to In-service. Otherwise, if a fault is raised before the timer expires, the timer is reset to its original value until all faults clear.

6.1 DOL managed objects fault hierarchy

When multiple faults are active against a managed object, one or more faults may be suppressed from reporting, according to the masking relationships that exist for the object's fault points. Masking of fault points is important in assisting with fault isolation when a single root cause may lead to multiple fault points being raised.

Masking relationships may also exist between fault points raised against different monitored objects. For example, if a Loss of Light fault is active against a port object, Loss of Light faults are masked against the Wavelength Channel objects contained within the port, and the reporting of WCH Loss of Light conditions is suppressed.

6.2 DOL managed objects fault severity and object state

Fault Severity

The following fault severity levels are supported by the DOL managed objects:

- CR: Critical
- MJ: Major
- MN: Minor
- NR: Not reported

Object State

The state for each of the fault points indicates to which operational status the managed object transitions, and with which operational status qualifiers, if its status is not In-Service or Normal (IS-NR):

- **FLT – OOS-AU,FLT**: Autonomously out-of-service with fault
- **ANR – IS-ANR** : In service, but, abnormal
- **NR – IS-NR** : Managed object remains in service and normal

6.3 OSC fault points

The OSC fault points are listed in the following table. All of the listed faults are supported for all OSC entities, with the exception of the Equalization Section Control Communications Failure fault, which is raised only against OSCs on equalizing network elements (NE)— OSCs supported by a ROADM-on-a-blade (ROB) module.

Table 6-2 OSC fault points

Fault point	Default severity	State	Description	Causes
Receive Loss of Light	MJ	FLT	The OSC signal cannot be detected.	The far-end NE is not yet commissioned. The far-end OSC is administratively disabled. The span fiber has been cut or disconnected.
Loss of Frame	MJ	FLT	The received OSC signal cannot be framed.	The span fiber is severely degraded or damaged. The far-end OSC transmitter is faulty.
Transmit Loss of Light	MJ	FLT	The transmitted OSC signal cannot be detected. This fault is not monitored when the OSC is administratively disabled.	The OSC signal transmitter has failed.
Far-end Node Identification Mismatch	MJ	FLT	The far-end node identifier attributes do not match the expected identifier attributes.	A span fiber has been connected to the wrong port. The expected far-end identifier attributes are incorrectly specified.
Far-end Node Configuration Inconsistent	MJ	FLT	Interoperation of the local NE with the DOL group on the NE at the far-end of the span is not supported.	The local DOL group is configured as a Non-equalizing Terminal and the far-end group type is not of this type, or vice-versa. The far-end group type is undefined (the OSC is on a module that has not been assigned to a DOL group). The far-end wavelength spacing (50 GHz / 100 GHz) or the number of supported channels (44 / 96) does not match near-end values.
Control Communications Failure, Span Section	MJ	FLT	Bi-directional control communications with the far-end NE on the span section have failed. This fault is not	A receive OSC failure is active on the far-end Ne.

Table 6-2 OSC fault points (Continued)

Fault point	Default severity	State	Description	Causes
			monitored when the OSC is administratively disabled.	A software process on the far-end NE has failed or is restarting.
Control Communications Failure, Equalization Section	NR	FLT	Bi-directional control communications to the NE at the far end of the equalization section have failed. This fault point is raised only against the OSC supported by a ROB2 module. This fault is not monitored when the OSC is administratively disabled.	A Span Section Control Communications Failure is active on a DOL NE between the local NE and far-end equalizing NE. An inter-card communications failure is active on a DOL NE within the equalization section terminated by the local NE.
Optical Back Reflection High Threshold Exceeded	MN	ANR	The measured optical back reflection of the transmitted OSC signal is above the normal operating range. This fault is not monitored when the OSC is administratively disabled.	The span fiber connected to the transmit Line port is degraded or of an unsupported type.
Optical Back Reflection Out of Specification	CR	FLT	The measured optical back reflection of the transmitted OSC signal exceeds the specification maximum limit. This fault is not monitored when the OSC is administratively disabled.	The span fiber connected to the transmit Line port is cut or disconnected.

6.4 WDM fault points

The WDM fault points are listed in the following table. All of the listed faults apply to a WDM entity on a 2D ROADM-on-a-blade or a 40-channel 4D ROADM-on-a-blade module. The "Invalid Amplifier Operating Configuration, Mid-amp" fault does not apply to the DLA2 module because the DLA2 module is not equipped with a mid-amplifier.

Note These fault points do not exist on the 96-channel 4D ROADM-on-a-blade module.

Table 6-3 WDM fault points

Fault point	Default severity	State	Description	Causes
Invalid Amplifier Operating Configuration, Pre-amp	MN	ANR	The pre-amplifier on the local module is operating with an invalid configuration for the span loss currently measured.	The span loss has changed significantly since the module was put in-service.
Invalid Amplifier Operating Configuration, Mid-amp	MN	ANR	The mid-amplifier on the local ROB module is operating with an invalid configuration for the DCM loss currently measured.	The DCM loss has changed significantly since the module was put in-service.
Invalid Amplifier Operating Configuration, Booster-amp	MN	ANR	The booster-amplifier on the local module is operating with an invalid configuration for the DCM/inter-module loss currently measured.	The DCM/inter-module loss has changed significantly since the module was put in-service.

6.5 Optical port fault points

The Optical Port fault points are listed in the following table. The full set of fault points does not apply to all ports in all configurations. See [Table 6-5](#) for a listing of the subset of fault points supported for each port of the various NE configurations.

Table 6-4 Optical port fault points

Fault point	Default severity	State	Description	Causes
Received Power Out of Specification	CR	FLT	The received optical power is either above or below the specified range. This fault applies only to the client port of the DLA2 module in a Non-equalizing Terminal NE configuration.	The number and power level of the constituent channels of the incoming WDM composite signal is either above or below the specification range for the composite signal receive power level.
Receive Loss Out of Specification	CR	FLT	The measured optical power loss is either above the specified range. When reported against a Line port, the measured loss is the span loss of the receive fiber. When reported against a DCM port, the measure loss is that of the attached DCM module array. When reported against a client port, the measured loss is that of the receive inter-connection patch fiber.	<p>The receive span fiber has excessive loss.</p> <p>The network deployment has excessive span length resulting in too much loss.</p> <p>The DCM module(s) connected to the port has a loss that is above the specification maximum.</p> <p>Patch fibers are mis-connected.</p>
Receive Loss High Threshold Exceeded	MN	ANR	The measured optical power loss is above the high threshold setting defined for the WDM entity. This fault point occurs only on the Line port and applies to the loss of the receive fiber.	<p>The received span loss has increased and now exceeds the high threshold setting.</p> <p>The high threshold setting needs be re-configured to be lower than the current measured value of the received span loss.</p>
Receive Loss Of Light	CR	FLT	The receive WDM composite signal power is below the detectable threshold.	<p>The span or patch fiber has been cut or disconnected.</p> <p>The amplifier transmitting into the patch fiber connected to the local receive port has shut down.</p>
Automatic Power Shutdown	CR	FLT	The transmit WDM composite signal has been automatically shutdown. This fault occurs only on the Line port.	<p>A receive Loss of Light fault is active against both the OSC and the WDM.</p> <p>The far-end NE has signaled the local NE to transition to the APSD state.</p>

Table 6-4 Optical port fault points (Continued)

Fault point	Default severity	State	Description	Causes
Payload Missing Indication	NR	FLT	The far-end NE has signaled the local NE that an upstream WDM composite signal failure condition has been detected, and no WDM composite signal is currently being transmitted to the local NE as a result. This fault occurs only on the Line port.	<p>An upstream non-equalizing line NE within the same equalization section as the local NE has detected a WDM composite signal Receive Loss of Light and an OSC Receive Loss of Light on its line port, and has initiated an APSD. The detected Loss of Light faults are in the direction of the local NE that raises the PMI fault.</p> <p>A WDM composite signal Loss of Light has been detected on a DCM or client-interconnect port of an upstream non-equalizing line NE within the same equalization section as the local NE. The detected Loss of Light fault is in the direction of the local NE that raises the PMI.</p>
Backward Defect Indication	NR	FLT	The far-end NE has signaled the local NE that a downstream APSD condition is active and no WDM composite signal is currently being transmitted to the local NE as a result. This fault occurs only on the Line port.	A downstream NE within the same equalization section as the local NE has detected a WDM composite Receive Loss of Light and an OSC Receive Loss of Light on its line port, and has thus initiated an APSD. The detected Loss of Light faults are in the opposite direction of the local NE that raises the BDI fault.
Channel Count Deficiency	MJ	ANR	The number of channels received on the port is below the minimum required based on the measured span loss of the receive fiber. The minimum channel count requirement is enforced for a span loss that exceeds 30 dB. Near 30 dB a minimum of 1 channel is required, and as the span loss is increased towards 35dB, the minimum channel requirement increases up to 4 channels near 35 dB. Beyond 35 dB, the Channel Count Deficiency	The span loss of the Line port receive fiber is approaching or has reached the specification maximum. A minimum number of channels must be present on the receive fiber to ensure that stable optical control can be maintained.

Table 6-4 Optical port fault points (Continued)

Fault point	Default severity	State	Description	Causes
			fault no longer applies as the Loss Out of Specification fault takes precedence at that span loss. This fault occurs only on the Line port. The number of channels counted for this fault is the number of received channels actually present on the receive fiber, and not the number of locally provisioned channels.	
Connection Mismatch	CR	FLT	The fiber connection on the port does not link to the correct port of the expected inter-connecting equipment. This fault occurs only on client port 2 (C2) of a 2D ROADM-on-a-blade (ROB2) module or client ports 2 to 4 (C2 to C4) of a 4D ROADM-on-a-blade (ROB4) module..	The fiber cable connected to the port is connected to the wrong ROB client port. Refer to the inter-degree connection mapping table, section Chapter 3, “Provisioning the DOL hardware” .
Connection Validation Timeout	CR	FLT	The port is unable to receive or decode a connection validation message on the client port input within the system-determined timeout interval. This fault occurs only on client port 2 (C2) of a 2D ROADM-on-a-blade (ROB2) module or client ports 2 to 4 (C2 to C4) of a 4D ROADM-on-a-blade (ROB4) module. .	The fiber cable is connected to the wrong port, for example to a DCM output port.

Table 6-5 Optical Port Faults By Configuration

Module/NE configuration	Port	POS-Rx	LOL-Rx	LOOS-Rx	Loss-HT	APSD	PMI	BDI	Channel Deficiency	Connection Mismatch	Connection Validation Timeout
DLA2 / Amplifier Terminal	Line		*	*1	*	*					
	DCM										
	Client	*									
DLA2 / Line Amplifier node	Line		*1	*1	*	*	*	*			
	DCM		*2	*							
	Client		*2								
ROB2, ROB4/ ROADM Terminal	Line		*1	*1	*	*	*	*	*1		
	DCM		*	*							
	C1		*1								
	C2		*1								
ROB2, ROB4/ Line Equalizing node	Line		*1	*1	*	*	*	*	*1		
	DCM		*	*							
	C2		*	*							
ROB2, ROB4/ ROADM node	Line		*1	*1	*	*	*	*	*1		
	DCM		*	*							
	C1		*								
	C2 - C4		*	*					*	*	*

¹The LOL-Rx and Channel Deficiency fault points are suppressed under zero channel turn-up conditions. The LOOS-Rx fault is suppressed under zero channel conditions on the Line port only

²The LOL-Rx fault point against the DCM port and the Client port of the DLA2 in a Line Amp configuration both identify a discontinuity of the WDM composite signal path from the DCM Tx port to the Client Rx port of the mate DLA. The control system is not able to accurately localize the location of the path discontinuity, so the fault point is raised against both ports concurrently.

6.6 Wavelength channel fault points

The Wavelength Channel fault points are listed in the following table. The full set of fault points does not apply to all ports in all configurations. See [Table 6-7](#) for a listing of the subset of fault points supported for each port of the various network element (NE) configurations.

Table 6-6 Wavelength Channel fault points

Fault point	Default severity	State	Description	Causes
Received Power Out of Specification – Low	MJ	ANR	The received optical power of the channel signal is below the specified range for operation. This fault applies only to channels on add/drop ports of ROB modules: C1 and C2 if configured for alien DWDM.	The patch fiber is dirty, degraded or has excessive loss. The transceiver transmitting into the patch fiber connected to the local receive port is faulty.
Received Power Out of Specification – High	MJ	ANR	The received optical power of the channel signal is above the specified range for operation. This fault applies only to channels on add/drop ports of ROB modules: C1 and C2 if configured for alien DWDM.	The source of the added channel is from a transceiver or other equipment that is configured for an excessively high transmit power.
Receive Loss of Light	CR	FLT	The receive wavelength channel signal cannot be detected. This fault applies only to channels on the C1 add/drop port of ROB modules, and the C2 port if it is configured for alien DWDM.	The patch fiber connecting the channel port to the transceiver source has been cut or disconnected. The transceiver transmitting into the patch fiber connected to the local receive port has failed or is administratively disabled.
Receive Power High Fail	CR	FLT	The received optical power of the channel signal is at an excessively high level and the channel is considered as failed. The channel is blocked from addition to the DOL line. This fault applies only to channels on add/drop ports of ROB modules: C1 and C2 if configured for alien DWDM.	The source of the added channel is from a transceiver or other equipment that is configured for an excessively high transmit power
Transmitted Power Out of Specification	CR	FLT	The transmitted optical power of the channel signal is either below or above the specified range for operation. This fault is not monitored when the WCH or supporting WDM is administratively disabled.	The received power for the wavelength on an upstream port is out of specification and could not be compensated through equalization to bring the power level within specification.

Table 6-6 Wavelength Channel fault points (Continued)

Fault point	Default severity	State	Description	Causes
				The ROB module may have failed.
Transmit Loss of Light	CR	FLT	No signal power can be detected for the transmitted wavelength channel. This fault is not monitored when the WCH or supporting WDM is administratively disabled.	The ROB module may have failed.
Wavelength Channel Unequipped	CR	FLT	The NE at the far end of the equalization section has signaled the local NE that the indicated wavelength channel has not been configured to carry a channel signal in the WDM composite signal that it has transmitted to the local NE. This fault occurs only on Line port channels.	The NE at the far end of the equalization section has signaled the local NE that the indicated wavelength channel has not been configured to carry a channel signal in the WDM composite signal that it has transmitted to the local NE. This fault occurs only on Line port channels.
Alarm Indication Signal, Optical Layer	NR	FLT	The far-end NE has signaled the local NE that the signal payload for the indicated wavelength channel is in a failed state and so has not been transmitted within the WDM composite signal. This fault occurs only on Line port channels.	A wavelength channel failure is active in an upstream NE, such as a Loss of Light on a channel add port.

Table 6-7 Wavelength channel faults by configuration

Module /NE config uration	WCH Port	POS-Rx-Low	POS-Rx-High	OPR-HT_Fail	LOL-Rx	POS-Tx	LOL-Tx	UNEQ	AIS
ROB2, ROB4/ROADM Terminal	Line					*	*	*	*
	C1	*	*	*	*	*	*		
	C2 (alien)	*	*	*	*	*	*		
ROB2, ROB4/Line Equalizing node	Line					*	*	*	*
	C2					*	*		
ROB2, ROB4/ROADM node	Line					*	*	*	*
	C1	*	*	*	*	*	*		

Table 6-7 Wavelength channel faults by configuration (Continued)

Module /NE config uration	WCH Port	POS-Rx- Low	POS-Rx- High	OPR- HT_Fail	LOL- Rx	POS- Tx	LOL- Tx	UNEQ	AIS
	C2-C4 (inter- conn)					*	*		

6.7 DOL threshold and hysteresis values

Table 6-8 Channel power threshold and hysteresis values

Port/ Hysteresis	Max Power - Hardware Limit (dBm/ ch)	Channel Fail High (dBm)	POS High (dBm/ch)	POS Low (dBm/ch)	LOL (dBm/ch)
C1 IN	15.0	4.0	1.0	-8.0	-11.0
C2 IN	5.0	0.0	-3.0	-11.0	-14.0
C3 IN	5.0	NA	1.0	-8.0	-11.0
C4 IN	5.0	NA	-3.0	-11.0	-14.0
Raise Hysteresis	NA	0.0	0.0	0.0	0.0
Clear Hysteresis	NA	0.5	1.0	1.0	0.5

Channel power threshold and hysteresis behavior:

- The POS High alarm is raised when the power is greater than the threshold value plus the raise hysteresis value.
- The POS High alarm is cleared when the power is less than the threshold value minus the clear hysteresis value.
- The LOL and POS Low alarms are raised when the power is less than the threshold value plus the raise hysteresis value.
- The LOL and POS Low alarms are cleared when the power is greater than the threshold value plus the clear hysteresis value.
- The channel is blocked at the WSS when the LOL threshold is crossed.
- The channel is blocked at the WSS when the Channel Fail High threshold is crossed.

Table 6-9 Port power threshold and hysteresis values

Port/Hysteresis	POS High (dBm)	POS Low (dBm)	LOL (dBm)	OBR High (dB)
C1 IN (DLA)	-3.0	-22.0	-35.0	NA
C1 IN	NA	NA	-20.0	NA
C2 IN	NA	NA	-24.5	NA
C3 IN	NA	NA	-24.5	NA
C4 IN	NA	NA	-24.5	NA
L1 IN WDM	NA	NA	-35.0	NA
L1 IN OSC	NA	NA	-40.0	NA
L1 OUT OBR-OS	NA	NA	NA	-18.0
L1 OUT OBR-HT	NA	NA	NA	-24.0
DCM IN	NA	NA	-31.0	NA

Table 6-9 Port power threshold and hysteresis values (Continued)

Port/Hysteresis	POS High (dBm)	POS Low (dBm)	LOL (dBm)	OBR High (dB)
Raise Hysteresis	0.0	0.0	0.0	0.0
Clear Hysteresis	1.0	1.0	3.0	-3.0

Port power threshold and hysteresis behavior

- The POS High alarm is raised when the power is greater than the threshold value plus the raise hysteresis value.
- The POS High alarm is cleared when the power is less than the threshold value minus the clear hysteresis value.
- The LOL and POS Low alarms are raised when the power is less than the threshold value minus the raise hysteresis value.
- The LOL and POS Low alarms are cleared when the power is greater than the threshold value plus the raise hysteresis value.
- The C1 IN POS High and POS Low alarms apply only to Amplifier Terminal NE configurations.
- The DCM IN LOL alarm applies to all DOL NE configurations except for Amplifier Terminal NE configurations.

Table 6-10 Loss OOS power threshold and hysteresis values

Port	WDM Threshold (dB)	OSC Threshold (dB)	Raise Hysteresis (dB)	Clear Hysteresis (dB)
C1/C2 PATCH-CORD	1.0	NA	0.1	0.1
DCM	13.0	NA	0.1	0.1
L1 MAX SPAN DLA2-TERM	30.0	32.0	0.1	0.1
L1 MAX SPAN DLA2-ILA	30.0	32.0	0.1	0.1
L1 MAX SPAN ROB	35.0	37.0	0.1	0.1
L1 MAX SPAN ROB 1-CH	30.0	NA	0.1	0.1
L1 MAX SPAN ROB 2-CH	33.0	NA	0.1	0.1
L1 MAX SPAN ROB 3-CH	34.0	NA	0.1	0.1
L1 MAX SPAN ROB 4-CH	35.0	NA	0.1	0.1

Loss OOS power threshold and hysteresis behavior

- The Loss OOS alarm is raised when the loss is greater than threshold value plus the raise hysteresis value.
- The Loss OOS alarm is cleared when the loss is less than the threshold value minus the clear hysteresis value.
- The span loss hysteresis values also apply to configurable span loss high thresholds.
- The Max span loss for ROB modules only applies when there is a ROB at the far-end of the span and there are at least four channels present.
- The Max span loss for low channel counts is used to raise the channel count deficiency alarm if the span loss is too high to support the channel count.
- The provisionable Span Loss Alarm Threshold maximum value is 35dB. For spans involving DLA2s the maximum value is 30dB. In this case, it is recommended to provision the threshold under 30dB .

6.8 DOL alarms

This section describes, in alphabetical order, the alarms and clearing procedures that are specific to DOL managed objects that are provisioned.

For a quick reference, the following table is a list of these alarms:

Table 6-11 DOL Alarms

Managed Object	Alarm
OSC	
	6.8.7, "CONTCOM-E (Control Communications Failure, Equalization Section)"
	6.8.8, "CONTCOM-S (Control Communications Failure, Span Section)"
	6.8.9, "FECI (Far End Configuration Inconsistent)"
	6.8.10, "FEIM (Far-end Node Identification Mismatch)"
	6.8.14, "LOF-RX (Received Loss of Frame) for OSC"
	6.8.15, "LOLIGHT-RX (Received Loss of Light) for OSC"
	6.8.18, "LOLIGHT-TX (Transmitted Loss of Light) for OSC"
	6.8.21, "OBROS (Optical Back Reflection Out of Specification)"
	6.8.22, "OBROS (Optical Back Reflection High Threshold Exceeded)"
	6.8.23, "OPR-HIGH-FAIL (Received Power High Fail) for a wavelength channel"
Optical port	
	6.8.2, "APSD (Automatic Power Shutdown)"
	6.8.3, "BDI (Backward Defect Indication)"
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	6.8.26, "POS-RX-HIGH (Received Power Out of Specification - High) for a wavelength channel"
	6.8.27, "POS-RX-LOW (Received Power Out of Specification - Low) for a wavelength channel"
	6.8.28, "POS-TX (Transmitted Power Out of Specification) for a wavelength channel"
	6.8.31, "UNEQ-O (Wavelength Channel Unequipped)"
Equipment: Equipment alarms are common for all BTI 7000 Series products	
	6.8.29, "REPLUNITDEGRADE (Circuit Pack Degrade)"

6.8.1 AIS-O (Alarm Indication Signal, Optical Level)

Problem Description

The far-end NE has signaled the local NE that the signal payload for the indicated wavelength channel is in a failed state and has not been transmitted within the WDM composite signal.

This fault applies to ROADM Terminal, Line Equalizing Node and ROADM Node configurations and only to channels on the Line port of the ROB module.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on the Line port.

Impact

Not reported. The upstream NE has a critical channel alarm, and service is affected on that channel.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.1.1 Clearing an AIS-O alarm indication signal, optical level alarm

Use this procedure to clear an AIS-O alarm.

Step 1 Look for and clear all "LOLIGHT-RX" alarms against wavelengths channels on upstream NEs.

Step 2 Ensure that all fibers are correctly connected.

Step 3 Check for excessive loss on the receive span fiber. Check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.2 APSD (Automatic Power Shutdown)

Problem Description

The transmitting amplifier has been automatically shutdown. A LOLIGHT-RX alarm is active against both the OSC and the WDM composite signal. The far-end NE has signaled the local NE to transition to APSD state.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.2.1 Clearing a APSD automatic power shutdown alarm

Use this procedure to clear a APSD alarm.

Step 1 Check the PM OPR value for the Line port on the alarmed module. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 Check for and resolve the following possible problems:

- A LOLIGHT-RX alarm is active against both the OSC and the WDM, possibly caused by Line fiber disconnect or fiber cut.
- The far-end NE has signaled the local NE to transition to the APSD state.

Step 3 Check and clean the upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.3 BDI (Backward Defect Indication)

Problem Description

This alarm applies to ROB, DLA, and TPR modules.

For ROB and DLA modules, the far-end NE has signaled the local NE that a downstream APSD condition is active and as a result, no WDM composite signal is being transmitted to the local NE.

For TPR modules, the far-end NE has signaled the local NE that a signal fail status was detected by the far-end NE in its upstream direction.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	OFF

LED behavior DLA or ROB modules

The Fault LED on the Line port of the downstream module is ON.

Impact

Not reported—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

TPR-(1,11,21,31)-(1-20)-(1-4)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.3.1 Clearing a BDI backward defect indication alarm

Use this procedure to clear a BDI alarm for ROB and DLA modules.

Step 1 Check for and resolve all “LOLIGHT-RX” alarms on downstream Line ports on the DLA or ROB modules.

Step 2 Check for and resolve the following:

- A downstream NE within the same equalization section as the local NE has detected a WDM composite signal “LOLIGHT-RX” alarm and an OSC “LOLIGHT-RX” alarm on its line port, and has initiated an APSD. The detected “LOLIGHT-RX” alarms are in the direction of the local NE that raised the BDI fault.

Step 3 Check for a possible fiber break in the downstream Line fiber span.

A break in the input fiber cable can cause a loss of signal. Contact your next level of support to determine if there is a break in the fiber span.

Step 4 Check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.4 CHNDFC (Channel Count Deficiency)

Problem Description

The number of channels received on the alarmed port is below the minimum required based on the measured span loss of the receive fiber.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for ROB modules

The Fault LED on the Line port is ON.

Impact

Major alarm—service might be affected.

Guidelines

For the ROB2 and the 40-channel ROB4 modules:

- For a span loss from 30 dB to 33 dB, the minimum number of channels is 2.
- For a span loss from 33 dB to 34 dB, the minimum number of channels is 3.
- For a span loss from 34 dB to 35 dB, the minimum number of channels is 4.

The maximum span loss for the ROB2 or the 40-channel ROB4 modules is 35 dB, after which the port is declared out of specification.

For the 96-channel ROB4 modules:

- For a span loss from 26 dB to 29 dB, the minimum number of channels is 2.
- For a span loss from 29 dB to 31 dB, the minimum number of channels is 4.

The maximum span loss for the 96-channel ROB4 module is 31 dB, after which the port is declared out of specification.

Note	The span loss values at which this alarm is raised and cleared may not exactly match the values above because of hysteresis.
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Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

Note	Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.
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Caution	Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.
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Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.4.1 Clearing a CHNDFC channel count deficiency alarm

Use this procedure to clear a CHNDFC alarm.

- Step 1** Check the PM Span Loss value for the Line port on the alarmed module. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.
The **PM Statistics** window is displayed, in which you can view the port's PMs.
- Step 2** Check the number of channels provisioned at each end of the span. Perform the following steps at each end of the span. The number of channels counted for this fault is the number of received channels actually present on the receive fiber, and not the number of locally provisioned channels.
- In the proNX 900, click the **Optical Layer** icon.
 - In the hierarchy window, right-click on the Group, and choose **Provision Cross Connects**.
The **Optical Cross Connects** window is displayed.
 - Using the **Optical Cross Connects** windows, compare the optical cross connects at both ends of the span to determine if there are inconsistencies with the number of provisioned cross connects, or with the channels that have been provisioned. Resolve any problems that you find.
- Step 3** Check for and resolve all upstream alarms on Client In ports.
- Step 4** Check for and resolve all other channel-related alarms on this span.
- Step 5** Check for and resolve the following possible problems:
- The span loss of the Line port receive fiber has reached the specification maximum. A minimum number of lit channels must be present on the receive fiber to ensure that stable optical control can be maintained.
 - The minimum channel count requirement is enforced for a span loss that exceeds 30dB.
 - For a span loss between 30-33dB, the minimum number of channels is 2.
 - For a span loss between 33-34dB, the minimum number of channels is 3.
 - For a span loss between 34-35dB, the minimum number of channels is 4.
 - Beyond 35dB, the Channel Count Deficiency alarm no longer applies as the LOSPEC-RX (Received Loss Out of Specification) alarm takes precedence at that span loss level.

Consult your network engineering group to determine the minimum channel count required for the span loss.

6.8.5 CNXMEA (Connection Mismatch)

Problem Description

There is a mismatch between the client port on a ROADM-on-a-blade (ROB) module and the Reconfigurable Add/Drop node to which it is assigned. This fault occurs on Client port 2 (C2) of a 2D ROAM-on-a-blade (ROB2) module, or Client ports 2 to 4 (C2 to C4) of a 4D ROAM-on-a-blade (ROB4) module.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for ROB module

The Fault LED on the Client port is ON.

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(C2 on ROB2; C2 to C4 on ROB4)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.5.1 Clearing a CNXMEA connection mismatch alarm

Use this procedure to clear a CNXMEA alarm on an optical port, by determining the expected module and fiber connections, using the proNX 900 Node Controller to view the fiber patchcords.

Step 1 In the toolbar, click the **Optical Layer** icon.

- Step 2** In the Navigation pane, fully expand **Optical Groups**. Right-click the particular port and choose **Edit Port**.
- Step 3** From the **Provision Port** dialog, choose the **Port** tab.
View the expected port and connection details, to determine how the fibers must be connected.
- Step 4** Physically, re-fiber the connections to match the expected module and fiber connections.
- If the alarm clears, you completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.6 CNXVLDTMOUT (Connection Validation Timeout)

Problem Description

The port is unable to receive or decode a connection validation message on the client input port within the system-determined timeout interval. This fault occurs only on client port 2 (C2) of a 2D ROADM-on-a-blade (ROB2) module or client ports 2 to 4 (C2 to C4) of a 4D ROADM-on-a-blade (ROB4) module. .

Following are possible causes:

- A fiber connection error to a dynamic optical layer group, DCM/line port, Mux/Demux port
- The communication within the backplane is down

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for ROB module

The Fault LED on the Client port is ON.

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(C2 on ROB2; C2 to C4 on ROB4)

Note	Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.
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Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.6.1 Clearing a CNXVLDTMOUT connection validation timeout alarm

Use this procedure to clear a CNXVLDTMOUT alarm on an optical port.

Before you proceed with these clearing procedures, we recommend that you first rule out other communication failures, and other fiber errors to line or DCM ports.

- Step 1** Check if the alarm is caused by an incorrect fiber connection, using the proNX 900 Node Controller.
- Step 2** In the toolbar, click the **Optical Layer** icon.
- Step 3** In the Navigation pane, fully expand **Optical Groups**. Right-click the particular port and choose **Edit Port**.
- Step 4** From the **Provision Port** dialog, choose the **Port** tab.
View the expected port and connection details, to determine how the fibers must be connected.
- Step 5** Physically, re-fiber the connections to match the expected module and fiber connections.
 - If the alarm clears, you completed this procedure. Otherwise, go to the next step to clear a backplane communication problem.
 - If the alarm does not clear, proceed to the next step, to clear a backplane communication problem.
- Step 6** Clear the backplane communication problem. Refer to the topic "Clearing a DSP communications failure alarm," in this guide.
 - If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.7 CONTCOM-E (Control Communications Failure, Equalization Section)

Problem Description

This alarm indicates that bi-directional control communications to the NE at the far end of the equalization section have failed.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	OFF

Module LED behavior

None.

Impact

Not reported—service is not affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.7.1 Clearing a CONTCOM-E control communications failure, equalization section alarm

Use this procedure to clear a CONTCOM-E alarm.

- Step 1** Check for OSC alarms on the NE(s) between the local (monitored) NE and the far-end equalizing NE. If there are existing OSC alarms, clear them before continuing at the next step.
- Step 2** Check the far-end NE for software upgrade alarms or module resets. Resolve any problems on the far-end NE.
- If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.8 CONTCOM-S (Control Communications Failure, Span Section)

Problem Description

This alarm indicates that bi-directional control communications with the far-end NE on the span section have failed. This fault is not monitored when the OSC is administratively disabled.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for ROB and DLA modules

The Fault LED on the Line Input port is ON

Impact

Major alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.8.1 Clearing a CONTCOM-S control communications failure, span section alarm

Use this procedure to clear a CONTCOM-S alarm.

- Step 1** Check for OSC alarms on the far-end NE. If there are existing OSC alarms, clear them before continuing at the next step.
- Step 2** Check the far-end NE for software upgrade alarms or module resets. Resolve any problems on the far-end NE.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.9 FECI (Far End Configuration Inconsistent)

Problem Description

This alarm indicates that interoperation of the local NE, provisioned in a group, with the NE at the far-end of the span is not supported.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Major alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.9.1 Clearing a FECI far-end node configuration inconsistent alarm

Use this procedure to clear a FECI alarm.

- Step 1** Ensure that the DOL components in the NE are properly configured according to the configurations and procedures in the *BTI 7000 Series Dynamic Optical Layer Engineering Guideline*.
- Step 2** Make sure that the DOL groups on the near-end and on the far-end NEs are compatible, as follows:
- An Amplifier Terminal NE must be connected to another Amplifier Terminal NE
 - Any of the other DOL types, as follows, can be connected to each other:
 - ROADM Terminal
 - Line Amplifier Node
 - ROADM Node
 - Line Equalizing Node
 - Both the near-end and far-end nodes must support the same wavelength spacing and the same number of supported channels.
- Step 3** If the alarm clears, you have completed this procedure.
If the alarm does not clear, contact your next level of support.

6.8.10 FEIM (Far-end Node Identification Mismatch)

Problem Description

The far-end node identifier attributes do not match the expected identifier attributes. The line span may be connected to the wrong far-end node.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Major alarm—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.10.1 Clearing a FEIM far-end node identification mismatch alarm

Use this procedure to clear a FEIM alarm.

Step 1 Retrieve the far-end node attributes of the OSC entity that raised the FEIM alarm. Refer to the topic "Validate fiber connections" in the *BTI 7000 Series Dynamic Optical Layer Engineer Guidelines*, or in the online help for the proNX 900 Node Controller.

Step 2 Compare each of the following pairs of attributes:

- Expected and Actual Far End System Identifier
- Expected and Actual Far End NMS IP Address
- Expected and Actual Far End Group Number
- Expected and Actual Far End Degree Number

Step 3 For any of the above-listed pair of values, if the expected value is not correct, and, the actual value is the correct value, modify the expected value to match the actual value.

This procedure clears the alarm.

Step 4 If any actual value of the far-end node is not correct, and, the expected value is correct, this means the line fiber, on which the OSC is carried, is not connected to the expected far end node.

You must resolve the misconnection between the local and far-end nodes.

6.8.11 IAOCB (Invalid Amplifier Operating Configuration Booster-amplifier)

Problem Description

The pre-amplifier on the alarmed module is operating outside of the acceptable operating power range, with an invalid configuration for the span loss currently measured.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

Module LED behavior

Location	Circuit Pack LEDs		
	Fail	Active	Fault
DLA, ROB	OFF	ON	ON

Impact

Minor alarm – service might be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.11.1 Clearing a IAOCB invalid amplifier operating configuration, booster-amplifier alarm

Use this procedure to clear a IAOCB alarm.

Step 1 Determine whether a “Received Power Out of Specification” alarm is raised for the client port (C1/C2) of the alarmed ROB2 module. If that alarm exists, clear it before continuing with this procedure.

Step 2 Determine whether a “Received Power Out of Specification” alarm is raised for the Line port of the alarmed DLA2 module. If that alarm exists, clear it before continuing with this procedure.

- Step 3** If traffic is not affected, wait for a maintenance window to perform the following steps. If traffic is affected, perform the following steps immediately.
- Step 4** Check for and clear any other alarms on the alarmed module.
- Step 5** There may be a problem with the upstream equipment. Resolve any upstream problems.
- Step 6** Check and clean all upstream fiber connections.
- If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.12 IAOCM (Invalid Amplifier Operating Configuration Mid-amplifier)

Problem Description

The pre-amplifier on the alarmed module is operating outside of the acceptable operating power range, with an invalid configuration for the span loss currently measured.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	ON

Module LED behavior

Location	Circuit Pack LEDs		
	Fail	Active	Fault
ROB	OFF	ON	ON

Impact

Minor alarm – service might be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

Note	Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.
Caution	Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.

**Caution**

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.12.1 Clearing a IAOCM invalid amplifier operating configuration, mid-amplifier alarm

Use this procedure to clear a IAOCM alarm.

Step 1 Check the PM OPR (Loss) value for the Line port on the alarmed module. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 If traffic is not affected, wait for a maintenance window to perform the following steps. If traffic is affected, perform this procedure immediately.

Step 3 Check for and clear any other alarms on the alarmed module.

Step 4 There may be a problem with the upstream equipment. Resolve any upstream problems.

Step 5 Check that any of the DCM modules that are connected to the DCM port on the ROB module are within specification for loss. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**. Check and clean all DCM fiber connections.

Step 6 Check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.13 IAOCF (Invalid Amplifier Operating Configuration Pre-amplifier)

Problem Description

The pre-amplifier on the alarmed module is operating outside of the acceptable operating power range, with an invalid configuration for the span loss currently measured.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	ON

Module LED behavior

Location	Circuit Pack LEDs		
	Fail	Active	Fault
DLA, ROB	OFF	ON	ON

Impact

Minor alarm – service might be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.13.1 Clearing a IAOCPP invalid amplifier operating configuration, pre-amplifier alarm

Use this procedure to clear a IAOCPP alarm.

Step 1 Check the PM OPR (Loss) value for Line port on the alarmed module. Using the proNX 900, right-click on the port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 If traffic is not affected, wait for a maintenance window to perform the following steps. If traffic is affected, perform this procedure immediately.

Step 3 Check for and clear any other alarms on the alarmed module.

Step 4 There may be a problem with the upstream equipment. Resolve any upstream problems.

Step 5 Check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.14 LOF-RX (Received Loss of Frame) for OSC

Problem Description

This alarm indicates that the received OSC signal cannot be framed.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior

The Fault LED on the Line Input port is ON.

Impact

Major alarm - service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.14.1 Clearing a LOF-RX received loss of frame alarm for OSC

Use this procedure to clear a LOF-RX alarm.

Step 1 Check the OPR value for the Line-input port on the alarmed module. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 If the power is too low, check and clean the upstream fiber connections.

Step 3 Check upstream NEs for any “LOLIGHT-TX (OSC)”, or “REPLUNITFAIL” or “REPLUNITDEGRADE” alarms. If any of these alarm are present, fix them and then check to see whether the “LOF-RX” alarm clears.

Step 4 If there are no alarms on the upstream NEs, check the OSC upstream power level by connecting a patch cord to the Line Out port and measuring the power with a power meter. If the power level is too low or if there is no light, and there is no “LOLIGHT-TX (OSC)” alarm, then the OSC transmitter is faulty (internal component on DLA and ROB modules). Replace the module.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.15 LOLIGHT-RX (Received Loss of Light) for OSC

Problem Description

This alarm indicates that the received OSC signal cannot be detected.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for DLA or ROB modules

The Fault LED on Line port is ON.

Impact

Major alarm - service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.15.1 Clearing a LOLIGHT-RX received loss of light alarm for OSC

Use this procedure to clear a LOLIGHT-RX for OSC alarm.

Step 1 Check if the far-end NE DLA or ROB module has been provisioned.

From the Toolbar, click the **Optical Layer** icon. Navigate to the group to which the module should be a member. Right-click and choose **Edit Group**; the **Provision Group** dialog displays:

Step 2 Check if the far-end OSC is administratively enabled—In Service (IS).

Using the proNX 900, right-click on the far-end ROB or DLA module, and choose **View OSC Info**. The **Provision OSC** dialog appears. From the **General** tab go to the **Administration Info** panel:

- If the **Administrative State** reads In-Service (IS) do nothing.
- To enable the administrative state, from the drop-down menu choose **In-Service (IS)**.

Step 3 Determine if a fiber is cut or if a fiber is disconnected.

If necessary, replace or re-connect the fiber.

Step 4 Check the power level of the signal connected to the Line In port. Using the proNX 900, right-click on the port, and choose **View Port PM**. The **PM Statistics** window is displayed, in which you can view the port's OPR PMs. If power is too low, check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.16 LOLIGHT-RX (Received Loss of Light) for an optical port

Problem Description

The receive WDM composite signal power is below the detectable threshold. This alarm applies to the following:

- the Line port of a DLA or ROB module
- the DCM-In port of a ROB module
- the Client-C1 port of a DLA or ROB module (also for DLA Line Amplifier Node Inter-module connection patch fiber)
- the Client-C2 port of a ROB module (for Alien wavelengths on a ROADM Terminal or C2 Inter-Card connection patch fiber on a ROADM Node or Line Equalizing Node).

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line, DCM, or Client port is ON.

Impact

Critical alarm – service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1,C1,C2,DCM)

DLA-(1,11,21,31)-(1-20)-(L1,C1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.16.1 Clearing a LOLIGHT-RX received loss of light alarm for an optical port

Use this procedure to clear a LOLIGHT-RX alarm on an optical port.

Step 1 Check the PM OPR value for the alarmed port, and determine if it is within specification. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's OPR PMs.

Step 2 Check for and resolve the following possible problems:

- the span fiber or patch panel fiber has been cut or disconnected or has excessive loss
- the amplifier transmitting into the patch fiber has shut down
- excessive loss on the DCM module(s) that are connected to the alarmed port
- excessive loss on upstream patch fibers

Step 3 Check and clean all upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.17 LOLIGHT-RX (Received Loss of Light) for a wavelength channel

Problem Description

This fault applies to both Channel Equalizing Terminal and Reconfigurable Add/Drop Node configurations and only to channels on the add/drop port (C1) of the ROB module and the C2 port if it is configured for alien DWDM wavelengths.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on Client ports (C1/C2).

Impact

Critical alarm – service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1-20)-(C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.17.1 Clearing a LOLIGHT-RX received loss of light alarm for a wavelength channel

Use this procedure to clear a LOLIGHT-RX alarm.

Step 1 Determine whether the upstream transmitting transceiver is administratively disabled (OOS). If it is, enable the administrative state of the transceiver by setting it to In-Service (IS). Using the proNX 900, right-click on the transceiver port, and choose **Provision Transceiver**.

The **Provision Transceiver** window is displayed. From the **Initial State** drop-down menu, choose **IS**, and then click **Apply**.

Step 2 Determine whether the upstream transceiver has the proper wavelength channel setting. If the wavelength channel is incorrect, use the **Wavelength** drop-down menu to choose the correct one, and then click **Apply**.

For information about wavelength channel settings refer to [5.3, “Wavelength channel performance monitoring”](#) in this guide

Step 3 Check and clean the upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.18 LOLIGHT-TX (Transmitted Loss of Light) for OSC

Problem Description

This alarm indicates that the transmitted OSC signal cannot be detected.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Major alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.18.1 Clearing a LOLIGHT-TX transmitted loss of light alarm for OSC

Use this procedure to clear a LOLIGHT-TX for OSC alarm.

Step 1 Replace the alarmed module.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.19 LOLIGHT-TX (Transmitted Loss of Light) for a wavelength channel

Problem Description

This fault applies to ROADM Terminal, Line Equalizing Node and ROADM Node configurations and to channels on the add/drop port (C1) of the ROB module, the C2 port if it is configured for alien DWDM wavelengths, and the Line port.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on ports L1,C1, and C2.

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1,C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.19.1 Clearing a LOLIGHT-TX transmitted loss of light alarm for a wavelength channel

Use this procedure to clear a LOLIGHT-TX alarm.

Step 1 Using the proNX 900, navigate to the optical group and the alarmed module to check the following:

- OPT value on the Client output port
- OPR value on the Client input port on the upstream NE
- OPT value on the Line output port on the upstream NE
- OPR value on the Line input port

Step 2 Right-click on the alarmed port and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs. From the **Select PM** drop-down menu, choose **Wavelength Channel** and click **Start**, to retrieve the statistics.

Step 3 Refer to the **Metric** table to determine whether the received power (OPR/OPT) for the wavelength channel on the port is out of specification or cannot be detected (alarm "LOLIGHT-RX"). For information about threshold values refer to "[6.7, 'DOL threshold and hysteresis values'](#)", in this guide .

If the power is too low, check and clean the upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.20 LOSPEC-RX (Received Loss Out of Specification)

Problem Description

The measured optical power loss is either above or below the specification limits. When reported against a Line port, the measured loss is the span loss of the receive fiber. When reported against a DCM port, the measure loss is that of the attached DCM module. When reported against a client port, the measured loss is that of the receive inter-module connection patch fiber between two ROB modules. This alarm may apply to any of the following:

- the span loss measured on the Line port of a DLA or ROB module. At least one cross connect or channel must be provisioned to raise the alarm for span loss.
- the DCM-In port of a ROB module
- the Client-C2 port of a ROB module (C2 inter-module connection patch fiber on a ROADM Node or a Line Equalizing Node).
- the C1 and DCM ports for a Line Amplifier Node

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line, DCM, or Client port is ON.

Impact

Critical alarm – service might be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1, C2, DCM)

DLA-(1,11,21,31)-(1-20)-(L1, C1, DCM)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.20.1 Clearing a LOSPEC-RX received loss out of specification alarm

Use this procedure to clear a LOSPEC-RX alarm.

- Step 1** Check the PM Span/DCM/C1/C2 Loss value for the corresponding Line Port, DCM, or Client-Intercard port on the alarmed DLA or ROB module. Using the proNX 900, right-click on the alarmed port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 Check for and resolve the following possible problems:

- excessive loss on the receive span fiber
- excessive span length resulting in loss that cannot be supported
- excessive loss on the DCM module(s) that are connected to the alarmed port
- excessive loss on upstream patch fibers
- excessive loss on the inter-module connection fiber panel

Step 3 Check and clean the upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.21 OBROS (Optical Back Reflection Out of Specification)

Problem Description

This alarm indicates that the measured optical back reflection of the transmitted OSC signal exceeds the specification maximum limit. This fault is not monitored when the OSC is administratively disabled. This alarm behaves as follows:

- this alarm is raised at -18dB (clear hysteresis is -3dB)
- the raising of this alarm blocks the turning up of traffic
- since traffic is not turned up, OBR continues to be measured, and so the alarm may clear if the OBR is reduced.
- the threshold level used to evaluate this fault point is not user readable or configurable
- this alarm masks the OBR-HT alarm

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1, C2, DCM)

DLA-(1,11,21,31)-(1-20)-(L1, C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.21.1 Clearing a OBROS optical back reflection out of specification alarm

Use this procedure to clear an OBROS alarm.

- Step 1** Ensure that the span fiber that the Line output port fiber is properly connected and is not damaged.
- Step 2** Ensure that the fiber connectors are all of a compatible type.
- Step 3** Thoroughly clean the Line output port fiber connection, and also any downstream fiber connections.
- If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.22 OBROS (Optical Back Reflection High Threshdhold Exceeded)

Problem Description

This alarm indicates that the measured optical back reflection of the transmitted OSC signal is above the normal operating range, but, not at a critical level. This fault is not monitored when the OSC is administratively disabled. This alarm behaves as follows:

- this alarm is raised at -24db (clear hysteresis -3db)
- the raising of this alarm does not block the turning up of traffic
- OBR can only be measured when there is no WDM traffic. If the alarm is raised and traffic is turned up, the alarm does not clear.
- the threshold level used to evaluate this fault point is not user readable or configurable

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	ON

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Minor alarm—service is not affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1, C2, DCM)

DLA-(1,11,21,31)-(1-20)-(L1, C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.22.1 Clearing a OBROS optical back reflection out of specification alarm

Use this procedure to clear an OBROS alarm.

- Step 1** Ensure that the span fiber that the Line output port fiber is properly connected and is not damaged.
- Step 2** Ensure that the fiber connectors are all of a compatible type.
- Step 3** Thoroughly clean the Line output port fiber connection, and also any downstream fiber connections.
- If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.23 OPR-HIGH-FAIL (Received Power High Fail) for a wavelength channel

Problem Description

The received optical power of the channel signal is at an excessive high level and the channel is considered as failed.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on Client ports (C1/C2).

Impact

Critical alarm—service is affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.23.1 Clearing a OPR-HIGH-FAIL received power high fail alarm for a wavelength channel

Use this procedure to clear a OPR-HIGH-FAIL alarm.

Step 1 Check the PM OPR value for the alarmed channel. Using the proNX 900, right-click on the alarmed channel and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the channel PMs.

Step 2 Determine whether the received optical power to the Client-input port is at an excessive high level and the channel is failed.

If the received optical power is too high, add an attenuation pad in the optical path to bring the power level to within the specified range for operation.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.24 PMI (Payload Missing Indication)

Problem Description

The far-end NE has signaled the local NE that an upstream WDM composite signal failure condition has been detected, and as a result, no WDM composite signal is being transmitted to the local NE.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	OFF

LED behavior DLA or ROB modules

The Fault LED on Line port of the upstream DLA or ROB module is ON.

Impact

Not reported—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.24.1 Clearing a PMI payload missing indication alarm

Use this procedure to clear a PMI alarm.

Step 1 Check for and resolve all “LOLIGHT-RX” alarms on upstream Line, DCM or Intercard-Client ports on the DLA or ROB modules.

Step 2 Check for and resolve the following:

- an upstream Line Amplifier Node within the same equalization section as the local NE has detected a WDM composite signal LOLIGHT-RX and an OSC LOLIGHT-RX on its line port, and has initiated an APSD. The detected LOLIGHT-RX alarms are in the direction of the local NE that raises the PMI fault.
- a WDM composite signal LOLIGHT-RX has been detected on a DCM or client-interconnect port of an upstream Line Amplifier Node within the same equalization section as the local NE. The detected LOLIGHT-RX fault is in the direction of the local NE that raises the PMI fault.

Step 3 Check for a possible fiber break in the input fiber span.

A break in the input fiber cable can cause a loss of signal. Contact your next level of support to determine if there is a break in the fiber span.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.25 POS-RX (Received Power Out of Specification) for an optical port

Problem Description

This alarm indicates that the received optical power is either above or below the specified range for operation. This fault applies only to the client port of the DLA module in a Amplifier Terminal configuration.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior for DLA module

The Fault LED on the Client port is ON.

Impact

Critical alarm – service is affected.

Affected AIDs

DLA-(1,11,21,31)-(1-20)-(C1)

Note	Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.
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Caution	Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.
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**Caution**

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.25.1 Clearing a POS-RX received optical power out of specification alarm for an optical port

Use this procedure to clear a POS-RX alarm on an optical port.

Step 1 Using the proNX 900, navigate to the optical group and the alarmed module to check the OPR value on the Client input port.

Step 2 Right-click on the alarmed port and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs. From the **Select PM** drop-down menu, choose **Optical Port** and click **Start**, to retrieve the statistics.

Step 3 Refer to the **Metric** table to determine whether the received optical power (OPR) to the Client-input port is higher or lower than the specified range for operation. For information about threshold values refer to "[6.7, “DOL threshold and hysteresis values”](#)," in this guide .

- If the received optical power is too high, add an attenuation pad in the optical path to bring the power level to within the specified range for operation.
- If the received optical power is too low, check and clean the upstream fiber connections.
- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.26 POS-RX-HIGH (Received Power Out of Specification - High) for a wavelength channel

Problem Description

The received optical power of the channel signal is above the specified range for operation. This applies only to channels on add/drop ports of ROB modules: C1 and C2 if configured for alien DWDM.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior

There is no Fault LED for WCH alarms on Client ports (C1/C2).

Impact

Major alarm—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.26.1 Clearing a POS-RX-High received optical power out of specification - High alarm for a wavelength channel

Use this procedure to clear a POS-RX-High alarm.

Step 1 Using the proNX 900, navigate to the optical group and the alarmed module to check the OPR value on the Client input port.

Step 2 Right-click on the alarmed port and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs. From the **Select PM** drop-down menu, choose **Wavelength Channel** and click **Start**, to retrieve the statistics.

Step 3 Refer to the Metric table to determine whether the received optical power (OPR) to the Client-input port is higher or lower than the specified range for operation. For information about threshold values refer to "[6.7, “DOL threshold and hysteresis values”](#)," in this guide .

If the received optical power is too high, add an attenuation pad in the optical path to bring the power level to within the specified range for operation.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.27 POS-RX-LOW (Received Power Out of Specification - Low) for a wavelength channel

Problem Description

The received optical power of the channel signal is below the specified range for operation. This applies only to channels on add/drop ports of ROB modules—C1 and C2— if configured for alien DWDM.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior

There is no Fault LED for WCH alarms on Client ports (C1/C2).

Impact

Major alarm—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.27.1 Clearing a POS-RX-LOW received optical power out of specification - Low alarm for a wavelength channel

Use this procedure to clear a POS-RX-High alarm.

- Step 1** Using the proNX 900, navigate to the optical group and the alarmed module to check the OPR value on the Client input port.
- Step 2** Right-click on the alarmed port and choose **View Port PM**.
The **PM Statistics** window is displayed, in which you can view the port's PMs. From the **Select PM** drop-down menu, choose **Wavelength Channel** and click **Start**, to retrieve the statistics.
- Step 3** Refer to the Metric table to determine whether the received optical power (OPR) to the Client-input port is higher or lower than the specified range for operation. For information about threshold values refer to "[6.7, “DOL threshold and hysteresis values”](#)," in this guide .
- Step 4** If the received optical power to the client input port is lower than the specified range for operation, check the following. Re-check the power after each step:
- a) Clean the fibers attached to the affected ports.
 - b) Change the patch cord fiber.
 - c) Check the source of the channel to determine if it is transmitting at an adequate level.
 - d) Check the fibers, and, any attenuators in the path to ensure that no unintentional, additional attenuation is added to the path.
 - If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

6.8.28 POS-TX (Transmitted Power Out of Specification) for a wavelength channel

Problem Description

The transmitted optical power is either above or below or the specified range for operation.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on Line and Client ports.

Impact

Critical alarm - service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1,C1,C2)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.28.1 Clearing a POS-TX transmitted optical power out of specification alarm for a wavelength channel

Use this procedure to clear a POS-TX alarm.

Step 1 Using the proNX 900, navigate to the optical group and the alarmed module to check the following:

- OPT value on the Client output port
- OPR value on the Client input port on the upstream NE
- OPT value on the Line output port on the upstream NE

Step 2 Right-click on the alarmed port and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs. From the **Select PM** drop-down menu, choose **Wavelength Channel** and click **Start**, to retrieve the statistics.

Step 3 Refer to the **Metric** table to determine whether the received power (OPR/OPT) for the wavelength channel on the port is out of specification or cannot be compensated through equalization to bring the transmitted power within specification. For information about threshold values refer to "6.7, “DOL threshold and hysteresis values”,” in this guide .

- If the transmitted optical power is too high, add an attenuation pad in the optical path to bring the power level to within the specified range for operation.
- If the transmitted optical power is too low, check and clean the upstream fiber connections.
- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.29 REPLUNITDEGRADE (Circuit Pack Degrade)

Problem Description

This alarm is raised when a physical component failure or degradation is detected on a module. This alarms alerts the operator that the module could be defective or that the current conditions on the module may degrade it to the point that it might require replacement. This alarm may also be caused by operating the module outside of the acceptable operating power range for a period of time.

This alarm is masked when any of the following alarms are active:

- Circuit Pack Missing
- Circuit Pack Mismatch
- Circuit Pack Unknown
- Circuit Pack Fail

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	ON	OFF

LED behavior for DLA or ROB modules

The Fault LED on the module is ON. Depending on the severity, all LEDs on the module might be ON.

Impact

Major alarm—service might be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)

DLA-(1,11,21,31)-(1-20)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.

**Caution**

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.29.1 Clearing a REPLUNITDEGRADE circuit pack degrade alarm

Use this procedure to clear a REPLUNITDEGRADE alarm.

Step 1 Perform a database backup before performing any troubleshooting steps. Refer to the *Operations Solutions Guide* for details.

Step 2 Check for and fix any other alarms on the alarmed DLA or ROB modules.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, go to the next step.

Step 3 Perform a warm restart of the alarmed module.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.30 T-LOSSRX-HT (Received Loss High Threshold Exceeded)**Problem Description**

The measured optical power loss is above the high threshold. This alarm occurs only on the Line port and applies to the loss of the receive fiber.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	OFF	OFF	ON

LED behavior for DLA or ROB modules

The Fault LED on the Line port is ON.

Impact

Minor alarm—service is not affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

DLA-(1,11,21,31)-(1-20)-(L1)

Note	Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.
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Caution	Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.
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Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.30.1 Clearing a T-LOSSRX-TH received loss high threshold exceeded alarm

Use this procedure to clear a T-LOSSRX-TH alarm.

Step 1 Check the PM Span Loss value for the Line port on the alarmed module. Using the proNX 900, right-click on the port, and choose **View Port PM**.

The **PM Statistics** window is displayed, in which you can view the port's PMs.

Step 2 Determine if the Maximum Span Loss Alarm Threshold is provisioned to the proper value according to the Link Engineering Specifications. Consult with your network engineer to confirm the value. If the Maximum Span Loss Alarm Threshold value is set to too low, provision the threshold to the proper value and see if the alarm clears, as follows:

- a) Using the proNX 900, right-click the alarmed module and choose **View WDM Info**.
- b) For the **Max. Span Loss Alarm Threshold** attribute, check the **Enable Alarm** checkbox, and then specify the desired value for the attribute.
- c) Click **OK**.

Step 3 Check for and resolve the following possible problems:

- excessive loss on the receive span fiber
- excessive span length resulting in loss that cannot be supported

- excessive loss on upstream patch fibers

Step 4 Check and clean the upstream fiber connections.

- If the alarm clears, you have completed this procedure.
- If the alarm does not clear, contact your next level of support.

6.8.31 UNEQ-O (Wavelength Channel Unequipped)

Problem Description

The NE at the far end channel of the equalization section has signaled to the local NE that the indicated wavelength has not been configured to carry a channel in the WDM composite signal that it has transmitted to the local NE.

This fault applies to ROADM Terminal, Line Equalizing Node and ROADM Node configurations and only to channels on the Line port of the ROB module.

LED behavior for BTI 7060/BTI 7200

Shelf LEDs		System LEDs			
Location	Trouble	Power	Critical	Major	Minor
MSI	ON	ON	ON	OFF	OFF

LED behavior

There is no Fault LED for WCH alarms on the Line port.

Impact

Critical alarm—service may be affected.

Affected AIDs

ROB-(1,11,21,31)-(1,3,5...19)-(L1)

Note Invisible laser radiation can be emitted from the aperture ports of various optical circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, SFP transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling circuit packs as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

6.8.31.1 Clearing a UNEQ-O wavelength channel unequipped alarm

Use this procedure to clear a UNEQ-O alarm.

Step 1 Using the proNX 900 navigate to the optical group.

Right-click a group and choose **Provision Cross Connects**. The **Optical Cross Connects - Group: <group number>** dialog appears.

Step 2 Determine whether the cross-connect exists for the channel at the far-end of the equalization section.

- If the cross-connect exists it is listed in the table. Go to Step 4.
- If the cross-connect does not exist you must create it. Go to the next step.

Step 3 Create the cross-connect.

To create the cross-connect refer to "[8.1.1, “Provisioning wavelength cross connections for DOL equipment”](#)," in this guide . Ensure that the channel matches the channel being reported in the alarm.

Step 4 Determine if the administrative state of the cross-connect channel is In-Service (IS). If the state is Out-of-service (OOS), change the state to IS:

- a) Navigate to the Optical Group, Degree and module that you are troubleshooting.
 - b) Right-click the module and choose **View WDM Info**. The **Provision WDM: <module>** dialog appears.
 - c) If the **Administrative State** is Out-of-Service (OOS), from the drop-down menu select In-Service or Auto-in-Service. Click **OK**.
- If the alarm clears, you have completed this procedure.
 - If the alarm does not clear, contact your next level of support.

7.0 Replacing modules

This chapter explains how to replace BTI ROADM-on-a-blade modules and includes the following topic:

7.1 Replacing ROADM-on-a-blade modules

Use this procedure to replace ROADM-on-a-blade (ROB) modules.

Note These procedures describe replacing a 2-degree ROB (ROB2) with a ROB2, or a 4-degree ROB (ROB4) with a ROB4 that has the same PEC.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- ROADM-on-a-blade (ROB) module
- Replacement transceivers
- Isopropyl alcohol and lint-free pads



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

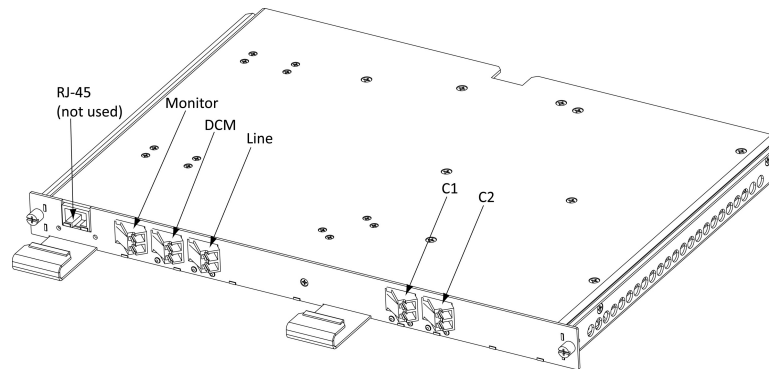
Prerequisites

You must do the following before replacing a ROB module:

- **Reroute traffic:** Transfer traffic going through the ROB module to an alternate route.
- **Database backup:** Perform a database backup, and ensure you know the location where the backup file is saved.
- **Fibers:** For the fiber connected to the module being replaced, ensure you have sufficient fiber slack to unseat the module, and ensure all fibers are labeled correctly.

Key module replacement features

The following figure shows the 2D ROADM-on-a-blade (ROB2) module. The difference between the ROB2 and ROB4 modules is the ROB4 has two additional client ports—C3 and C4.

Figure 7-1 2DROADM-on-a-blade (ROB2)**Replacement procedure**

Follow these steps to replace a ROADM-on-a-blade module:

Step 1 Reroute Traffic

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the module. Transfer traffic to this alternate route before proceeding with this procedure.

Step 2 Move the Cables

Shelf cables may need to be moved aside to get clear access to the module. The cables rest on the handles that are at the front of the module.

Step 3 Disconnect the Cables

Disconnect the fiber cables from the module that is being replaced. Make note on how the cables are connected. You need this information when you install the replacement module.

Note Ensure that the optical ports on the module and the optical cables are protected with protective caps while disconnected.

Step 4 Loosen the Faceplate Screws

- a) Facing the front of the shelf, locate the faceplate screws.
- b) Using a slot-head or Phillips screwdriver, loosen the screws.

Step 5 Remove the Module

- a) Grasp the handles on the front of the module and firmly pull the module straight out.

Note An equipment missing alarm—REPLUNITMISS—appears once you remove the module.

- b) Place the module on a flat work surface.

Step 6 Replace the ROB module

- a) Align the replacement module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot until the module LEDs turn on. The LEDs remain on for 5 to 10 seconds and then turn off. The REPLUNITMISS alarm should clear after a few seconds.

Step 7 Restore the Module to Service

The ROB module automatically upgrades to the same BTI software release that is running on the shelf, and automatically receives the module and channel provisioning from the SCP. The system should recover to its original state, this takes a few minutes.

Note If the system does not recover, contact your BTI representative.

Step 8 Replace the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the faceplate screws:
 - Partially tighten one of the screws.
 - Partially tighten the other screw.
 - Fully tighten both screws, to a torque that is no more than 4.7 in-lbs.

Step 9 Reconnect Optical Cables

If any cables were moved to access the module, clean the cables and reconnect them to their original positions.

Note If you loop excess fiber around the fiber management spool, allow sufficient slack for the fiber management spool to move freely.

Step 10 Reroute traffic

Provision the new ROB module with the preferred traffic route.

You have successfully completed this procedure.

7.2 Replacing a ROADM-on-a-blade module with a different degree ROADM module

This procedure describes using a spare ROADM-on-a-blade (ROB) module to temporarily replace a failed 2-degree ROADM module (ROB2) with a 4-degree module (ROB4), or replace a ROB4 with a ROB2 module—if using only the C1 and C2 ports on the ROB4. The procedures are very similar to same-degree ROADM module replacements. The primary difference is that you need to re-provision the equipment code (PEC), since you are replacing a failed module with a different module-type.

Note You cannot use this procedure to replace a ROB2 or a 40-channel ROB4 module with a 96-channel ROB4 module, or vice versa.

Note Depending on the failure condition, traffic may continue to run on the failed module. In this case, you must re-route traffic before replacing the module.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- ROADM module serving as the replacement
- Replacement transceivers
- Isopropyl alcohol and lint-free pads



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

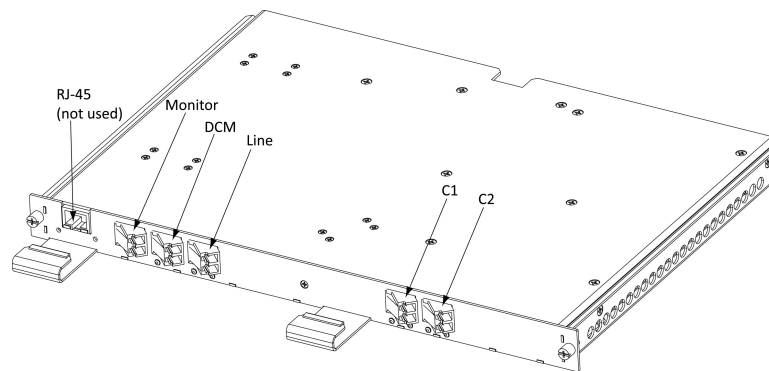
Prerequisites

You must do the following before replacing a ROB module:

- **Database backup:** Perform a database backup, and ensure you know the location where the backup file is saved.
- **Fibers:**
 - Ensure you have sufficient fiber slack to unseat the module.
 - Ensure all fibers are labeled correctly. You need to maintain the same cross-connection assignments.

Key module replacement features

The following figure shows the ROB2 module. The difference between the ROB2 and ROB4 modules is the ROB4 has two additional client ports—C3 and C4. You do not use C3 and C4 for this type of module replacement.

Figure 7-2 2DROADM-on-a-blade (ROB2)**Replacement procedure**

Follow these steps to replace a ROADM-on-a-blade module with a different degree ROADM module:

Step 1 Reroute Traffic

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the module. Transfer traffic to this alternate route before proceeding with this procedure.

Step 2 Move the Cables

Shelf cables may need to be moved aside to get clear access to the module. The cables rest on the handles that are at the front of the module.

Step 3 Disconnect the Cables

Disconnect the fiber cables from the module that is being replaced. Make note on how the cables are connected. You need this information when you install the replacement module.

Note Ensure that the optical ports on the module and the optical cables are protected with protective caps while disconnected.

Step 4 Loosen the Faceplate Screws

- a) Facing the front of the shelf, locate the faceplate screws.
- b) Using a slot-head or Phillips screwdriver, loosen the screws.

Step 5 Remove the Module

- a) Grasp the handles on the front of the module and firmly pull the module straight out.

Note An equipment missing alarm—REPLUNITMISS—appears once you remove the module.

- b) Place the module on a flat work surface.

Step 6 Replace the ROB module

- a) Align the replacement module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot until the module LEDs turn on. A circuit pack mismatch—REPLUNITMEA— alarm appears. To clear the alarm you need to assign the module to the slot. Go to the next step.

Step 7 Assign the PEC of the replacement module to the slot. This step assumes you are using proNX 900 Node Controller.

- a) Click the **System Configuration** icon and navigate to the system for which the module is replaced.
- b) Right-click on the slot that contains the replacement module. Click **Provision Module**.
- c) From the **PEC/CLEI Code** drop-down menu, select the PEC of the replacement module, and click **Apply**.
- d) The REPLUNITMISS and REPLUNITMEA alarms should clear after 5 to 10 seconds.

Step 8 Restore the Module to Service

The ROADM module automatically upgrades to the same BTI software release that is running on the shelf, and automatically receives the module and channel provisioning from the SCP. The system should recover to its original state, this takes a few minutes.

Note If the system does not recover, contact your BTI representative.

Step 9 Replace the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the faceplate screws:
 - Partially tighten one of the screws.
 - Partially tighten the other screw.
 - Fully tighten both screws, to a torque that is no more than 4.7 in-lbs.

Step 10 Reconnect Optical Cables

If any cables were moved to access the module, clean the cables and reconnect them to their original positions. All corresponding line and client port alarms on replaced modules, as well as, adjacent node line alarms, should clear.

Note If you loop excess fiber around the fiber management spool, allow sufficient slack for the fiber management spool to move freely.

Step 11 Reroute traffic

Provision the new ROB module with the preferred traffic route.

You have successfully completed this procedure.

8.0 Activating services using the proNX 900 Node Controller

This topic describes how to activate a DWDM Optical Layer using the proNX 900 Node Controller.

8.1 Activating optical services using proNX 900

Activating optical services using the proNX 900 involves provisioning cross connections for DOL equipment. This section describes activating services on the following DOL configurations:

- ROADM Terminal
- Line Amplifier Node
- ROADM Node
- Line Equalizing Node
- Amplifier Terminal

8.1.1 Provisioning wavelength cross connections for DOL equipment

Wavelength channel cross connections are provisioned to configure channel traffic through a ROADM-on-a-blade (ROB)-based DOL node. The channel cross connection consists of a source and destination that specifies a channel route through the DOL node. All channel cross connections on the DOL are bi-directional.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Equipment must be provisioned prior to provisioning cross connections.

Each optical configuration has different cross-connection requirements.

Configuration	Cross Connection	Supporting Information
ROADM Terminal	Create an Add-Drop cross connection for each service.	There is only one degree on a ROADM Terminal. All cross connections are in Degree 1.
ROADM Node	Channels (services) that traverse the node: create a Pass-Through cross connection for each service. Channels (services) that added/dropped at the node: create an Add-Drop cross connection for each service on each of the degrees.	The system takes care of creating the bidirectional channel. You do not have to specify a degree.
Line Equalizing Node	Create a Pass-Through cross connection for each service that traverses the node.	
Line Amplifier Node	None. All services are passed through automatically.	
Amplifier Terminal	None. All services are added/dropped automatically.	

Provisioning cross connections

Follow these steps to provision DOL equipment cross connections:

Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, expand **Optical Groups**, right-click a group and choose **Provision Cross Connects**.

Step 3 On the **Optical Cross Connects** dialog, select **Create New Cross Connect**.

Step 4 On the **Create Cross Connect** dialog, set the connection type, Degree, and Channel for the cross connect.

Step 5 Click **OK**.

Step 6 Repeat steps 3 and 4 until all cross connects are complete.

You have successfully completed this procedure.

8.1.2 Viewing cross connections for DOL equipment

Use this procedure to View cross connects for DOL equipment.



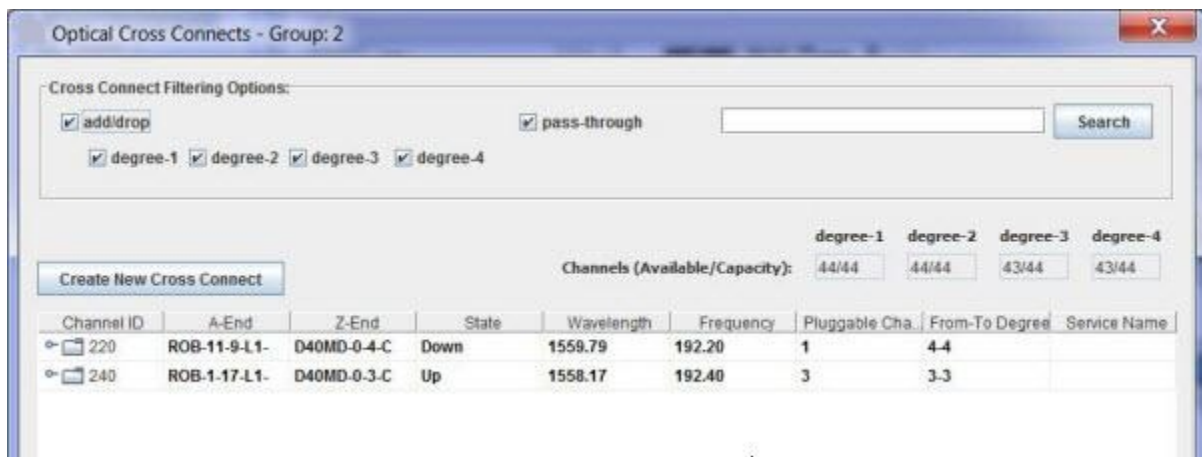
Prerequisites

- Cross connects must be provisioned prior to viewing.

Follow these steps to view cross connects for DOL equipment:

Step 1 In the toolbar, click the **Optical Layer** button.

Step 2 In the Navigation pane, expand **Optical Groups**, right-click a group and choose **Provision Cross Connects**. The **Optical Cross Connects - Group: <group number>** dialog appears.



Step 3 In the **Cross Connect Filtering Options** section, select or deselect the add/drop, degree and pass-through options to filter your view of the existing cross connections. To perform a custom filter, enter a text string in the **Search** field.

Step 4 Click **Cancel** to close the dialog without making changes.

You have successfully completed this procedure.

8.1.3 Deleting wavelength cross connections for DOL equipment

Use this procedure to delete cross connections for DOL (Dynamic Optical Layer) equipment.



Step 1 In the toolbar, click the Optical Layer button.



Step 2 In the Navigation pane, expand **Optical Groups**, right-click a group and choose **Provision Cross Connects**.

Step 3 On the **Optical Cross Connects** dialog, right-click a single row that includes the cross connection you are deleting. Select **Delete**.

Step 4 Click **OK**.

You have successfully completed this procedure.

9.0 Managing optical services using PSM

The PSM client allows users to activate and manage optical layer services in the network for the BTI 7000 Series NEs.

This section covers the following topics:

- 9.1, “Icons and definitions”
- 9.2, “Visualizing an optical service”
- 9.3, “Activating an optical service on a BTI 7000 Series network”
- 9.4, “Viewing the optical services table”
- 9.5, “Viewing the optical services per span table”
- 9.6, “Viewing the optical topology table”
- 9.7, “Working with optical/transport services and topology tables”
- 9.8, “Updating an optical service”
- 9.9, “Deleting an optical service”
- 9.10, “Saving a service image”
- 9.11, “Viewing real-time optical service PMs”

9.1 Icons and definitions

Topology map icons appear in the topology Map view. Service icons appear in the different service views.

Table 9-1 Topology Map Icons








Icon	Description
	A network element.
	A router.
	Multiple connections (links) between network elements. To determine whether to display this icon, PSM counts the connections for all layers currently being displayed. For this icon to be meaningful, ensure that you only select a single layer in the topology Map view. Otherwise, PSM displays this multi-link icon when there is a single connection at more than one layer (e.g. a connection at layer 0 and a connection at layer 1).
	A link down-up indication next to a link to indicate that the link has recently gone down and come back up. The length of time that this indication is displayed is configurable.
	A link connecting network elements in a split ROADM node configuration.
	A replication cluster member. When server replication is enabled and working, this is found on the PSM server you are logged on to, and on all members of the same server replication cluster.
	A network element that has been marked. .

Table 9-2 Service Icons


















Icon	Description
General service icons	
	A network element.
	A module, appears when expanding a network element in a service.
	A service endpoint.
	A multi-layer service.
	Logical connection between an endpoint and the network element or module.
Optical service icons	
	ROADM Node: a collection of modules providing add/drop/passthrough capability.
	Line Amplifier Node: a collection of modules providing line amplification between two spans.

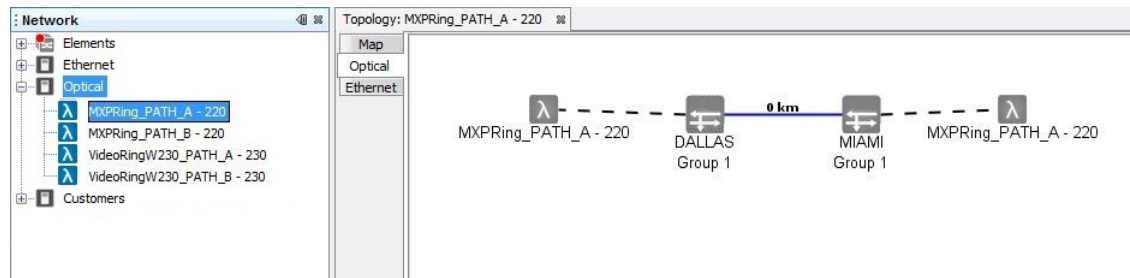
Table 9-2 Service Icons (Continued)


Icon	Description
	Line Equalizing Node: a collection of modules providing channel equalization between two spans.
	ROADM Terminal Node: a collection of modules providing add/drop capability with channel equalization in a linear span.
	An optical service endpoint.
	Fiber connection between nodes (with span length displayed in kilometers).
	A link connecting network elements in a split ROADM node configuration.
Ethernet service icons	
	A UNI endpoint.
	An NNI endpoint.
	An RPL link passing traffic in an ERPS service.
	A blocked RPL link in an ERPS service.
	A failed link in an ERPS service.

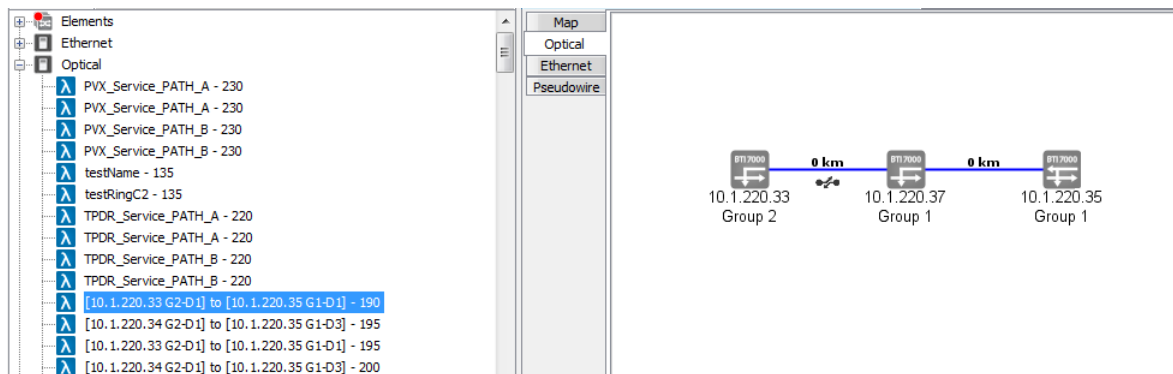
9.2 Visualizing an optical service

The proNX Service Manager client allows users several ways to visualize an optical service. An optical service can be visualized at the network, service, group, and module levels. Service paths can be highlighted and detailed information can be displayed through tool tips or in table form.

Step 1 To see an optical service in its own panel, select it in the Network tree under the Optical branch.



If the service includes a split ROADM node, the link connecting the two network elements comprising the ROADM node is shown with a  icon. For example, in the following figure, 10.1.220.33 and 10.1.220.37 are both part of a single ROADM node, with each NE providing a degree:



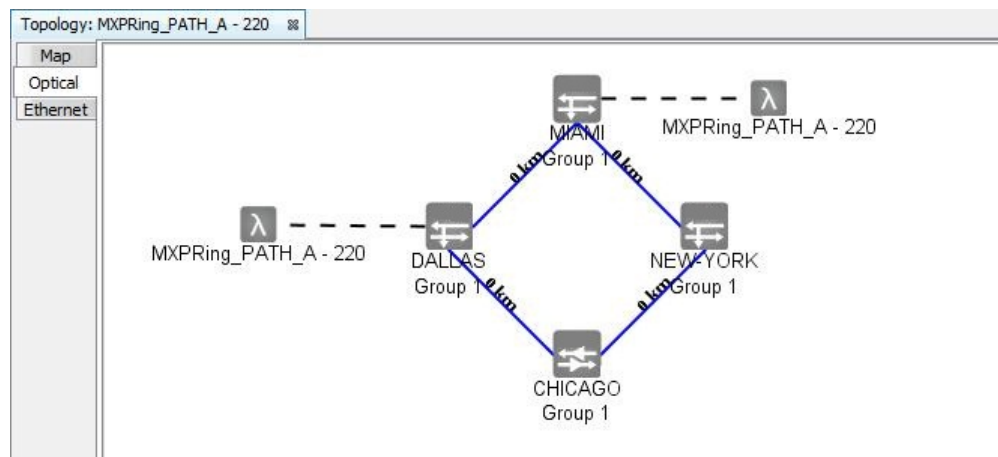
For more information on how PSM recognizes split ROADM nodes on BTI 7000 Series network elements, see the *proNX Service Manager User Guide*.

Note If this is your first time visualizing this service, you will see the administratively-defined default layout if it exists. If a default layout does not exist for this service, then you will see the layout that PSM automatically generates. See [Step 12](#).

Note If this is your second or subsequent time visualizing this service, you will see the layout that existed when you last exited this service view.

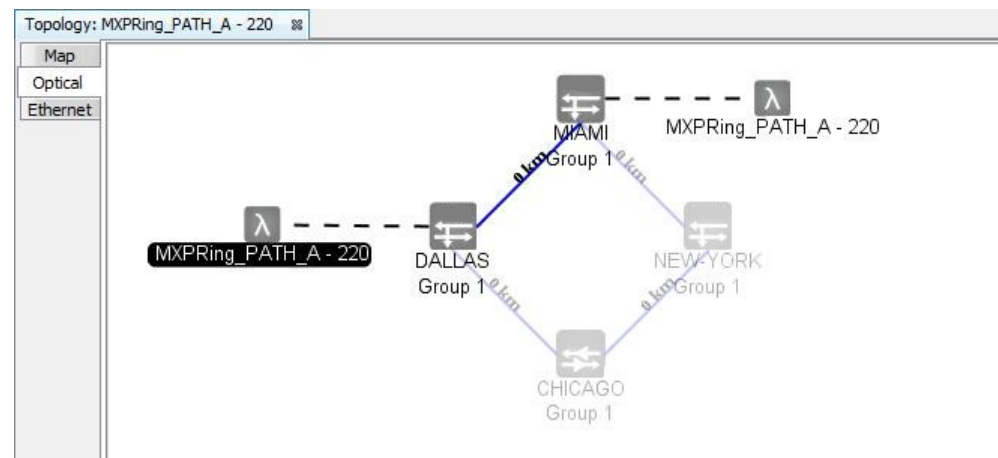
Step 2 To see a complete service view:

a) In the main window, right-click and select **Show All Topology**.



Step 3 To see a service path:

a) Right-click the endpoint and select **Highlight Service**.



Only groups that are part of the service are highlighted.

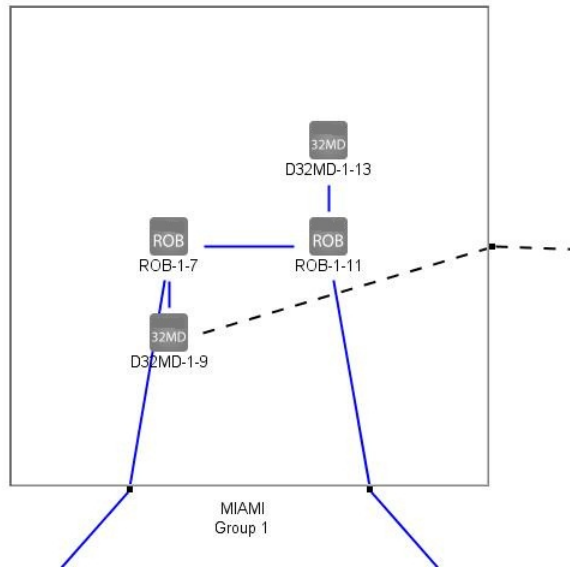
b) Right-click on the background and select **Clear Highlighting**.

Step 4 To see the optical port or interface associated with the service endpoint, right-click the endpoint and select **Navigate > Optical Port** or **Navigate > Interface**.

The optical port or interface associated with the endpoint is highlighted in the Network tree.

Step 5 To see the physical equipment in a group, double-click the optical group icon:

The physical equipment and connections within the group are shown in a zoomed-in view.



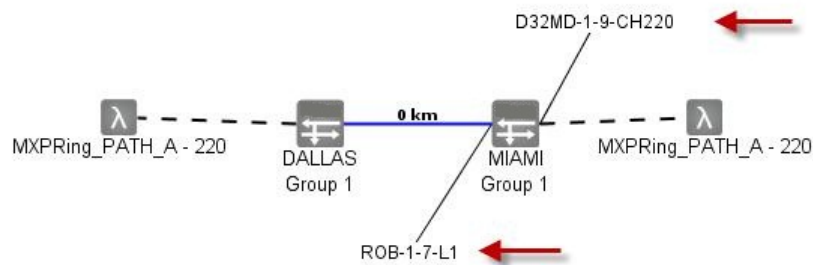
Step 6 To change the size of the service view:

- a) Right-click the background and select **Zoom In** to increase the view size
- b) Right-click the background and select **Zoom Out** to decrease the view size
- c) Right-click the background and select **Reset Zoom** to return the view size to its original size

Alternatively, you can use your mouse scroll wheel.

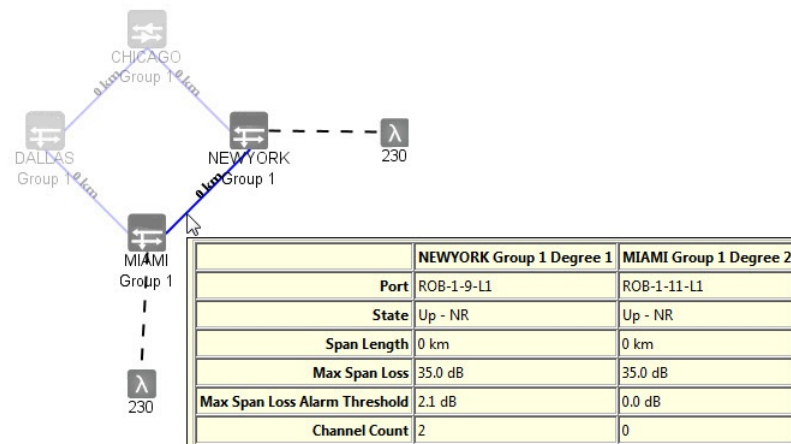
Step 7 To show port labels:

- a) Select an optical group icon. Right-click and choose **Show Port Labels**.



- b) Right-click and unselect **Show Port Labels** to hide port labels.

Step 8 To see details on a link, hover over the link.



Step 9 Right-click a network element and select **Network Element** to see the regular NE menu options.

Step 10 To move elements in this view, drag elements to the desired location.

Step 11 To move all of the ports and switches in the service, choose **Select All** and drag the service within the window.

Step 12 You can save the current layout as the default, or revert to the default, or revert to the layout that PSM automatically generates.

- a) To save the current layout as the default layout for this service, right-click the background and select **Save Layout as Default**.

Note You must have administrator privileges to execute this command.

Once the current layout is saved as the default, subsequent users who visualize this service will be able to see the current layout.

- b) To reset the current layout to the default, right-click the background and select **Reset Layout to Default**.
- c) To reset the current layout to the layout that PSM automatically generates, right-click the background and select **Reset Layout**.


Step 13 To save the service screen view as an image:

- a) Select **Save Service Image**.
The Save Service Image dialog appears.
- b) Navigate to the desired folder and enter the filename.
The default file format is png. To save the file in jpg format, enter .jpg at the end of the filename.
- c) Click **Save**.

You have successfully completed this procedure.

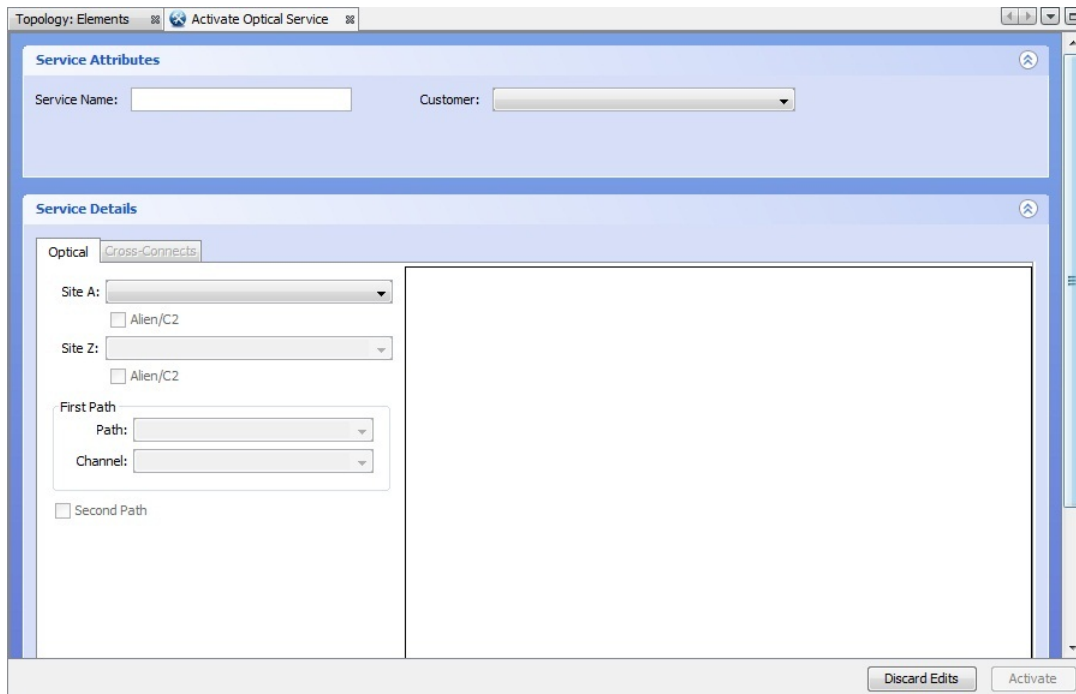
9.3 Activating an optical service on a BTI 7000 Series network

Use this procedure to configure and activate an optical service between BTI 7000 Series optical ports across a BTI 7000 Series network. The BTI 7000 Series optical network is called the BTI 7000 Series Dynamic Optical Layer (DOL).

Step 1 Select **Tools > Service Activation > Optical > Ports**. Alternatively, click the **Service Activation**  button on the toolbar, and select **Optical > Ports**.

Optical ports service activation is used when the specified endpoints are ports on optical equipment, such as a service between BTI 7000 Series DOL endpoints.

The Activate Optical Service panel opens.



Step 2 In the Service tab, enter the required information as described in the following table.

Table 9-3 Fields on the Activate Optical Service dialog

Field	Description	Required field?
Service Name	User-defined name that uniquely identifies the service.	Yes
Customer	Select from the drop-down list. To add a customer to the list, select Edit>Add Customer from the main menu.	Optional
Site A	Choose from a drop-down menu of existing sites.	Yes
Site Z	Choose from a drop-down menu of existing sites.	Yes

Table 9-3 Fields on the Activate Optical Service dialog (Continued)

Field	Description	Required field?
Alien/C2	When selected, the service is not provisioned to add or drop on the multiplexer/demultiplexer, but on the Alien/C2 port of the ROADM module. Note This option is not available for selection in a split ROADM node. In a split ROADM node, the Alien/C2 interface is used to connect the ROADM modules together and cannot be configured for Add/Drop wavelengths.	Optional
Path	Choose from a drop-down list of possible paths from Site A to Site Z. Each path has the following format: <code><Site A> to <Site Z> [via <Site N1>[; <Site N2>[;...]]]</code> where <Site Nx> represents a decision point for a ROADM with more than two degrees. Each decision point specifies the incoming and outgoing degrees for the path through that NE. See 9.3.1, “Examples of path selection in a BTI 7000 Series optical network”. Note By default, the maximum number of spans that a path can have is 10. If your path requires more than 10 spans, contact BTI Support to increase this limit.	Yes
Channel	Choose from a drop-down list of existing channels.	Yes
Second Path	When selected, the Path and Channel for the protected path can be specified. This selection is greyed out if no alternative path exists.	Optional

Step 3 Click Activate.

Note You must wait for the activation tasks to complete before performing any other operation on the NEs affected by this activation.

You have successfully completed this procedure.

9.3.1 Examples of path selection in a BTI 7000 Series optical network

When you activate an optical service, you need to select the first (primary) path and channel, and optionally the second (protected) path and channel between the service endpoints. All paths and channels are selected from drop-down menus in the **Activate Optical Service** dialog. The drop-down menus list all the valid possibilities. A second path can only be selected if an alternative path exists. Otherwise the **Second Path** check box is greyed out and cannot be selected.

The path itself may contain decision points. A decision point refers to the decision that needs to be made when traversing ROADM nodes with more than 2 degrees. When more than 2 degrees exist, there can be multiple outgoing degrees for each incoming degree. The decision point qualifies the path by specifying the incoming and outgoing degrees through these nodes.

Selecting paths and channels

Figure 9-1 shows the selection of the first path and channel for a service between NEW-YORK and MIAMI. The topology is a ring with 2-degree ROADMs in NEW-YORK, MIAMI, and DALLAS, and a line amplifier node in CHICAGO. The first path is chosen to be the shortest path around the ring.

Figure 9-1 Selecting the first path and channel

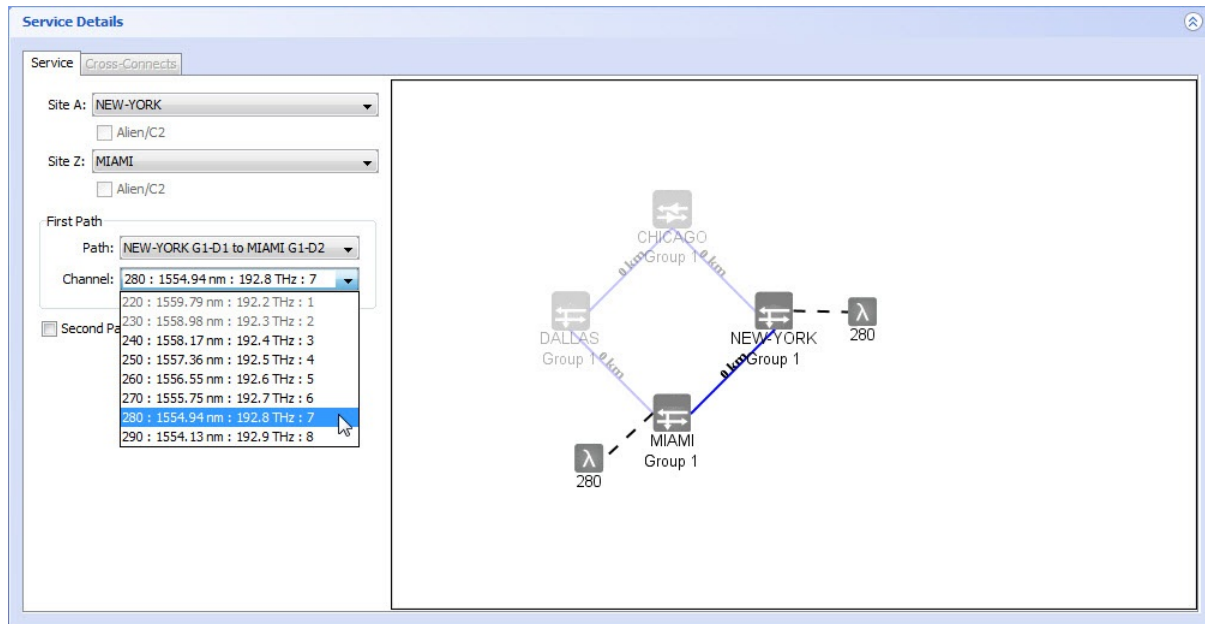
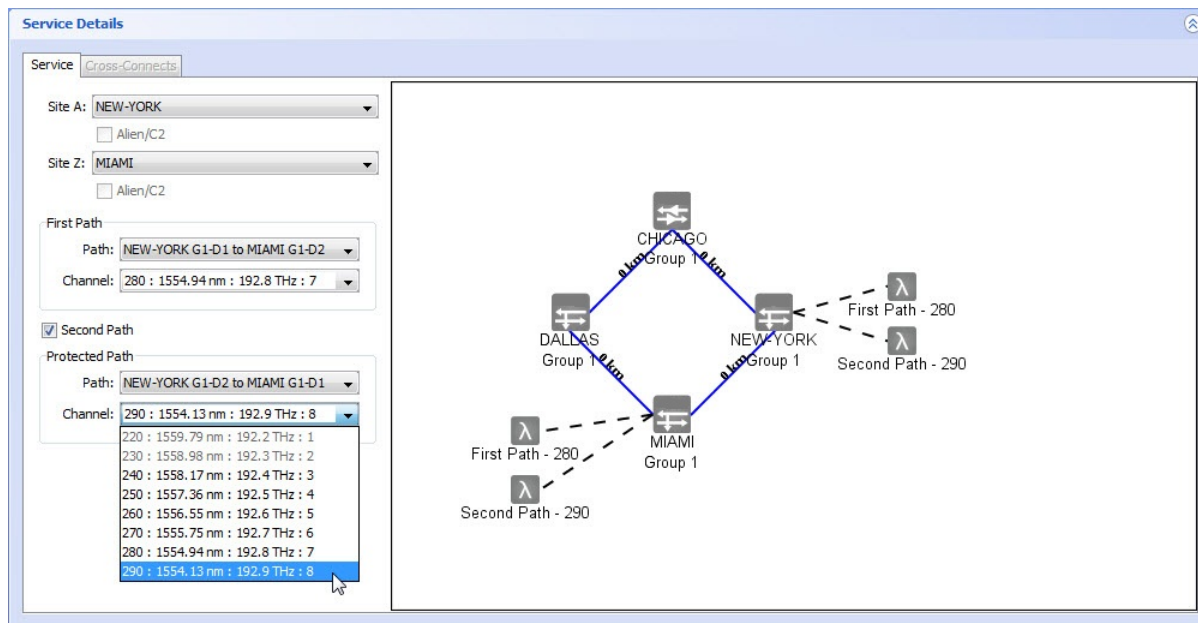
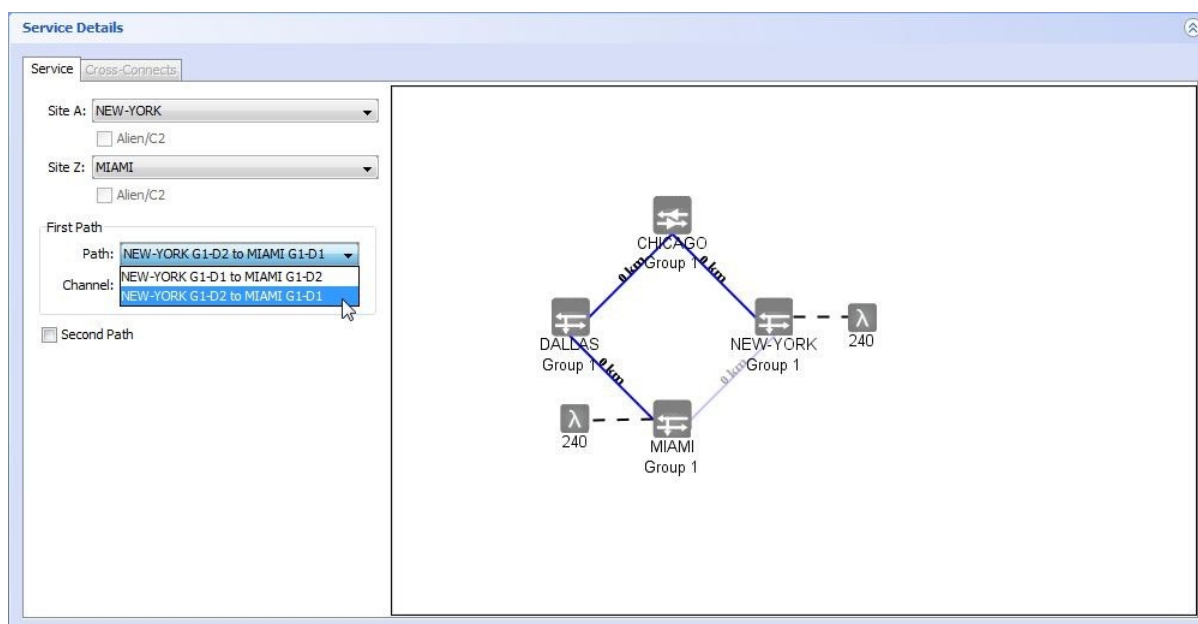


Figure 9-2 shows the selection of the second path and channel. In this topology, a second path is possible via CHICAGO and DALLAS.

Figure 9-2 Selecting the second path and channel

Selecting a path with no decision points

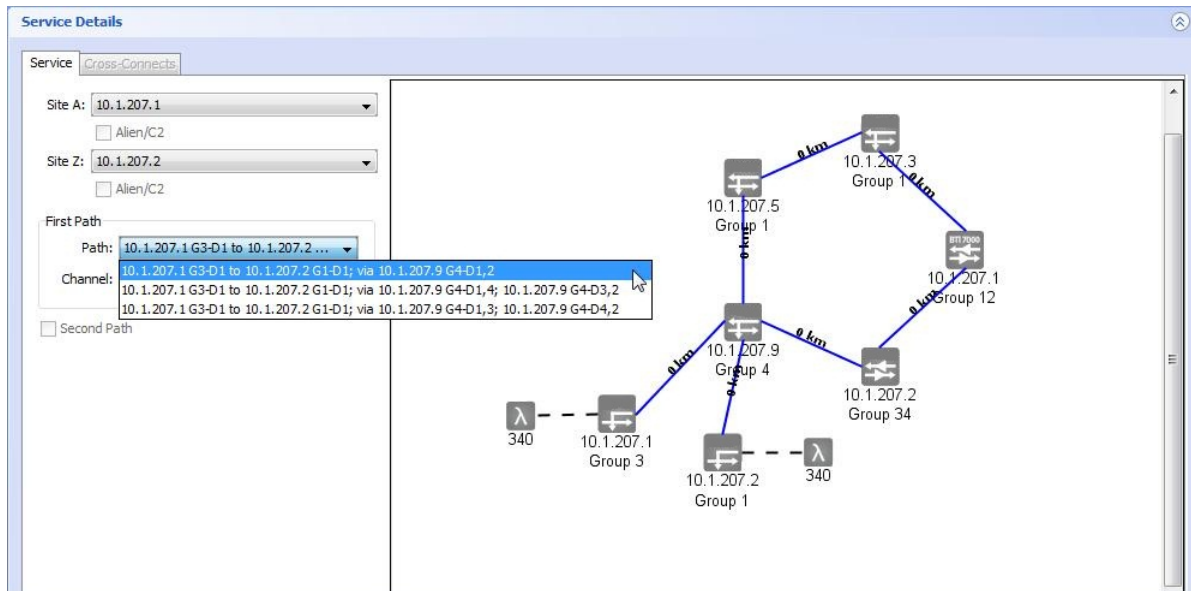
Figure 9-3 shows the selection of a path with no decision points. The topology is a ring with 2-degree ROADMs in NEW-YORK, MIAMI, and DALLAS, and a line amplifier node in CHICAGO. The path merely specifies the start and end points.

Figure 9-3 Selecting a path with no decision points

Selecting a path with one decision point

Figure 9-4 shows the selection of a path with one decision point. A 4-degree ROADM is at 10.1.207.9 while the other sites contain 2-degree ROADMs. The decision point is at 10.1.207.9 going from degree 1 to degree 2, representing the most direct path between 10.1.207.1 and 10.1.207.2.

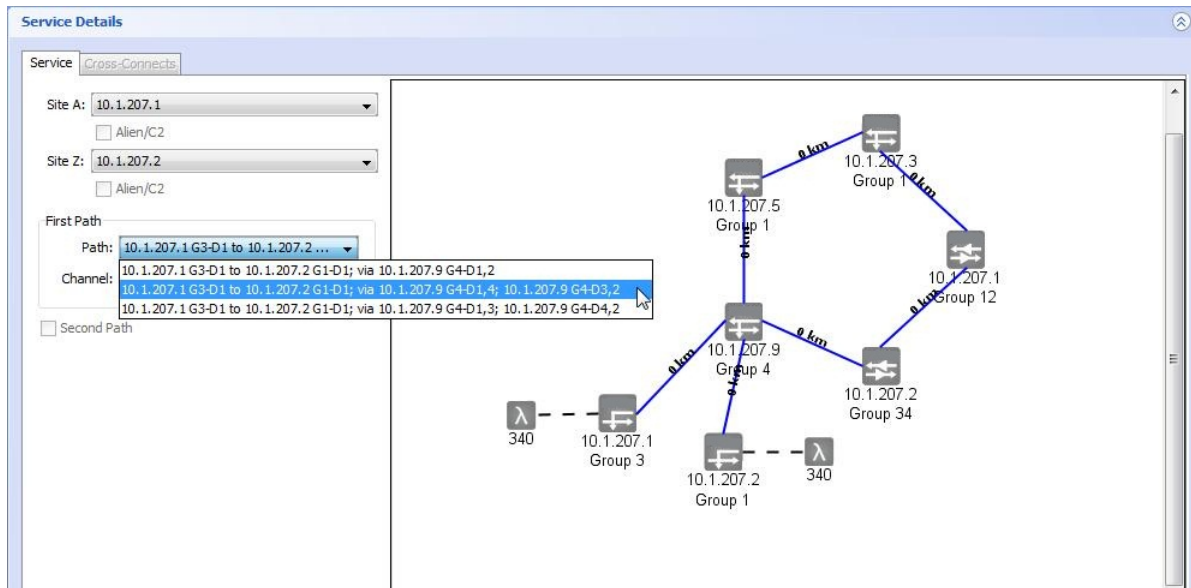
Figure 9-4 Selecting a path with one decision point



Selecting a path with two decision points

Figure 9-5 shows the selection of a path with two decision points. The first decision point is at 10.1.207.9 going from degree 1 to degree 4 traversing the ring in one direction, and the second decision point is at 10.1.207.9 going from degree 3 to degree 2, re-entering the 4-degree ROADM from the other side of the ring.

Figure 9-5 Selecting a path with two decision points









9.4 Viewing the optical services table

You can view a list of the optical services with information such as Customer, Service Name, Channel, Site A, Site Z, End-To-End State, Intermediate Nodes, and more.

Step 1 To view the optical services table, from the main menu choose **View > Optical > Services**.

The Optical Services tab is displayed.

Topology: Network Element Groups		Optical Services				
Customer	Service Name	Channel	Site A	Site Z	End-To-End State	Intermediate Nodes
 DC1	VideoRing_PATH_A	230	NEW-YORK G1-D1	MIAMI G1-D2	Up	
 DC1	MXPRing_PATH_B	220	DALLAS G1-D1	MIAMI G1-D2	Up	CHICAGO G1-D2, CHICAGO G1-D1,...
 DC1	MXPRing_PATH_A	220	DALLAS G1-D2	MIAMI G1-D1	Up	
 DC1		260	10.1.207.5 G1-D1	10.1.207.5 G...	Up	10.1.207.3 G1-D2, 10.1.207.3 G1-...
 DC1	VideoRing_PATH_B	230	MIAMI G1-D1	NEW-YORK G...	Up	DALLAS G1-D2, DALLAS G1-D1, CHI...
 DC1		220	10.1.207.5 G1-D1	10.1.207.5 G...	Up	10.1.207.3 G1-D2, 10.1.207.3 G1-...

Note To apply filters to this table, see [9.7, “Working with optical/transport services and topology tables”](#)

Step 2 Use the scroll bar on the right side of the window to scroll through the list of services.

9.5 Viewing the optical services per span table

You can view a list of the optical services per span with information such as Span Source, Span Far-End, Channel, Service Name, Customer Name, Service Site A, Service Site Z, Source Port State, Source Port Admin State, Far-End Port State, Far-End Port Admin State information, and more.

Step 1 To view the optical services per span table, from the main menu choose **View > Optical > Services per Span**.

The Optical Services per Span tab is displayed.

Topology: Network Element Groups									
Optical Services per Span									
Span Source	Span Far-End	Channel	Service Name	Service Site A	Service Site Z	Source Port State	Source Port Admin State	Far-End Port State	Far-End Port Admin State
CHICAGO G1-D1	NEW-YORK G1-D2	230	VideoRing_PATH_B	MIAMI G1-D1	NEW-YORK G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
DALLAS G1-D1	CHICAGO G1-D2	230	VideoRing_PATH_B	MIAMI G1-D1	NEW-YORK G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
MIAMI G1-D1	DALLAS G1-D2	230	VideoRing_PATH_B	MIAMI G1-D1	NEW-YORK G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
NEW-YORK G1-D1	MIAMI G1-D2	230	VideoRing_PATH_A	NEW-YORK G1-D1	MIAMI G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
CHICAGO G1-D1	NEW-YORK G1-D2	220	MXPRing_PATH_B	DALLAS G1-D1	MIAMI G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
DALLAS G1-D1	CHICAGO G1-D2	220	MXPRing_PATH_B	DALLAS G1-D1	MIAMI G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)
NEW-YORK G1-D1	MIAMI G1-D2	220	MXPRing_PATH_B	DALLAS G1-D1	MIAMI G1-D2	Up - NR	In-Service (IS)	Up - NR	In-Service (IS)

Note To apply filters to this table, see [9.7, “Working with optical/transport services and topology tables”](#)

Step 2 Use the scroll bar on the right side of the window to scroll through the list of services per span.

9.6 Viewing the optical topology table

You can view a table of the optical topology with information such as Source Site, Source Degree, Source Port, Far-End Site, Far-End Degree, Administrative Status, State, Span Length (km), Max. Span Loss (dB), Channel Count information, and more.

The optical topology table has a row for each end of the link – that is, for each connection shown in the topology view there are two rows in the table. If only one end of the link is discovered, only one row is displayed. This table contains the same information shown in the tool tip, but can be manipulated with the sorting and filtering functionality available for all tables.

Step 1 To view the optical topology table, from the main menu choose **View > Optical > Topology**.

The Optical Topology tab displays.

Topology: [10.1.207.5 G1-D1] to [10.1.207.5 G1-D2] - 220 Optical Services per Span Optical Topology										
Source Site	Source Group-Deg...	Source Port	Far-End ...	Far-End Group-Degree	Administrative Status	State	Span Length ...	Max. Span L...	Max. Span Lo...	Channel Count
S3N2	G1-D1	DLA-1-3-L1	10.1.104.3	G44-D3	In-Service (IS)	Up - NR	0	30.0	0.0	0
S3N2	G1-D2	DLA-1-1-L1	10.1.103.6	G1-D1	In-Service (IS)	Up - NR	51	30.0	0.0	0
NEW-YORK	G1-D1	ROB-1-9-L1	MIAMI	G1-D2	In-Service (IS)	Up - NR	0	35.0	0.0	2
NEW-YORK	G1-D2	ROB-1-15-L1	CHICAGO	G1-D1	In-Service (IS)	Up - NR	0	30.0	0.0	2
NEW-YORK	G0-D0	MXP-1-3-L1				Down - ...	null			null
NEW-YORK	G0-D0	MXP-1-3-C3				Down - ...	null			null
MIAMI	G1-D1	ROB-1-7-L1	DALLAS	G1-D2	In-Service (IS)	Up - NR	0	35.0	0.0	2
MIAMI	G1-D2	ROB-1-11-L1	NEW-YORK	G1-D1	In-Service (IS)	Up - NR	0	35.0	0.0	2
DALLAS	G1-D1	ROB-1-13-L1	CHICAGO	G1-D2	In-Service (IS)	Up - NR	0	30.0	0.0	2
DALLAS	G1-D2	ROB-1-17-L1	MIAMI	G1-D1	In-Service (IS)	Up - NR	0	35.0	0.0	2

Note To apply filters to this table, see [9.7, “Working with optical/transport services and topology tables”](#)

Step 2 Use the scroll bar on the right side of the window to scroll through the optical topology details.

9.7 Working with optical/transport services and topology tables

The PSM Client can display optical/transport services, optical/transport services per span, and optical/transport topology information in table format. These tables can be manipulated to show information in different forms, depending on the need.

Sorting the tables

The tables can be sorted in the following ways:

- To sort the tables by a column, click the column title.
- To change the order (ascending or descending) of a column, click the column heading until the arrow shows ascending or descending order as desired.
- To show or hide columns, right-click the table title bar and check the column names you want to show, and uncheck the column names you want to hide in the drop-down menu. Different tables have different column selections. [Figure 9-6](#) shows the column selections for the optical topology table.

Figure 9-6 Optical topology column selection

Topology: Elements		Optical Topology			
Source Site Name	Source Group-Degree	Source Port	Far End Site Name	Far End Group-Degree	Administrative Status
Chicago	G1-D1	DLA-1-3-L1	NewYork	G1-D2	In-Service (IS)
Chicago	G1-D2	DLA-1-4-L1	10.10.20.100	G1-D1	In-Service (IS)
Dallas	G1-D1	ROB-1-7-L1	10.10.20.100	G1-D4	In-Service (IS)
Dallas	G1-D2	ROB-1-15-L1	Miami	G1-D1	In-Service (IS)
Kanata-B103	G1-D1	DLA-1-1-L1	10.127.210.22	G1-D2	In-Service (IS)
Kanata-B103	G1-D2	DLA-1-2-L1	10.127.11.21	G1-D1	In-Service (IS)
Miami	G1-D1	ROB-1-7-L1	Dallas	G1-D2	In-Service (IS)
Miami	G1-D2	ROB-1-11-L1	10.10.20.100	G1-D3	In-Service (IS)

Filtering the tables

The optical information tables behave as follows:

- If there is no filtering applied, the window title reflects the table being displayed, for example "Optical Topology".
- If a filter is applied, the title changes to indicate the presence of the filter, for example "Optical Topology (Filtered)".
- Each time a new entity or filter is chosen, the previous filtering is cleared and the tables display the entries that pertain to the newly chosen criteria.

To filter the tables to show only a particular set of entries, right-click a cell in the column of the table that has the data you want to filter with, and choose the filter option **Show only rows where** to filter out (hide) all other entries from the table. In the following screen for the optical services per span table, the filter chosen is to show only entries using channel 230.

Topology: [10.1.207.5 G1-D1] to [10.1.207.5 G1-D2] - 220				Optical Services per Span	Optical Services	Activate Optical Service
Span Source	Span Far-End	Channel	Service Name	Service Site A	Service Site Z	Source P...
CHICAGO G1-D1	NEW-YORK G1-D2	230	VideoRing_PATH_B	MIAMI G1-D1	NEW-YORK G1-D2	Up - NR
DALLAS G1-D1	CHICAGO G1-D2	230	VideoRing_PATH_B	MIAMI G1-D1	NEW-YORK G1-D2	Up - NR
MIAMI G1-D1	DALLAS G1-D2	230		MIAMI G1-D1	NEW-YORK G1-D2	Up - NR
NEW-YORK G1-D1	MIAMI G1-D2	230		NEW-YORK G1-D1	MIAMI G1-D2	Up - NR
CHICAGO G1-D1	NEW-YORK G1-D2	220		AMI G1-D2		Up - NR
DALLAS G1-D1	CHICAGO G1-D2	220	MXPring_PATH_B	AMI G1-D2		Up - NR
NEW-YORK G1-D1	MIAMI G1-D2	220	MXPring_PATH_B	AMI G1-D2		Up - NR
DALLAS G1-D2	MIAMI G1-D1	220	MXPring_PATH_A	AMI G1-D1		Up - NR
10.1.207.1 G12-D2	10.1.207.2 G34-D1	260		.1.207.5 G1-D2		Up - NR
10.1.207.1 G12-D2	10.1.207.2 G34-D1	220		.1.207.5 G1-D2		Up - NR
10.1.207.2 G34-D2	10.1.207.9 G4-D3	260		.1.207.5 G1-D2		Up - NR
10.1.207.2 G34-D2	10.1.207.9 G4-D3	220		10.1.207.5 G1-D1	10.1.207.5 G1-D2	Up - NR

Note The **View** and **Delete** options in the right-click menu are not filtering options. **View** brings up the "Service Attributes" and "Service Details" panels, and **Delete** deletes the optical service.

To remove filtering, right-click any cell in the table and choose **Show only rows where>No Filter**.

9.8 Updating an optical service

Use this procedure to change the service name and customer of an activated optical service.

Step 1 On the Network tree, double-click the service you want to update. Alternatively, select the service, right-click and choose **View**.

The Service Attributes window opens.

Step 2 Modify the Customer or Service Name.

Step 3 Click **Apply**.

The optical service is updated. If you update an optical service that is supporting a transport service between MX Series router endpoints, the transport service is updated implicitly.

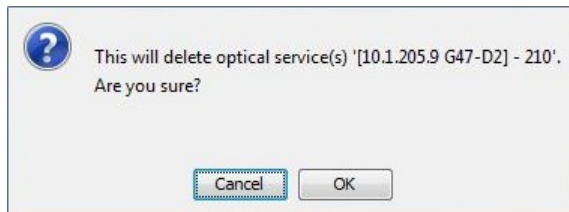
9.9 Deleting an optical service

Use this procedure to delete an optical service.

When a service is deleted, the associated modules and ports remain in the UP state.

Step 1 In the Network tree, right-click an optical service and choose **Delete**.

An information window opens asking for confirmation.



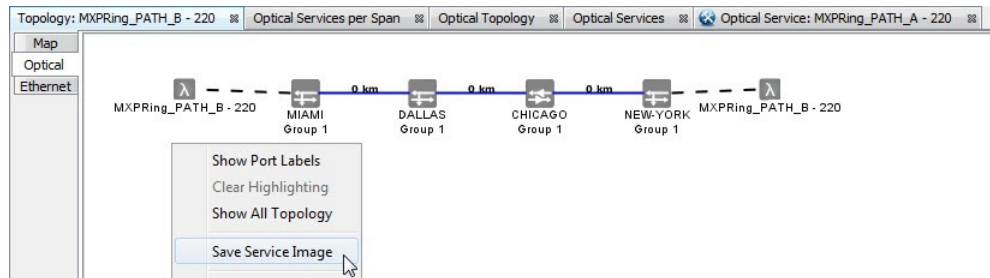
Step 2 Click **OK**.

The optical service is deleted from the network elements and the PSM server. If you delete an optical service that is supporting a transport service between MX Series router endpoints, the transport service is deleted implicitly.

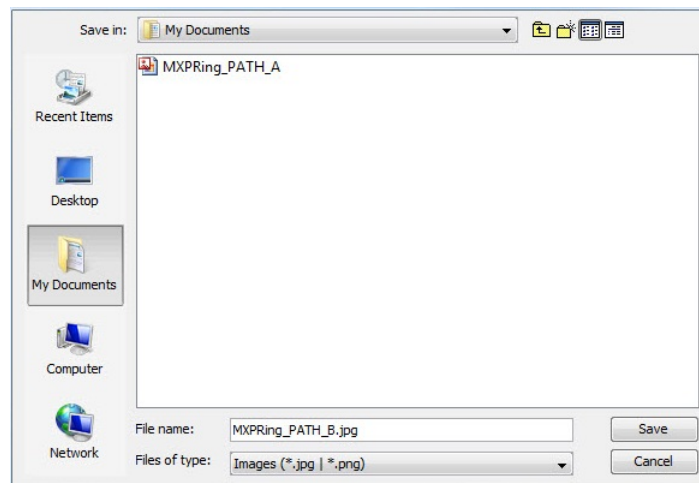
9.10 Saving a service image

Use this procedure to save the service screen view to either a jpg or png image file. The default file format is .png. To save the file in jpg format, enter .jpg at the end of the file name.

Step 1 In the main window, right-click and choose **Save Service Image**.



The windows file explorer window appears.



Step 2 Navigate to the desired folder, specify a file name, and click **Save**.

Your service view is saved as an image.

9.11 Viewing real-time optical service PMs

Use this procedure to enable and view real-time PMs for optical services on BTI 7000 Series network elements. The PMs are displayed in both textual and graphical formats.

PSM supports the following BTI 7000 Series optical service PMs:

Table 9-4 BTI 7000 Series Optical Service PMs

Description	Port PMs	OSC PMs	Service Channel PMs
Instantaneous optical power received	Yes	No	No
Minimum optical power received	Yes	No	No
Maximum optical power received	Yes	No	No
Average optical power received	Yes	No	No
Optical power loss received	Yes	No	No
Standard deviation power received	Yes	No	No
Instantaneous optical power transmitted	Yes	No	No
Minimum optical power transmitted	Yes	No	No
Maximum optical power transmitted	Yes	No	No
Average optical power transmitted	Yes	No	No
Optical power loss transmitted	Yes	No	No
Standard deviation power transmitted	Yes	No	No
OSC optical power received	No	Yes	No
OSC optical power transmitted	No	Yes	No
Code violations	No	Yes	No
Errored seconds	No	Yes	No
OSC optical back-reflected power	No	Yes	No
Severely errored framing seconds	No	Yes	No
Severely errored seconds	No	Yes	No
Unavailable seconds	No	Yes	No
Instantaneous channel power received	No	No	Yes
Minimum channel power received	No	No	Yes
Maximum channel power received	No	No	Yes
Instantaneous channel power transmitted	No	No	Yes
Minimum channel power transmitted	No	No	Yes
Maximum channel power transmitted	No	No	Yes

Step 1 To enable real-time PMs, right-click on an optical service in the tree view or in the background of an optical service topology view, and choose one of the following:

- **Enable Realtime PMs>Port**
- **Enable Realtime PMs>OSC**

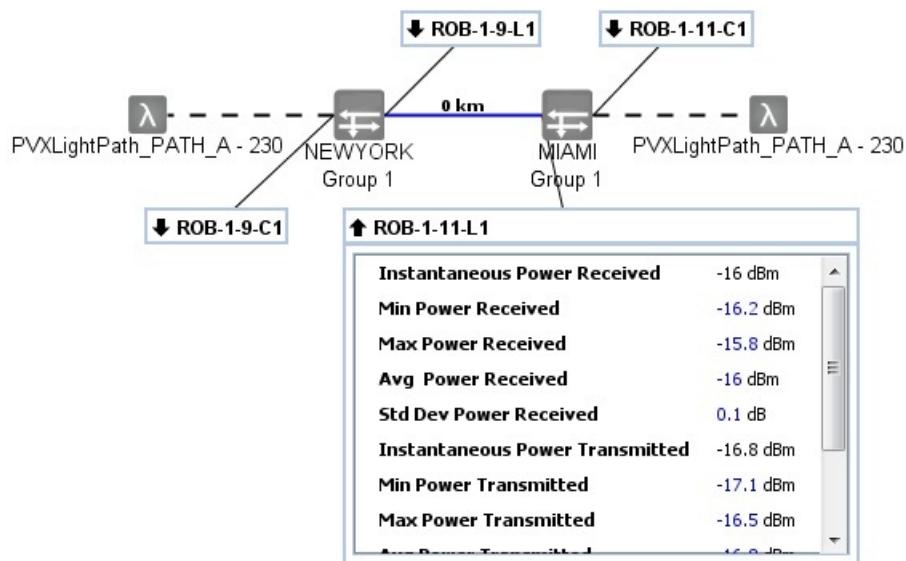
- **Enable Realtime PMs>Service Channel**
- **Enable Realtime PMs>All Channels**

Real-time PM collection for the optical service is started, and a PM data widget title bar is displayed for each PM collection point. Additionally, a graphical view displaying the instantaneous power along with the detected power range is provided at the bottom of the screen.

Note When you enable PMs on a stranded service⁷, you may see PM data widgets that do not have lines connecting them to the network elements. This behavior is normal.

Step 2 Click the PM data widget title bar to show or hide the PM data.

Figure 9-7 Real-time PMs port view



⁷ A service is stranded if one or more segments in the path between the service endpoints has not been configured.

Figure 9-8 Real-time PMs OSC view

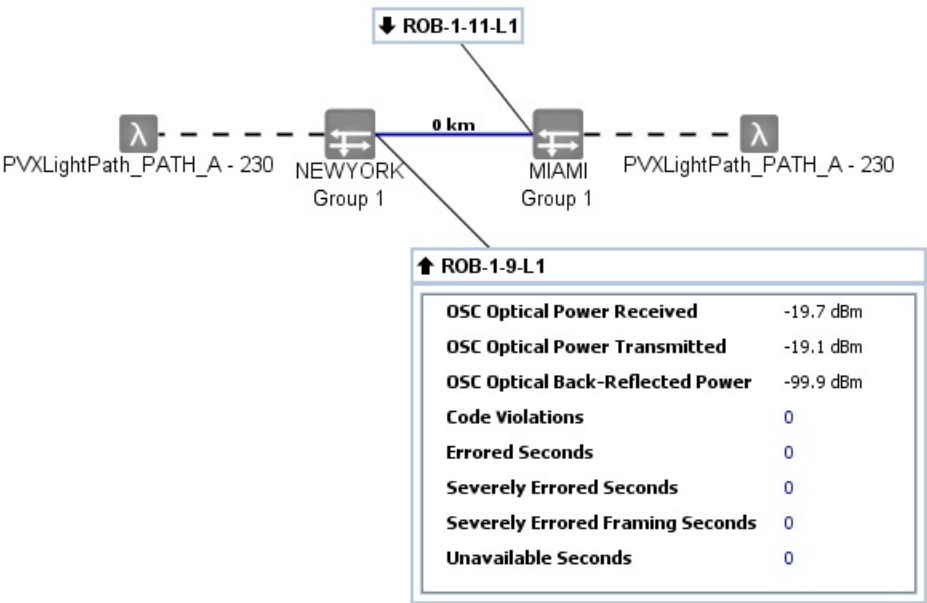


Figure 9-9 Real-time PMs service channel view

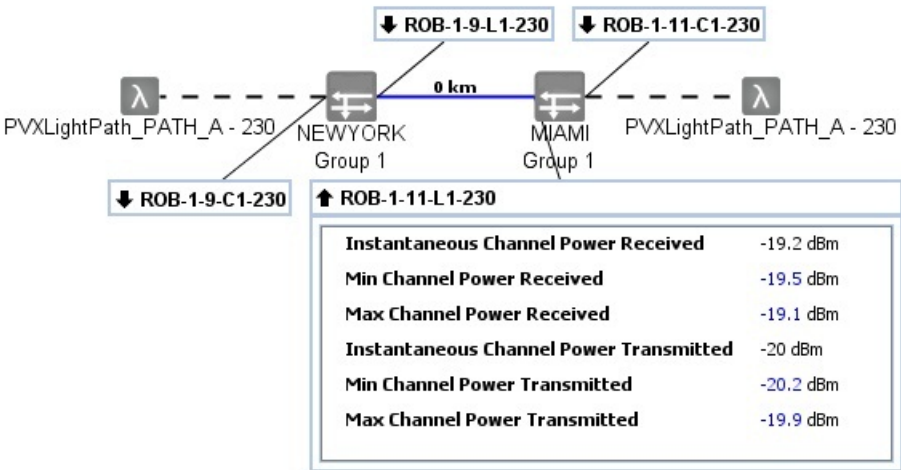
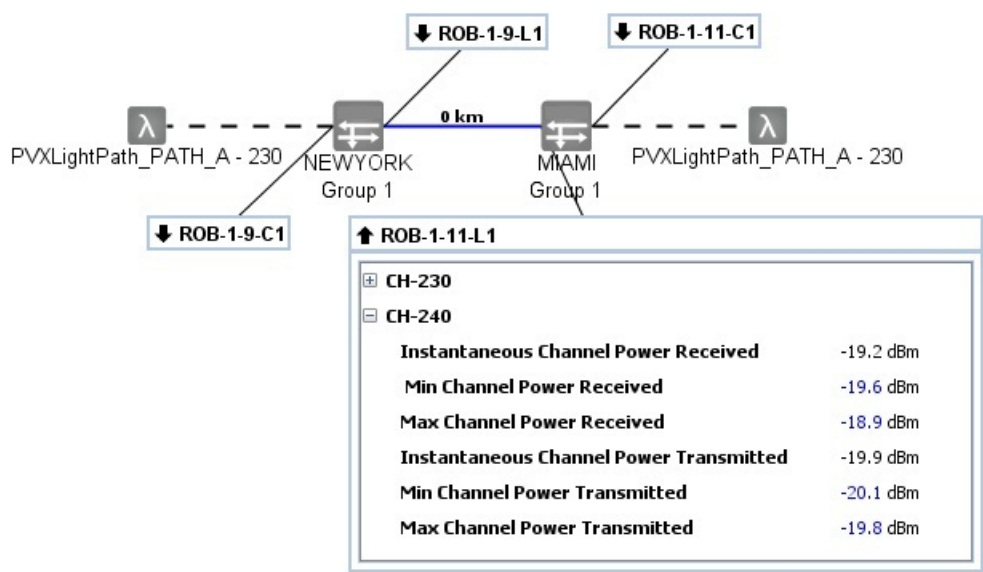


Figure 9-10 Real-time PMs all channels view



Step 3 To undock the graph to its own window, right-click on the tab in the graph window and select **Undock**.

The graph appears in a window that you can reposition and resize.

Figure 9-11 Real-time PMs port view graph

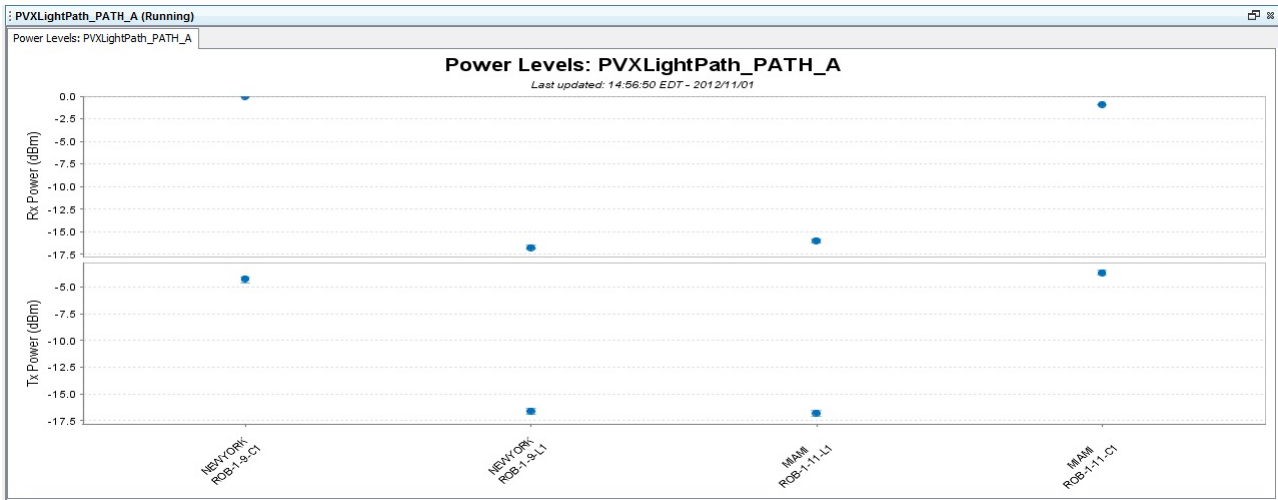


Figure 9-12 Real-time PMs OSC view graph

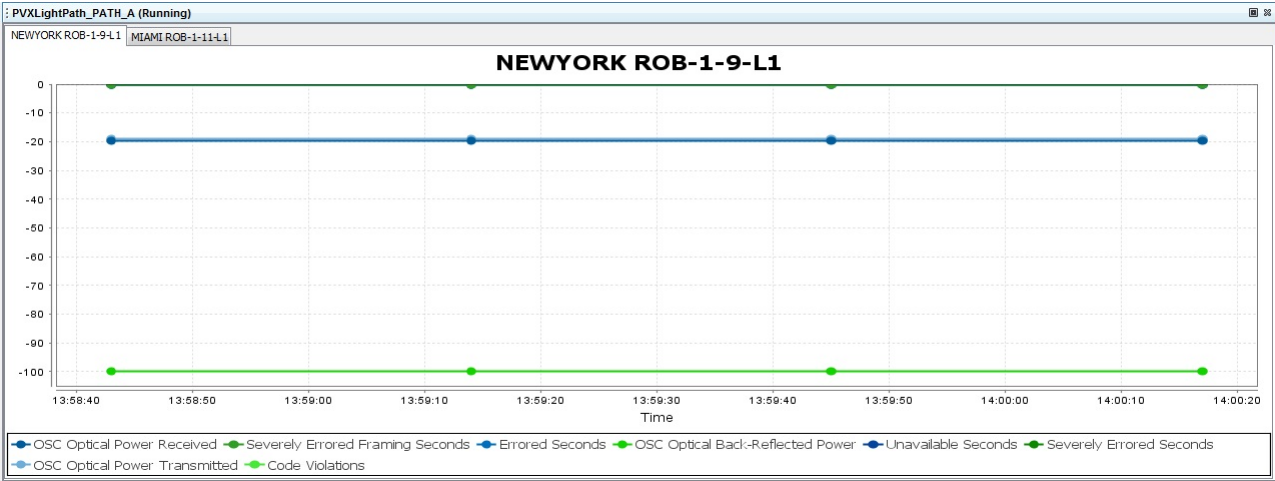


Figure 9-13 Real-time PMs service channel view graph

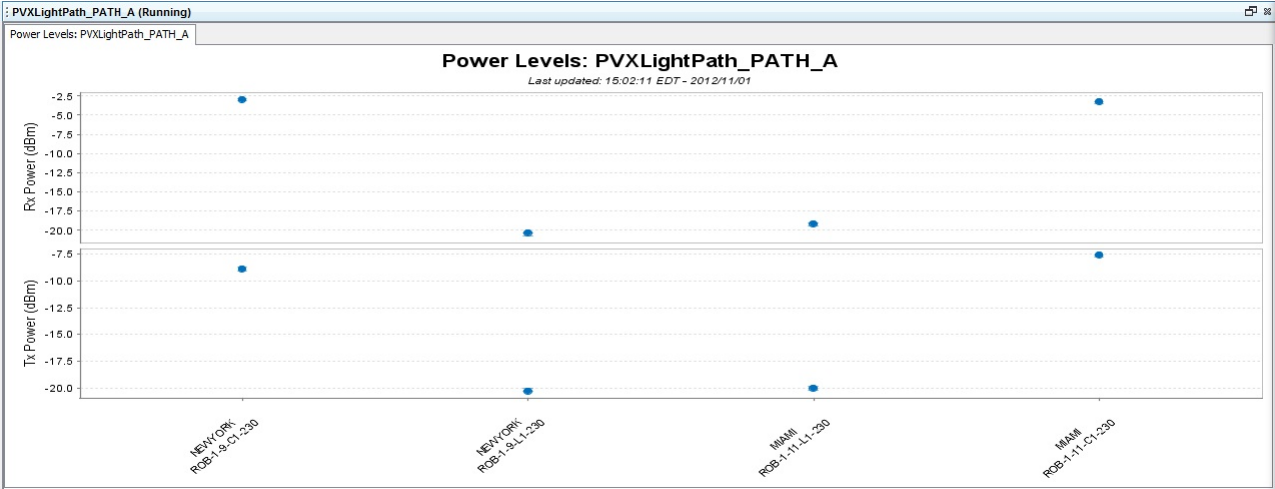
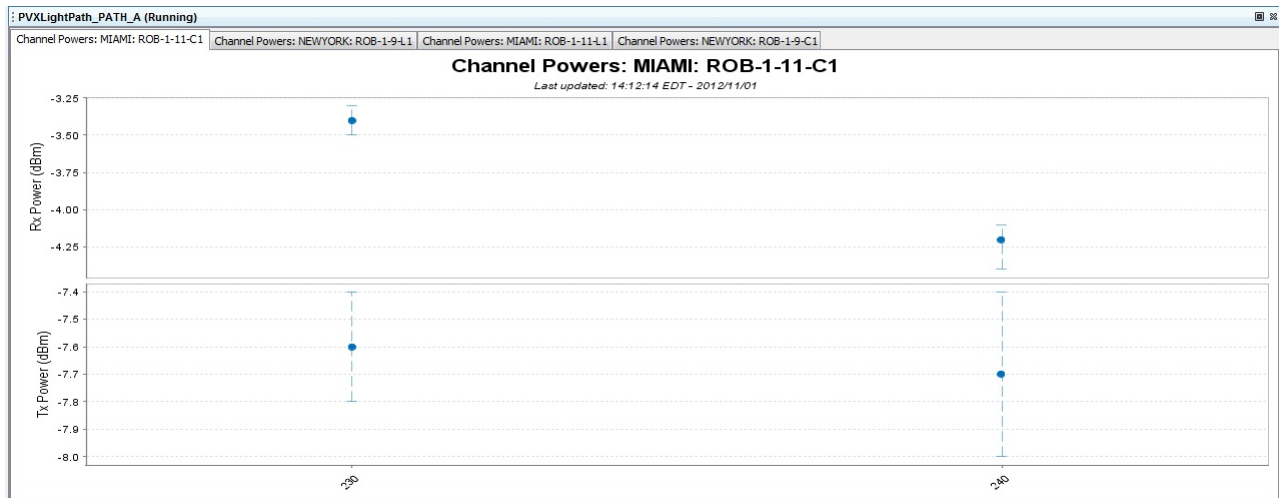
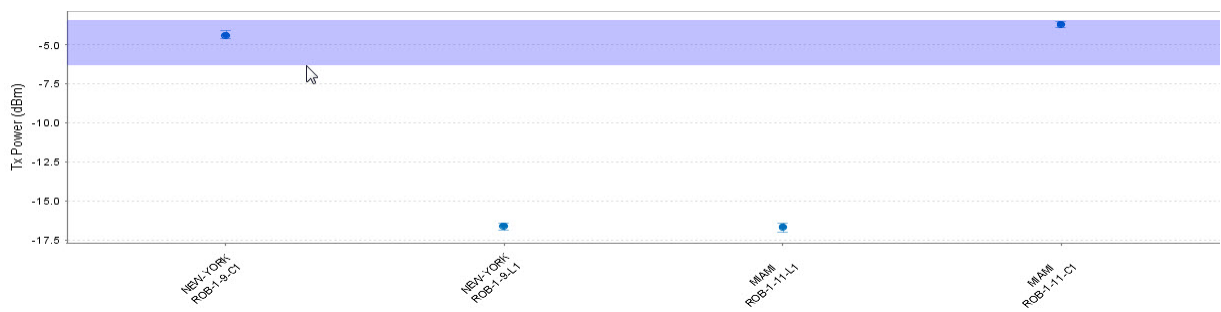


Figure 9-14 Real-time PMs all channels view graph

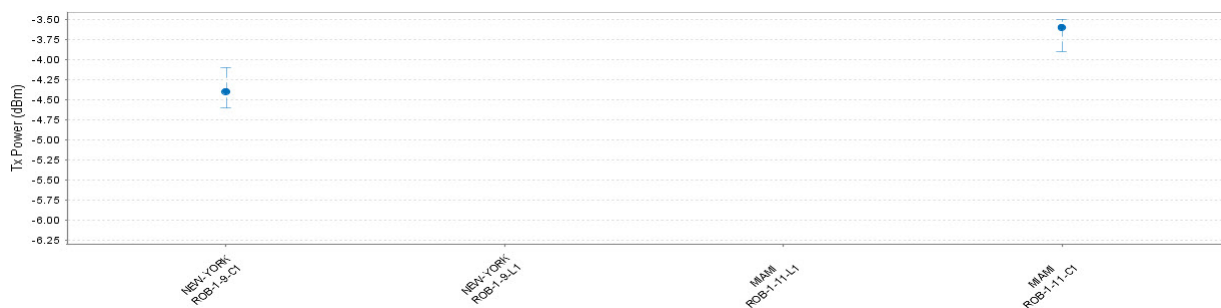


Note The information displayed on the domain (horizontal) axis of the real-time PMs all channels graph is selectable. See the "proNX Service Manager User Guide" for details on how to select what is shown.

Step 4 To change the range (vertical) scale of the graphs, highlight the desired area by left-clicking and dragging the mouse to highlight the area of focus, and release.



Repeat until the desired magnification is achieved.



Note You can also change the scale by right-clicking on a graph, and selecting **Zoom In** or **Zoom Out**.

Step 5 To turn off real-time PMs, right-click in the optical services topology window and choose **Disable Realtime PMs**.



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