



## PRODUCT DOCUMENTATION

### *BTI 7000 Series Multiplexing Solutions Guide*

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# Preface

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

## Audience

This guide is primarily intended for technicians and network operations center (NOC) staff.

## 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

**BTI 7000 Series common equipment (Continued)**

<b>Equipment</b>	<b>PEC</b>
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 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**

<b>proNX Management Suite</b>
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
<b>FDA</b>	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.
<b>FCC</b>	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.
<b>Industry Canada</b>	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 TLI 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
<b>Note</b>	Means reader take note. Notes contain helpful suggestions or background information.
 <b>Caution</b>	Means reader be careful. Equipment damage or loss of data can result from your actions.
 <b>Warning</b>	Means reader be careful. Harm to yourself or others can result from your actions.
 <b>Laser Warning</b>	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 Multiplexing portfolio

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This section identifies the CWDM and DWDM Multiplexing modules that the BTI 7000 Series supports, and provides information about software release compatibility.

- 1.1, “[Multiplexing modules](#)”

## 1.1 Multiplexing modules

**Table 1-1 Optical Multiplexers**

Modules	PEC	System software introduced
<b>Passive multiplexing modules</b>		
1-Channel DWDM Optical Add/Drop Module	BP1A36AA	7.1.0
Double 1-Channel CWDM OADM/Double OSC Coupler Splitter	BP1A32CA	7.1.0
4-Channel CWDM Mux/Demux, Channel 1 - 4		7.1.0
4-Channel CWDM Mux/Demux, Channel 5 - 8	BP1A33BB	7.1.0
4-Channel CWDM Mux/Demux, Channel 9 - 12	BP1A33BC	7.1.0
4-Channel CWDM Mux/Demux, Channel 13 - 16	BP1A33BD	7.1.0
4-Channel CWDM Mux/Demux, Channel 1 - 4, LC (without inventory)		
4-Channel CWDM Mux/Demux, Channel 5 - 8, LC (without inventory)		
4-Channel CWDM Mux/Demux, Channel 9 - 12, LC (without inventory)		
4-Channel CWDM Mux/Demux, Channel 13 - 16, LC (without inventory)		
32-Channel DWDM Mux/Demux Module 1	BP1A35AA	7.1.0
32-Channel DWDM Mux/Demux Module 2	BP1A35AB	7.1.0
32-Channel DWDM Mux/Demux Module 3	BP1A35AC	7.1.0
32-Channel DWDM Mux/Demux Module 4	BP1A35AD	7.1.0
32-Channel DWDM Bidirectional Mux/Demux (Mux Band 1, Demux Band 2)	BP1A35DA-12	7.1.0
32-Channel DWDM Bidirectional Mux/Demux (Mux Band 2, Demux Band 1)	BP1A35DA-21	7.1.0
32-Channel DWDM Bidirectional Mux/Demux (Mux Band 4, Demux Band 2)	BP1A35DA-42	7.1.0
32-Channel DWDM Bidirectional Mux/Demux (Mux Band 2, Demux Band 4)	BP1A35DA-24	7.1.0
2-Channel DWDM OADM	BP1A36AB	7.1.0
4-Channel DWDM OADM	BP1A36AC	7.1.0
4-Channel DWDM OADM, BTI Channels E1, E3, E5, E7	BP1A36BC	7.1.0
<b>Coupler/Splitter modules</b>		
1310 nm and C-Band Coupler/Splitter	BP1A38AA	7.1.0
CWDM + DWDM Splitter Combiner	BP1A30AA	7.1.0
DWDM Bidirectional Coupler/Splitter	BP1A39CA	7.1.0
Single 50/50 Coupler/Splitter	BP1A39DA	7.1.0

**Table 1-1 Optical Multiplexers (Continued)**

<b>Modules</b>	<b>PEC</b>	<b>System software introduced</b>
<b>Multiplexer/Demultiplexer passive shelves</b>		
40-Channel DWDM Mux/Demux	BT7A37AA	7.1.0
40-Channel DWDM Mux/Demux (ETSI)	BT7A37CA	7.1.0
96-Channel DWDM Mux/Demux	BT8A96MD01-I02	10.3
96-Channel DWDM Mux/Demux (ETSI)	BT8A96MD02-I02	10.3
96-Channel DWDM Mux/Demux (FMD96)	BT8A78MD03	13.2





## 2.0 Multiplexing features

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This section provides information about the features of the Multiplexing module portfolio and the 40-channel and the 96-channel DWDM Mux/Demux.

- [2.1, “Multiplexing module features”](#)
- [2.2, “40-Channel DWDM Mux/Demux features”](#)
- [2.3, “96-Channel DWDM Mux/Demux features”](#)
- [2.4, “CWDM wavelength plan”](#)
- [2.5, “40-channel DWDM wavelength plan”](#)
- [2.6, “96-channel DWDM wavelength plan”](#)

## 2.1 Multiplexing module features

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The Multiplexing portfolio offers a complete suite of CWDM, DWDM, multiplexing, demultiplexing and optical Add/Drop modules.

- Module size:
  - 32-Channel DWDM Mux/Demux modules 1 to 4: Double-width slot
  - All other modules: Single slot
- Supported platforms:
  - BTI 7060,
  - BTI 7030,
  - BTI 7020 (CWDM and DWDM Mux/Demux modules only)
- CWDM and DWDM Mux/Demux and OADM configurations available
- Scalable to 32-channel DWDM, 16-channel CWDM
- CWDM to DWDM hybrid configurations
- Optional bidirectional single fiber solution
- C-band red/blue filter to maximize optical reach performance
- Full inventory management visibility
- Expansion port for cascading and hitless in-service upgrades
- DWDM, CWDM, multiplexing, demultiplexing and optical Add/Drop modules are environmentally hardened for outside plant (OSP) operations, meeting the Telcordia GR-3108 OSP requirement for extended temperature.

<b>Note</b>	The 1-Channel CWDM OADM (1511 nm) and the Double 1-Channel CWDM OADM (1511 nm) are also used for the OSC channel.
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## 2.2 40-Channel DWDM Mux/Demux features

The 40-Channel DWDM Mux/Demux is a 2RU, low-loss, standalone passive optical module that provides easy access to all 40 DWDM channels at a single site. It is ideally suited for high-density, add/drop requirements in DWDM networks.

**Figure 2-1 40-Channel DWDM Multiplexing shelf**



## 2.3 96-Channel DWDM Mux/Demux features

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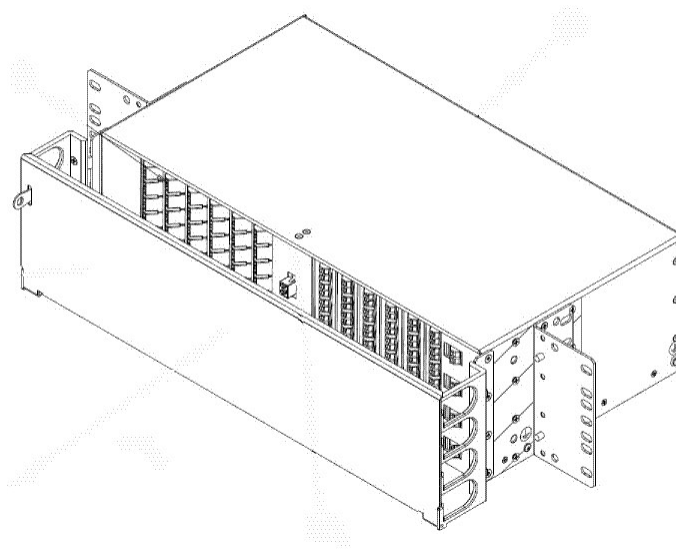
The 96-Channel DWDM Mux/Demux is a passive, rack-mounted module that is installed alongside the BTI 7000 Series shelf in a DOL node to provide local fixed grid access to all 96 wavelengths in the DWDM 50 GHz channel plan. It has a single bidirectional line port, a monitor port, and 96 bidirectional client ports with each client port carrying a different fixed wavelength.

Since this multiplexer/demultiplexer is a passive shelf, it is not equipped with a programmed inventory record (FRU data) and does not provide a communications interface to the SCP.

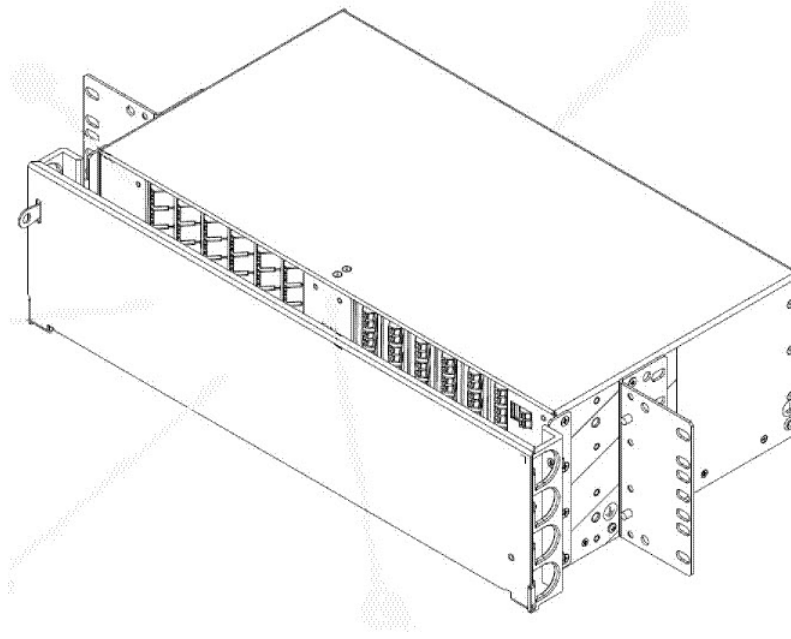
The following are the characteristics of the 96-Channel Mux/Demux:

- 96 DWDM channels
- 50 GHz spacing
- Can be represented as part of the Dynamic Optical Layer
- BT8A96MD01-I02 (ANSI), BT8A96MD02-I02 (ETSI):
  - 3U high
  - Compatible with the LGA/MGA/MGM optical amplifiers and with the 96-Channel ROB4 modules
  - Optional 1610 nm passthrough port for OSC add/drop management. You can connect a pre-amplifier or booster-amplifier to this port without requiring a separate 1610 nm filter.
- FMD96 (BT8A78MD03):
  - 2U high
  - Compatible with the 96-Channel ROB4 modules

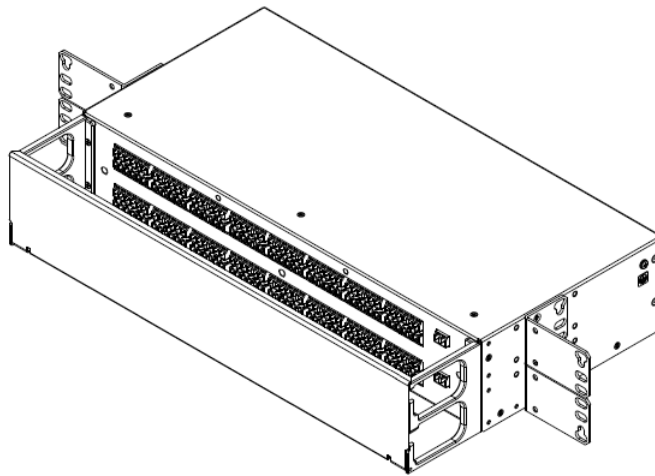
**Figure 2-2 BT8A96MD01-I02 (ANSI)**



**Figure 2-3 BT8A96MD02-I02 (ETSI)**



**Figure 2-4 FMD96 (BT8A78MD03)**



## 2.4 CWDM wavelength plan

The 4-channel CWDM multiplexer/demultiplexer modules support 4 channels in each module. The 16 wavelengths supported by the modules combined are listed in the following table.

**Note** Channels 1391 nm and 1441 nm are not supported as a result of high fiber attenuation at those wavelengths.

Table 2-1 CWDM Wavelength Plan

Available Wavelengths (nm)	Mux/Demux Modules	BTI Channel Numbers
1271	4	16
1291	4	15
1311	4	14
1331	4	13
1351	3	12
1371	3	11
1431	3	10
1451	3	9
1471	2	8
1491	2	7
1511	2	6
1531	2	5
1551	1	4
1571	1	3
1591	1	2
1611	1	1

## 2.5 40-channel DWDM wavelength plan

This DWDM wavelength plan applies to the following modules:

- 32-Channel DWDM Mux/Demux
- 32-Channel DWDM Bidirectional Mux/Demux
- 2-, and 4-Channel DWDM OADMs
- 40-Channel DWDM Mux/Demux

**Important** DWDM OADMs support only channels 1 to 32.

**Table 2-2 DWDM Wavelength Plan**

Wavelength (nm)	BTI Channel Numbers	Wavelength (nm)	BTI Channel Numbers
1529.55	E8	1545.32	E4
1530.33	32	1546.12	16
1531.12	31	1546.92	15
1531.90	30	1547.72	14
1532.68	29	1548.51	13
1533.47	28	1549.32	12
1534.25	27	1550.12	11
1535.04	26	1550.92	10
1535.82	25	1551.72	9
1536.61	E7	1552.52	E3
1537.40	E6	1553.33	E2
1538.19	24	1554.13	8
1538.98	23	1554.94	7
1539.77	22	1555.75	6
1540.56	21	1556.55	5
1541.35	20	1557.36	4
1542.14	19	1558.17	3
1542.94	18	1558.98	2
1543.73	17	1559.79	1
1544.53	E5	1560.61	E1

## 2.6 96-channel DWDM wavelength plan

The following table lists the DWDM wavelength plan for the BTI 7000 Series 96-channel Mux/Demux passive shelf:

**Table 2-3 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
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



Table 2-3 96-channel DWDM Wavelength Plan (Continued)

DOLChannel Numbers	Frequency (THz)	Wavelength (nm)
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
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

**Table 2-3 96-channel DWDM Wavelength Plan (Continued)**

<b>DOLChannel Numbers</b>	<b>Frequency (THz)</b>	<b>Wavelength (nm)</b>
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
135	191.35	1566.72

## 3.0 Multiplexing and demultiplexing applications

---

This section provides information about the applications that Optical Multiplexing modules support.

- [3.1, “Capacity expansion”](#)
- [3.2, “Fiber exhaust”](#)
- [3.3, “Single-fiber applications”](#)

## 3.1 Capacity expansion

---

CWDM and DWDM Multiplexing modules and passive shelves expand the capacity of a fiber up to 96 channels for applications such as fiber relief and overlay of new-generation services on existing fiber networks. WDM technology offers significant return on investment by combining multiple services into a single pair of fibers.

DWDM multiplexing modules are suitable for applications in which a higher number of channels is required. The DWDM infrastructure provides for more than extension, allowing any other protocol to be multiplexed into the same fiber pair. This added flexibility enables you to consolidate and scale data, voice, video, storage, and SONET/SDH infrastructures. CWDM is optimized for lower channel counts and shorter distances.

OADM capability enables deployment of a complete photonic layer, with the ability to add and drop services at intermediate sites for simple, economical, and scalable site connectivity.

## 3.2 Fiber exhaust

---

CWDM and DWDM Multiplexing modules and passive shelves can be used to overlay new broadband services and expand fiber capacity up to 96 DWDM and/or 16 CWDM channels on a single fiber pair. No changes to existing client equipment are required: mux/demux ports connect directly to CWDM or DWDM client ports, or connect to 850nm, 1310nm, 1550nm, or 1610nm client ports through a Transponder module. A CWDM to DWDM hybrid combination can be provided with the CWDM/DWDM coupler/splitter.

## 3.3 Single-fiber applications

---

The 32-Channel DWDM Bidirectional Mux/Demux and Double Bidirectional Coupler/Splitter modules provide a single-fiber, bidirectional transmission solution that meets the growing bandwidth demands of metro and regional networks.

Bidirectional transmission allows signals to be transmitted and received on one fiber, which is particularly beneficial for operators using leased dark fiber, since only one leased fiber is required instead of two. With reduced costs and optimized usage of a single fiber, this solution for fiber-constrained networks is available for both amplified and non-amplified applications.

The 32-Channel DWDM Bidirectional Mux/Demux supports up to 16 channel configurations of eight channels transmitting and receiving in each direction. Eight signals are multiplexed and demultiplexed at each site. The following band combinations are available:

- Band 1/Band 2
- Band 2/Band 4

Bands 1 and 2 are recommended in 16-channel configurations (eight channels per direction) using BTI 7000 Series single-channel amplifiers.

## 4.0 Installing Multiplexer and Demultiplexer modules

---

This section provides instructions for installing CWDM and DWDM modules, and includes the following topics:

- [4.1, “Installing Multiplexing modules”](#)
- [4.2, “Installing a 40-Channel DWDM Mux/Demux”](#)
- [4.3, “Installing a 96-Channel DWDM Mux/Demux \(BT8A96MD01-I02, BT8A96MD02-I02\)”](#)
- [4.4, “Installing a 96-Channel Fixed Mux/Demux \(BT8A78MD03\)”](#)

## 4.1 Installing Multiplexing modules

Use this procedure to install Multiplexing modules.

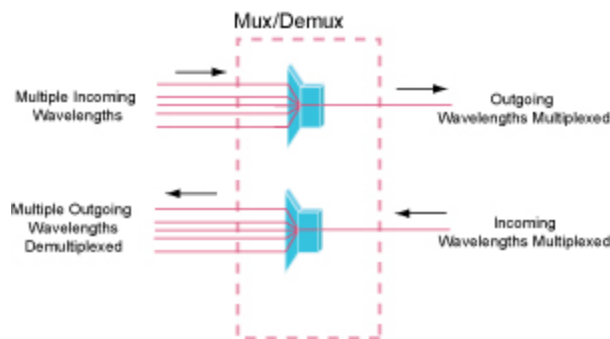
**Important** The D32BMD24 (32-Channel DWDM Bi-Directional Mux/Demux) and the D32BMD42 (32-Channel DWDM Bidirectional Mux/Demux) modules must be installed in a passive shelf only.

**Note** The connector interface supports LC connectors only.

### Typical deployment

In most cases, a multiplexer/demultiplexer is used to split and combine wavelengths, as shown in the following figure.

#### Typical deployment of a multiplexer/demultiplexer



### What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Multiplexing module
- Standard fiber cleaner (1.25 mm HUXcleaner recommended)

### Prerequisites

- For 32-Channel Mux/Demux modules, the shelf must be configured to accommodate double-width modules. See the *Common Equipment Installation Guide* for more information.



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.

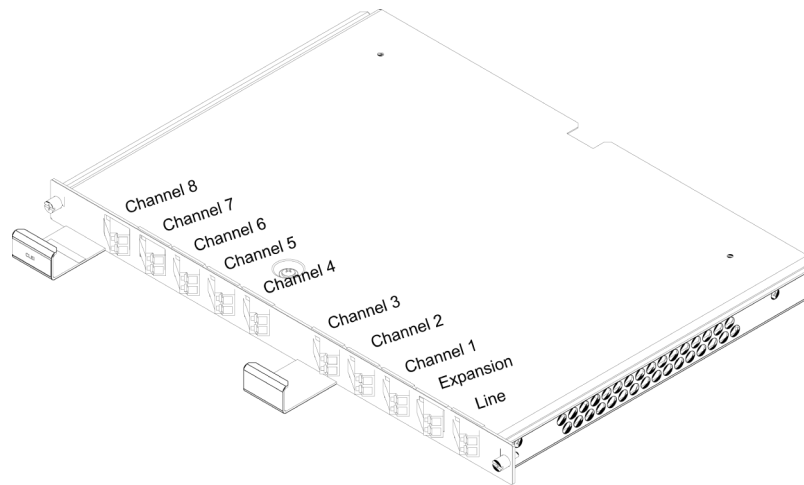


Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).



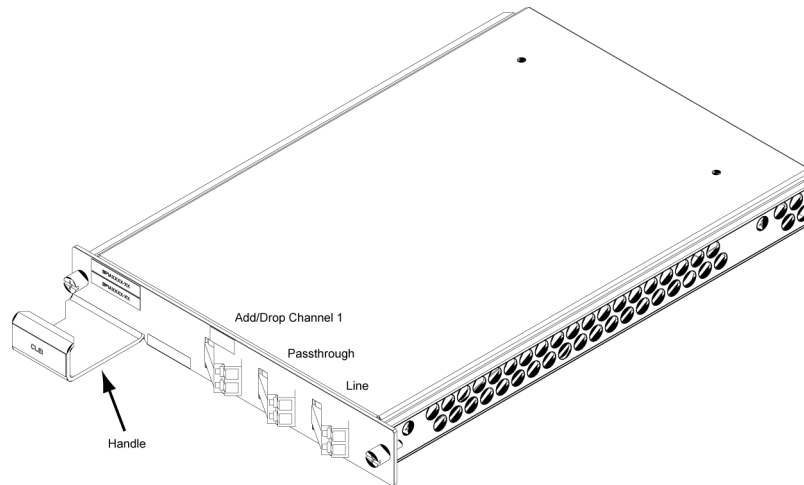
The following figure shows an 8-channel module of the 32-Channel DWDM Mux/Demux.

### 32-Channel DWDM Mux/Demux module

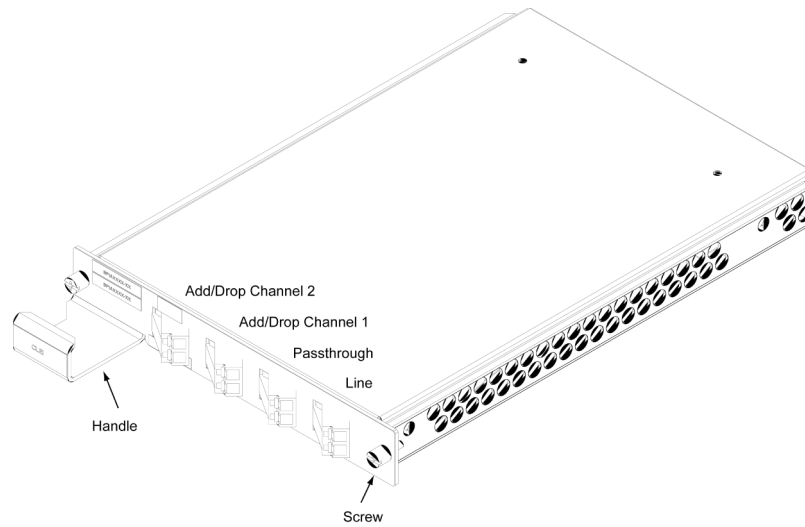


The following figures show the key physical features of the 1-Channel, 2-Channel, and 4-Channel DWDM Optical Add/Drop modules.

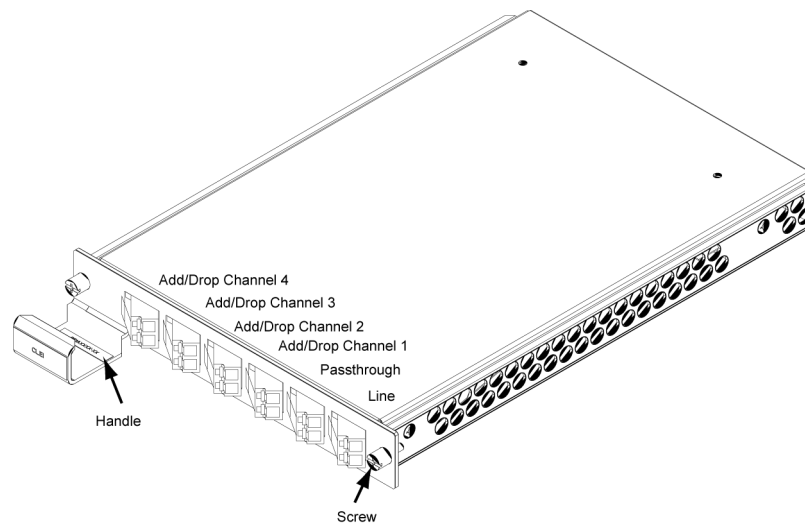
### 1-Channel OADM



## 2-Channel OADM



## 4 -Channel OADM



## Installation procedure

To install a Multiplexing modules, follow these steps:

### Step 1 Insert the module

Align the with the slot in which the module is being inserted.  
Carefully push the module straight into the slot.

### Step 2 Attach the Faceplate Screws

Facing the front of the shelf, align the module with its mounting holes.  
Using a slot-head or Phillips screwdriver, carefully tighten the faceplate screws:

- Partially tighten the first screw.

- Partially tighten the second screw.
- Fully tighten the first screw.
- Fully tighten the second screw.

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

**Step 3 Clean the Ends of the Fiber Optic Cables**

Use standard fiber cleaners to clean the ends of the fiber optic cables.

**Step 4 Connect the Optical Cables**

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

**Note** Passive multiplexing modules are shipped with port terminators on their output ports to prevent optical back reflection from occurring on unused ports. Before connecting an optical cable to an output port on a passive multiplexing module, remove the port terminator and dispose of it, and then clean the port. Do not remove a port terminator until you are ready to connect a fiber cable to it. Port terminators are intended for single-use only. Do not re-use a port terminator.

**Note** If an optical cable is removed from an output port on a passive multiplexing module, install a new port terminator on the port.

**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.

## 4.2 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:

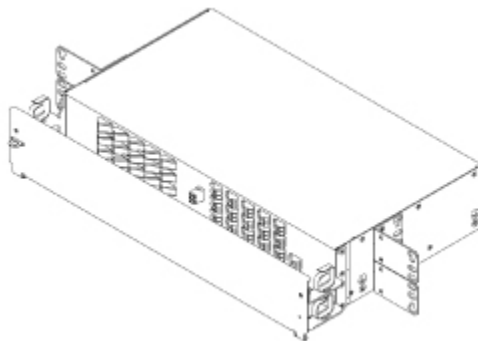
- 23-inch ANSI equipment rack, mid-mount with front cover
- 19-inch ANSI equipment rack, mid-mount with front cover
- 19-inch (450 mm) ETSI equipment rack, front-mount without front cover
- 19-inch (410 mm) ETSI equipment rack, front-mount with front cover
- 21-inch (500 mm) ETSI equipment rack, front-mount 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 4-6 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.

## 4.3 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.

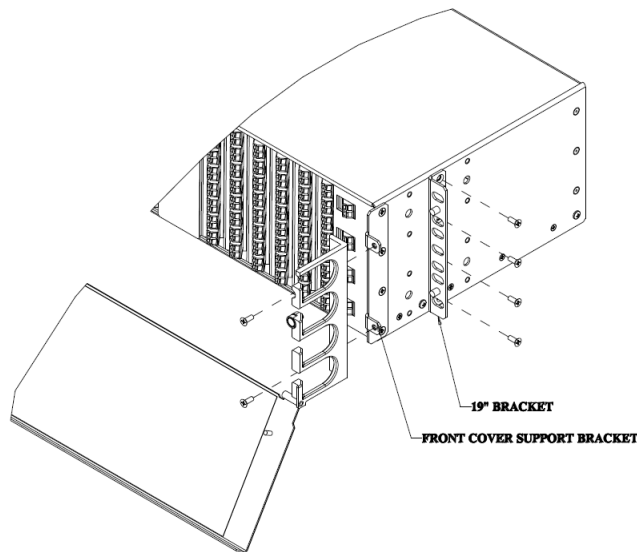
- 23-inch ANSI equipment rack, mid-mount with front cover
- 19-inch ANSI equipment rack, mid-mount with front cover
- 19-inch (410 mm) ETSI equipment rack, front-mount with front cover
- 21-inch (500 mm) ETSI equipment rack, front-mount with front cover

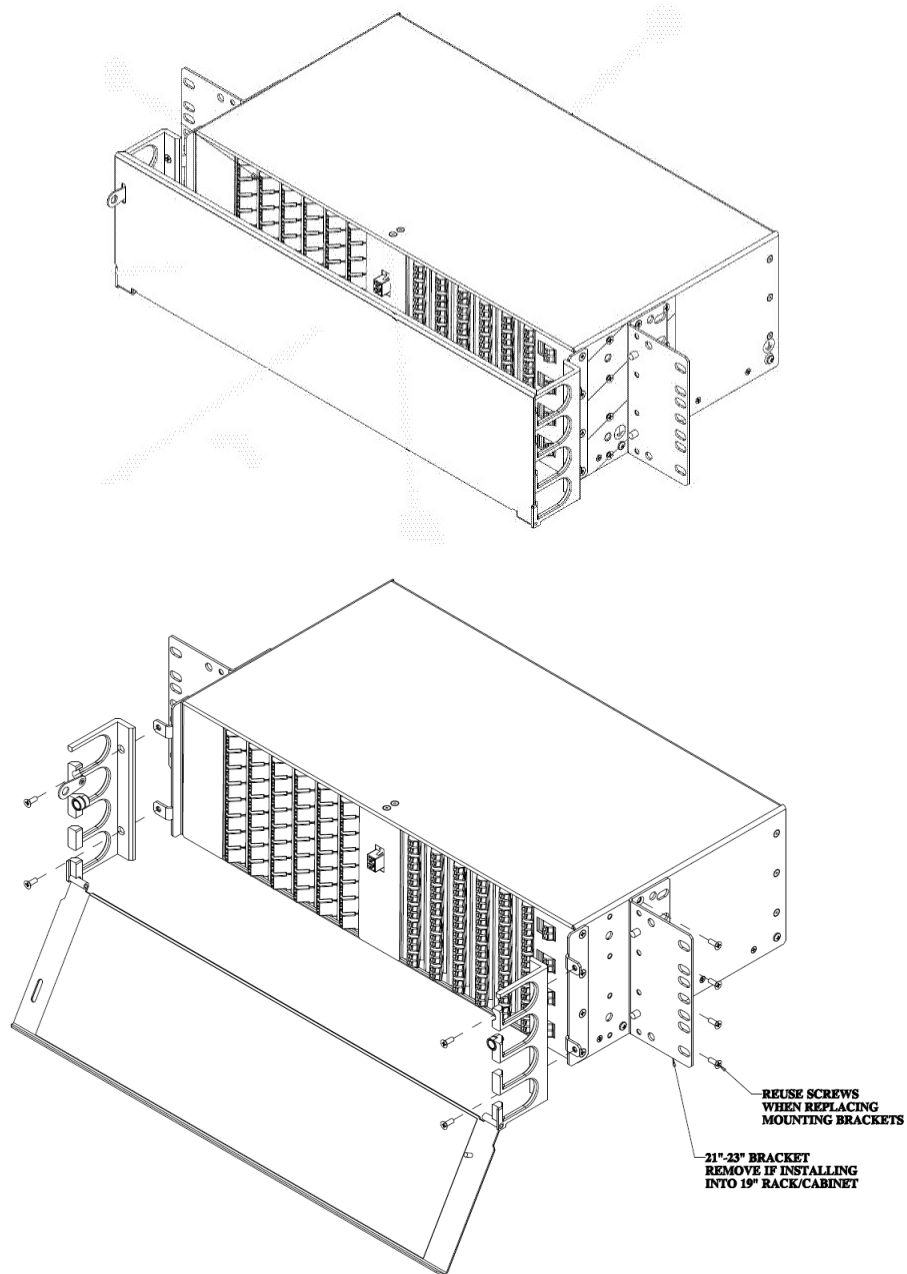
**Note** We do not recommend installing the module without the front cover, since the inside of the cover includes the channel plan labeling.

### 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 4-7 96-Channel DWDM Mux/Demux with 19-inch bracket**



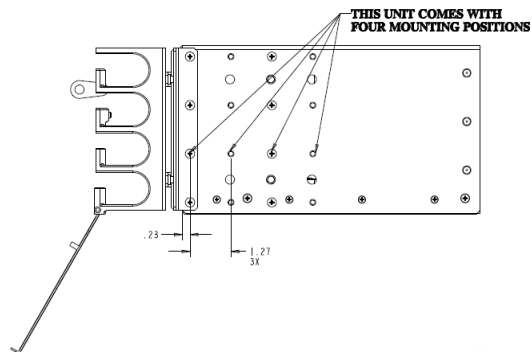
**Figure 4-8 96-Channel DWDM Mux/Demux with 23-inch bracket****Installation procedure**

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

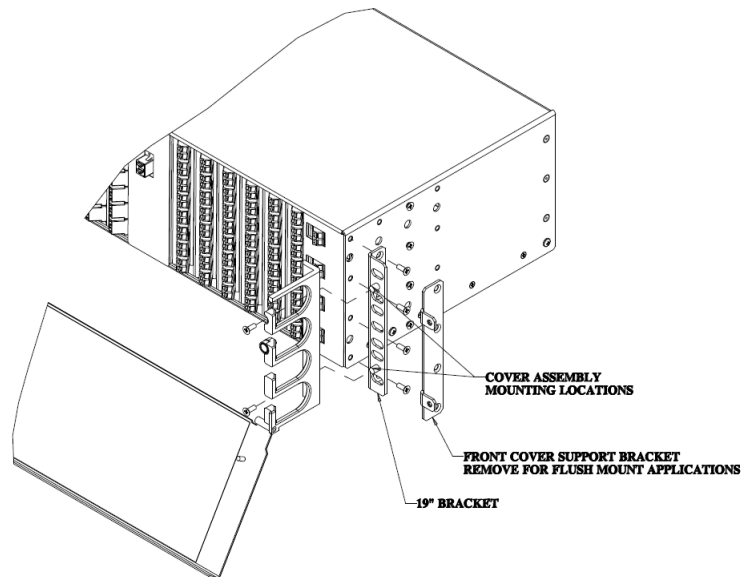
**Step 1** Arrange the mounting brackets next to the sides of the shelf.

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.

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

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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.

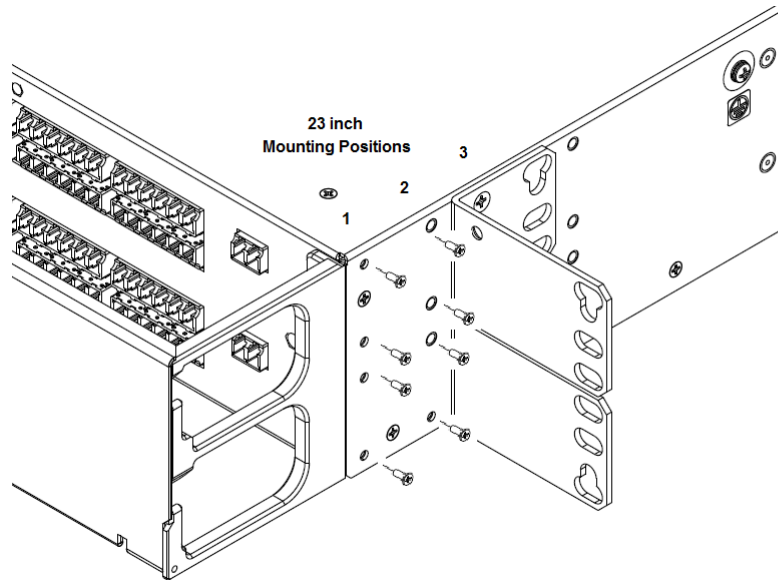
### Tools Required

- 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 BTI 7000 Series shelf. 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.

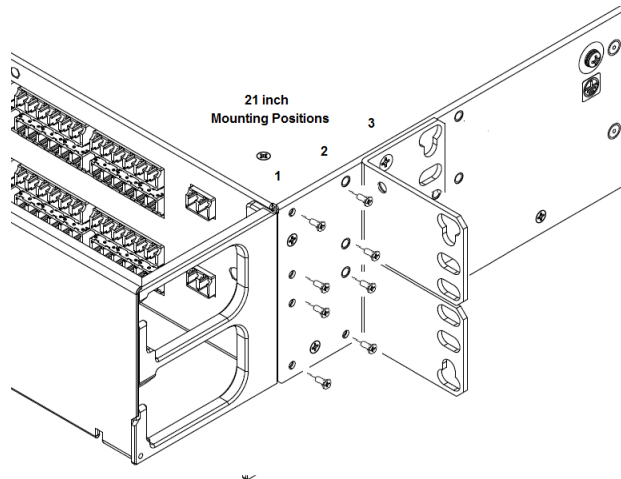
a) To install the 23-inch brackets:

**Figure 4-9 23-inch bracket mounting positions**

Choose the mounting positions which enable the module to be installed flush with the adjacent BTI 7000 Series shelf.

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

b) To install the 21-inch brackets:

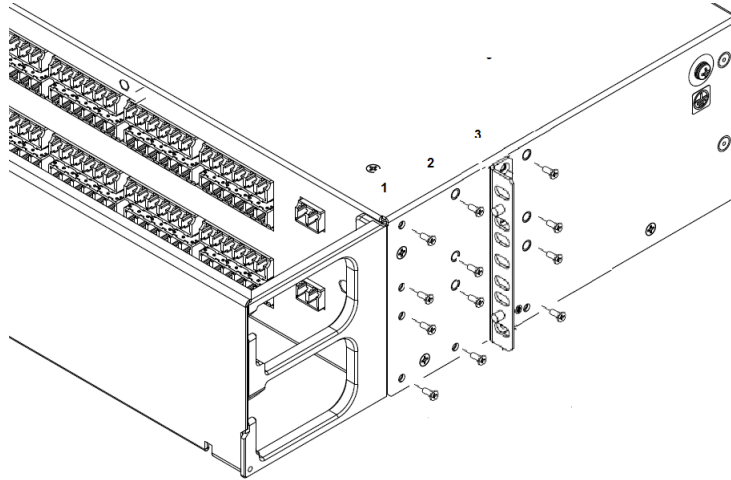
**Figure 4-10 21-inch bracket mounting positions**

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 BTI 7000 Series shelf.

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

- c) To install the 19-inch brackets:

**Figure 4-11 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 BTI 7000 Series shelf.

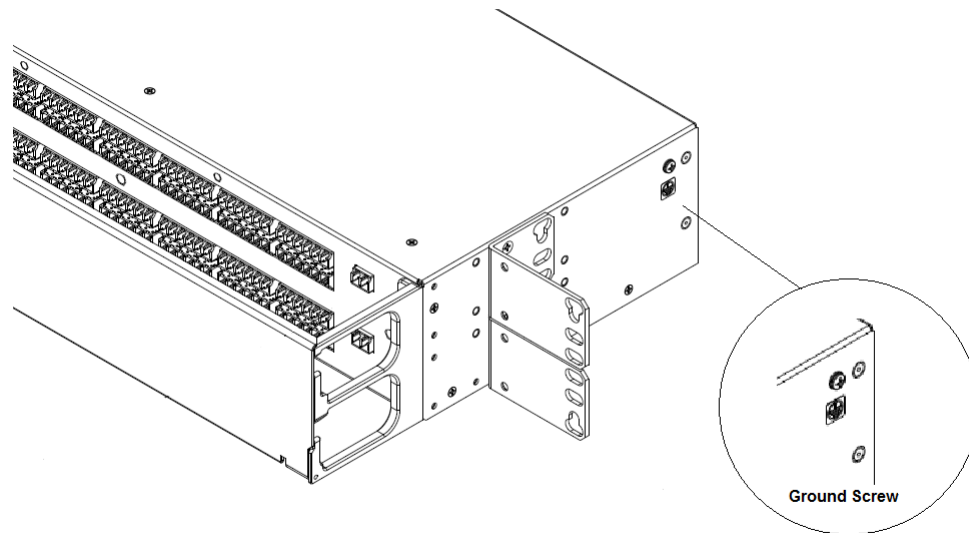
Reuse the mounting bracket screws to fasten the 19-inch mounting bracket to the module.

**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.

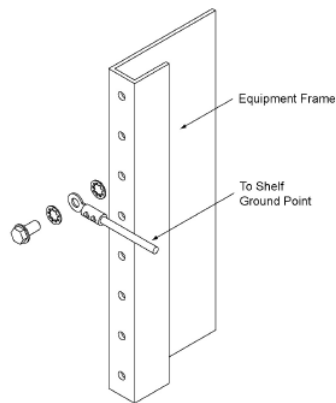
**Step 3** Perform the following to ground the module.

- 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.



## 5.0 Connecting modules

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This section provides information on connecting multiplexing modules:

- 5.1, “Basic cascading of OADMs to provide mux/demux functionality”
- 5.2, “ODM survivability of upstream and downstream traffic”
- 5.3, “Cascading OADMs for survivability and future growth”

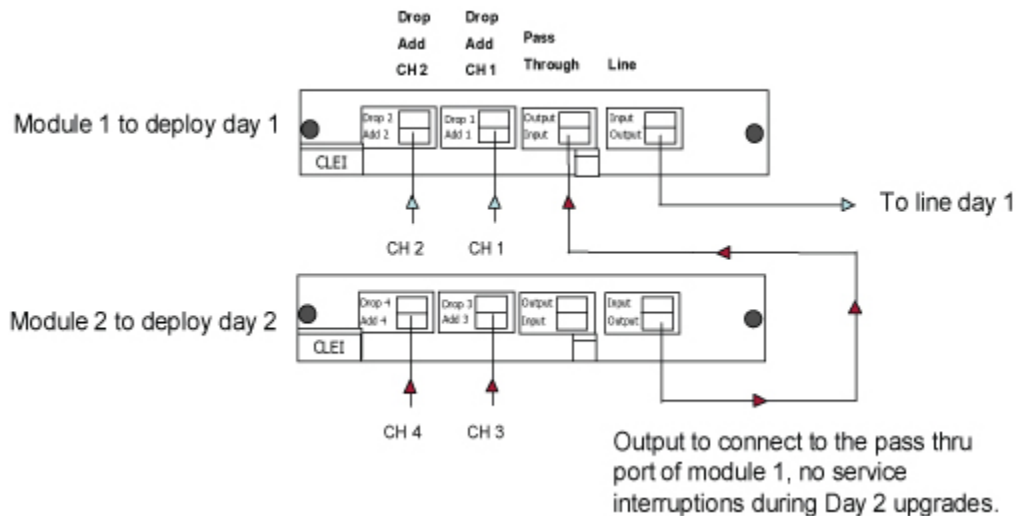
## 5.1 Basic cascading of OADMs to provide mux/demux functionality

Optical add/drop modules (OADM) can be cascaded to provide the functional equivalent of a mux/demux.

In the following example, a two-channel OADM is deployed on Day 1 with two input wavelengths that are combined into a composite output from the line port.

On Day 2, a second two-channel OADM is deployed that adds channels three and four. The composite line output from the second OADM is added to the first OADM through the pass through port. This results in the four wavelengths being combined into a composite output from the line port of the first OADM.

### Two-wavelength OADMs serving as a mux/demux



A third wavelength could be added to the first OADM through the pass through port, making the second OADM unnecessary.



## 5.2 OADM survivability of upstream and downstream traffic

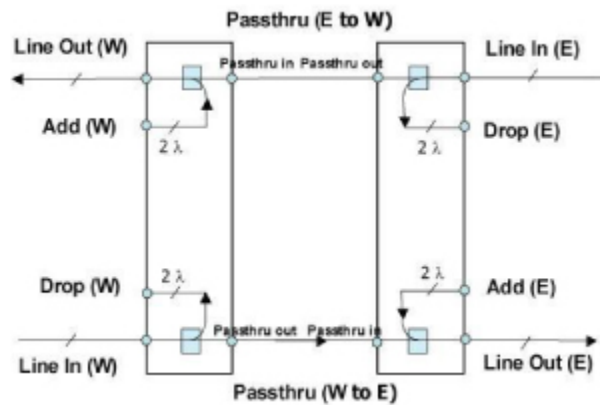
Optical add/drop modules (OADM) can be combined to ensure that upstream and downstream traffic can survive even if there is a module failure at a line site.

In the following example, a pair of two-channel OADMs are deployed where two wavelengths are dropped and then added back to the composite signal that passes through the site. Traffic upstream and downstream from a line site failure is not affected.

The inbound composite traffic is connected to the line in port of the first OADM. The two selected wavelengths are dropped by the first OADM and the remaining composite traffic exits through the pass through output port of the first OADM. The composite traffic is then connected to the pass through input port of the second OADM. At the second OADM, two selected wavelengths are added back to the composite traffic that exits through the line output port.

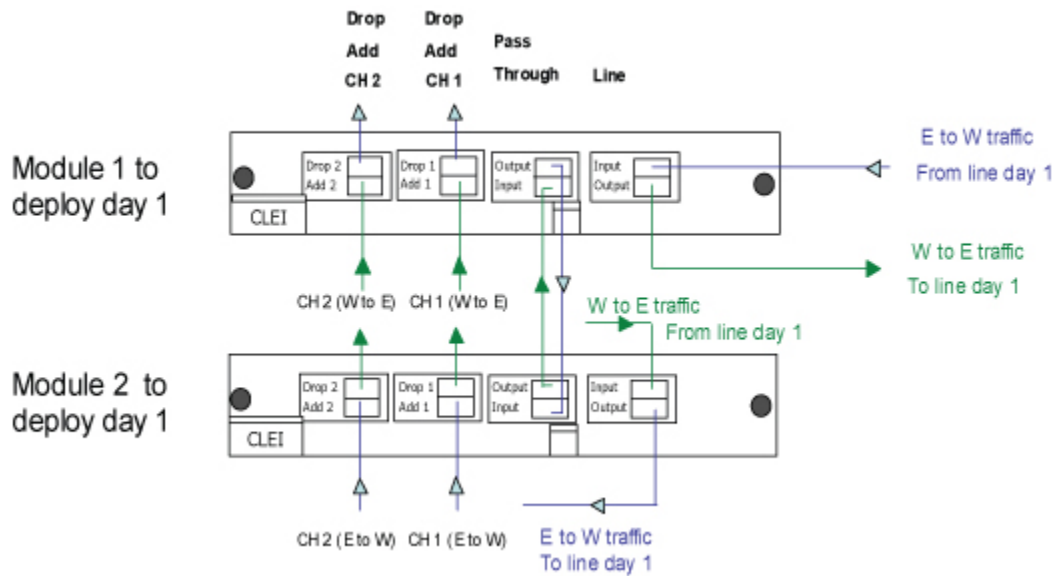
For traffic flowing in the opposite direction, the remaining OADM ports are used.

### OADM survivability of upstream and downstream traffic



The following figure indicates what the fiber connections would look like for this example.

## OADM survivability fiber connections



## 5.3 Cascading OADMs for survivability and future growth

The concepts of OADM cascading and survivability can be combined to provide a robust configuration that allows for future growth in the number of wavelengths that are added and dropped at a site.

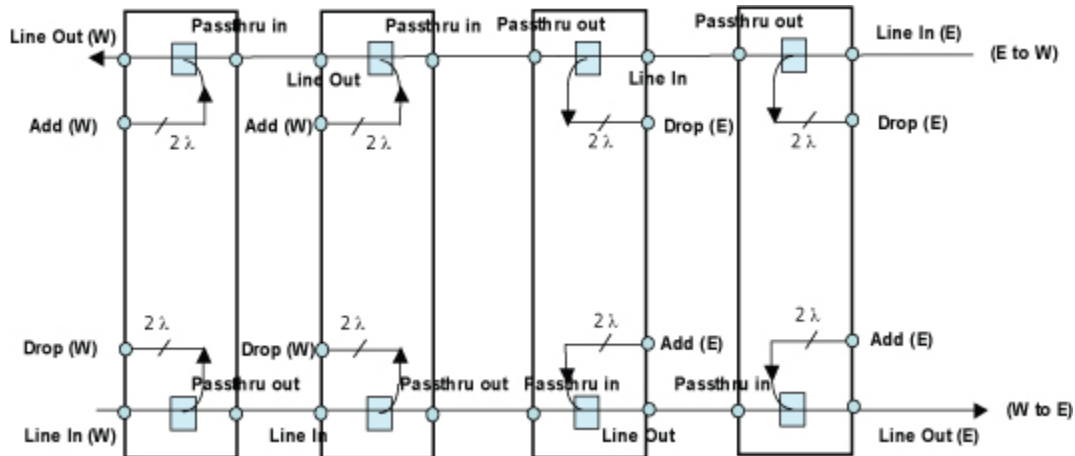
In the following example, four two-channel OADMs are deployed where four wavelengths are dropped and then added back to the composite signal that passes through the site. Traffic upstream and downstream from a line site failure is not affected.

The inbound composite traffic is connected to the line in port of the first OADM. The first two selected wavelengths are dropped by the first OADM and the remaining composite traffic exits through the pass through output port of the first OADM. The composite traffic is then connected to the line input port of the second OADM. At the second OADM, two more wavelengths are dropped and the remaining composite traffic exits through the pass through output port.

The composite traffic is then connected to the pass through input port of the third OADM. At the third OADM, two selected wavelengths are added back to the composite traffic that exits through the line output port. The composite traffic is then connected to the pass through input port of the fourth OADM. At the fourth OADM, two more selected wavelengths are added back to the composite traffic that exits through the line output port.

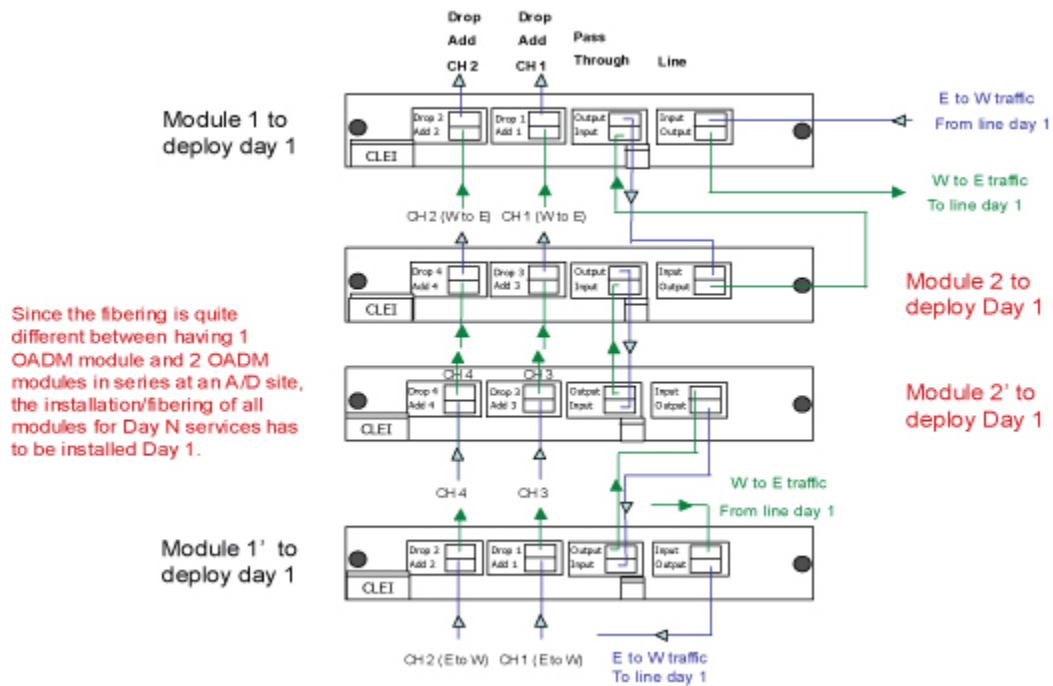
For traffic flowing in the opposite direction, the remaining OADM ports are used.

### Cascading OADMs for survivability and future growth



The following illustration indicates what the fiber connections would look like for this example.

## Cascading OADMs for survivability and future growth fiber connections



## 6.0 Management interfaces

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This section provides a brief overview about each management interface you can use to provision, monitor, and administer multiplexer/demultiplexer modules.

- 6.1, “proNX 900 Node Controller, CLI, TL1, SNMP, and proNX Service Manager”

## 6.1 proNX 900 Node Controller, CLI, TL1, SNMP, and proNX Service Manager

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### proNX 900 Node Controller

proNX 900 Node Controller (proNX 900) provides a graphical user interface you can use to provision, operate, monitor, and troubleshoot all BTI 7000 Series modules. This interface provides a representational view of the physical configuration of each shelf in the network, and the modules in each shelf. For information about using the proNX 900 Node Controller, see the *proNX 900 Node Controller Online Help*.

### CLI

The CLI is used to configure, monitor, and maintain packetVX and other modules. The CLI does not support all BTI 7000 Series modules. For information about using CLI commands, see the *CLI Reference Guide*.

### TL1

The BTI 7000 Series supports a comprehensive and interactive Transaction Language One (TL1) interface, based on Telcordia standards, including GR-831, GR-199-CORE, and GR-833-Core. For information about using TL1 commands to provision, monitor, and administer BTI 7000 Series modules, see the *TL1 Reference Guide*.

### SNMP

The BTI SNMP implementation supports SNMP Version 1 (SNMPv1) as defined in RFCs 1155, 1157, 1212, 1213, and 1215. The SNMP implementation also supports SNMPv2c as defined in RFCs 1901 through 1907. For information about the BTI SNMP implementation, see the *SNMP Overview Guide*.

### proNX Service Manager

The proNX Service Manager provides proactive, service-centric management of network resources using tools closely aligned with service providers' own business processes. It is designed to simplify network operations from visualization and activation of services to troubleshooting and supporting end customers. For more information, see the *proNX Service Manager User Guide*.

## 7.0 Provisioning Multiplexing modules

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This section explains how to provision the CWDM and DWDM multiplexing modules.

- [7.1, “Autoprovisioning support on Multiplexing modules”](#)
- [7.2, “Modifying the parameters of a Multiplexing module port”](#)
- [7.3, “Retrieving the parameters of a Multiplexing module port”](#)

## **7.1 Autoprovisioning support on Multiplexing modules**

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When a CWDM or DWDM Multiplexing module is inserted into an unprovisioned slot, it is auto provisioned with the primary state set to the same value as the AUTOP parameter. All supported ports are auto provisioned and carry no primary state.

Once a port is auto provisioned, its parameters can be modified or retrieved.



## 7.2 Modifying the parameters of a Multiplexing module port

Use this procedure to modify the definable parameters of a port on a Multiplexing module.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

### Prerequisites

The port is provisioned.

#### Step 1 Enter the command ED-PORT, specifying new parameter values as required.

```
ED-PORT:[TID]:<aid>:[CTAG]::[ID1=<id1>][,ID2=<id2>][,FIBER=<fiber>]
[,GRID=<grid>][,CHNLS=<chnls>][,C1=<custom1>][,C2=<custom2>]
[,C3=<custom3>],[REMOTEID=<remoteid>;
```

where

TID is the target identifier

aid is access identifiers. See the following table.

CTAG is the correlation tag

#### Example input

```
ED-PORT:BTI7000:C1ADM-1-3-1:100::C1=Under Test;
```

You have successfully completed this procedure.

Equipment type	AID
C1ADM Line	C1ADM-(1,11,21,31)-(1-20)-(1-2)
C1ADM Pass Through	C1ADM-(1,11,21,31)-(1-20)-(1-2)-P
C1ADM Channel	C1ADM-(1,11,21,31)-(1-20)-(1-2)-(1-16)
C2ADM Line	C2ADM-(1,11,21,31)-(1-20)-1
C2ADM Pass Through	C2ADM-(1,11,21,31)-(1-20)-1-P
C2ADM Channel	C2ADM-(1,11,21,31)-(1-20)-1-(1-16)
C4MD Line	C4MD-(1,11,21,31)-(1-20)-1
C4MD Expansion Port	C4MD-(1,11,21,31)-(1-20)-1-E
C4MD Channel	C4MD-(1,11,21,31)-(1-20)-1-(1-16)
CDSC Line	CDSC-(1,11,21,31)-(1-20)-1
CDSC Channels	CDSC-(1,11,21,31)-(1-20)-1-C
CDSC Channels	CDSC-(1,11,21,31)-(1-20)-1-D
CS Line	CS-(1,11,21,31)-(1-20)-(1,2)
CS DWDM Port	CS-(1,11,21,31)-(1-20)-(1,2)-(1-9)

Equipment type	AID
CS Channel	CS-(1,11,21,31)-(1-20)-(1,2)-D
D32MD1 Line	D32MD1-(1,11,21,31)-(1,3,5...19)-1
D32MD1 Upgrade	D32MD1-(1,11,21,31)-(1,3,5...19)-1-E
D32MD1 Channel	D32MD1-(1,11,21,31)-(1,3,5...19)-1-(1-8)
D32MD2 Line	D32MD2-(1,11,21,31)-(1,3,5...19)-1
D32MD2 Upgrade	D32MD2-(1,11,21,31)-(1,3,5...19)-1-E
D32MD2 Channel	D32MD2-(1,11,21,31)-(1,3,5...19)-1-(9-16)
D32MD3 Line	D32MD3-(1,11,21,31)-(1,3,5...19)-1
D32MD3 Upgrade	D32MD3-(1,11,21,31)-(1,3,5...19)-1-E
D32MD3 Channel	D32MD3-(1,11,21,31)-(1,3,5...19)-1-(17-24)
D32MD4 Line	D32MD4-(1,11,21,31)-(1,3,5...19)-1
D32MD4 Upgrade	D32MD4-(1,11,21,31)-(1,3,5...19)-1-E
D32MD4 Channel	D32MD4-(1,11,21,31)-(1,3,5...19)-1-(25-32)
D1ADM Line	D1ADM-(1,11,21,31)-(1-20)-1
D1ADM Port	D1ADM-(1,11,21,31)-(1-20)-1-P
D1ADM Channel	D1ADM-(1,11,21,31)-(1-20)-1-(1-32)
D2ADM Line	D2ADM-(1,11,21,31)-(1-20)-1
D2ADM Port	D2ADM-(1,11,21,31)-(1-20)-1-P
D2ADM Channel	D2ADM-(1,11,21,31)-(1-20)-1-(1-32)
D4ADM Line	D4ADM-(1,11,21,31)-(1,3,5...19)-1
D4ADM Port	D4ADM-(1,11,21,31)-(1,3,5...19)-1-P
D4ADM Channel	D4ADM-(1,11,21,31)-(1,3,5...19)-1-(1-32)
D4MD Line	D4MD-(1,11,21,31)-(1-20)-1
D4MD Channel	D4MD-(1,11,21,31)-(1-20)-1-(1-32)

## 7.3 Retrieving the parameters of a Multiplexing module port

Use this procedure to retrieve the parameters of a port.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

### Prerequisites

The port is provisioned.

#### Step 1 Enter the command RTRV-PORT.

```
RTRV-PORT:[TID]:[<aid>]:[CTAG]:;
```

where

TID is the target identifier

aid is the access identifier. See [7.2, “Modifying the parameters of a Multiplexing module port”](#).

CTAG is the correlation tag

#### Example command and response

```
RTRV-PORT:BTI7000::100::;
```

```
BTI7000 03-11-12 11:42:00
M 100 COMPLD "C1ADM-1-6-1:"
"C1ADM-1-6-1-9:WAVELENGTH=1451"
"C1ADM-1-6-1-P:"
;
```

**Table 7-1 Multiplexing module port information fields**

Parameter	Range of Values	Description
ID1	1 to 32 alphanumeric characters	The identifier that describes the port
ID2	1 to 32 alphanumeric characters	The identifier that describes the port
FIBER	DSF NDSF (SMF-28) NZDSF	The fiber type that connects to the port
GRID	50 GHz 100 GHz 200 GHz	ITU-T wavelength grid numbers
CHNLS	0 to 40	The number of DWDM channels
C1, C2, C3	1 to 256 alphanumeric characters	The custom fields for specific operating company information
WAVELENGTH	.	The wavelength in nm

You have successfully completed this procedure.

## 8.0 Troubleshooting Multiplexing modules

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This section provides information for troubleshooting issues on CWDM and DWDM Multiplexing modules.

- [8.1, “Alarms and events on Multiplexing modules”](#)

## 8.1 Alarms and events on Multiplexing modules

---

The proNX 900 Node Controller allows you to view alarms and events reported on a Multiplexing module at any time.

When a Multiplexing module is in the In-Service state or Out-of-Service state, any fault condition pertaining to the module is reported as an autonomous alarm. For information about clearing alarms pertaining to Multiplexing modules, see the *Alarm and Troubleshooting Guide*.

An event reported on a Multiplexing module can indicate the module's status, a periodic report of information, or asynchronous command completion information.

For a description of the information provided by the proNX 900 Node Controller about an alarm or event, see the *proNX 900 Node Controller Online Help*.

### 8.1.1 View alarms or events for a Multiplexing module

Use this procedure to view alarms or events reported on Multiplexing module.



#### Prerequisites

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

#### Viewing alarms and events

Follow these steps to view alarms and events on a Multiplexing module:

**Step 1** Click one of the following tabs in the **Alarm** pane:

- **Alarms** — to view the list of alarms
- **Events** — to view the list of events

**Step 2** Double-click an alarm or event to view detailed information about it.

You have successfully completed this procedure.

## 9.0 Replacing Multiplexing modules

---

This section provides instructions for replacing Multiplexing modules.

- [9.1, “Replacing Multiplexing modules”](#)

## 9.1 Replacing Multiplexing modules

---

Use this procedure to replace Multiplexing modules.

### What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Multiplexing module

### Prerequisites

**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.

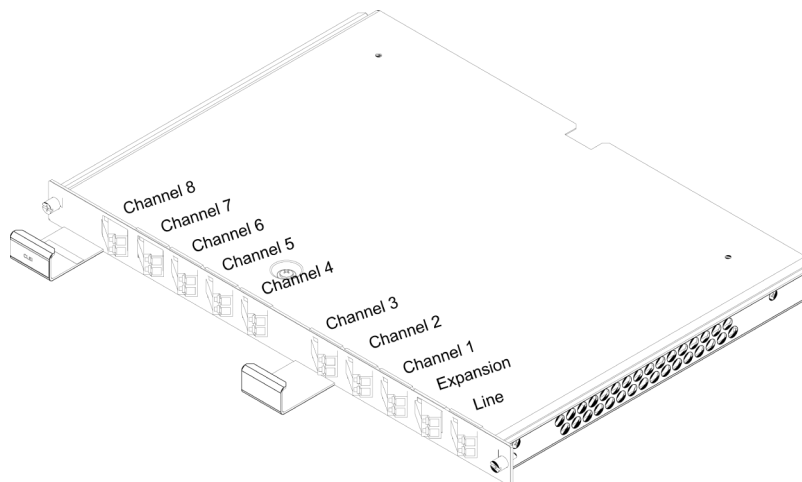


**Caution**

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).

The following figure shows an 8-channel module of the 32-Channel DWDM Mux/Demux.

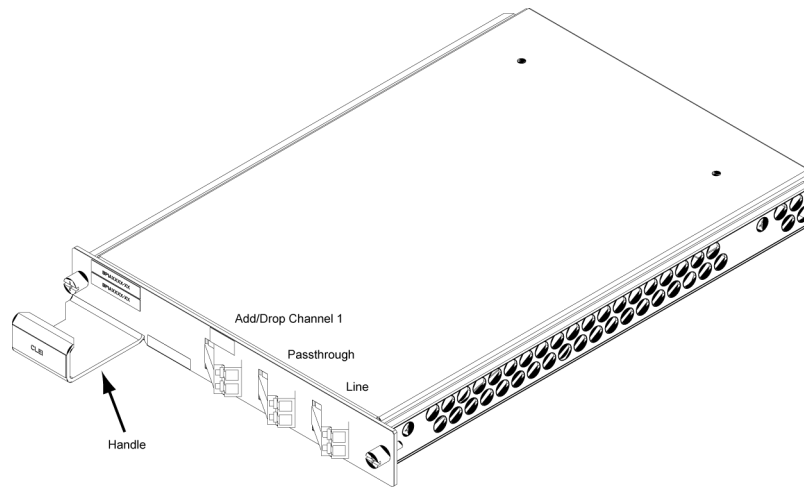
### 32-Channel DWDM Mux/Demux module



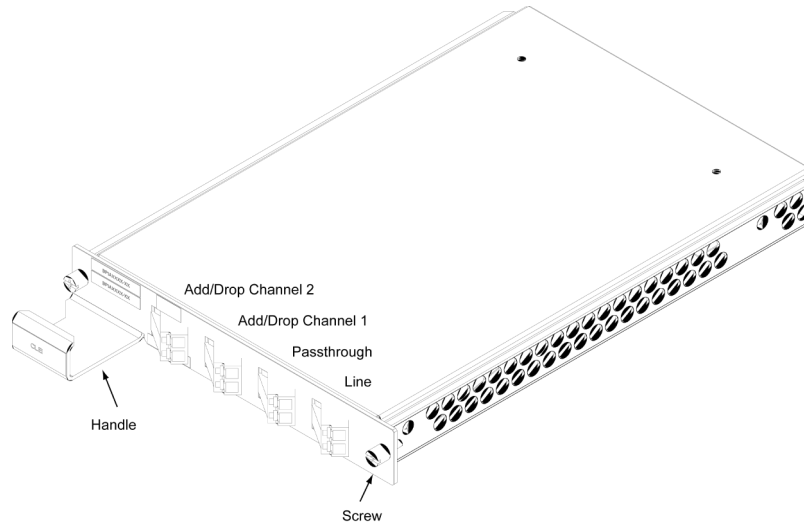
The following figures show the key physical features of the 1-Channel, 2-Channel, and 4-Channel DWDM Optical Add/Drop modules.



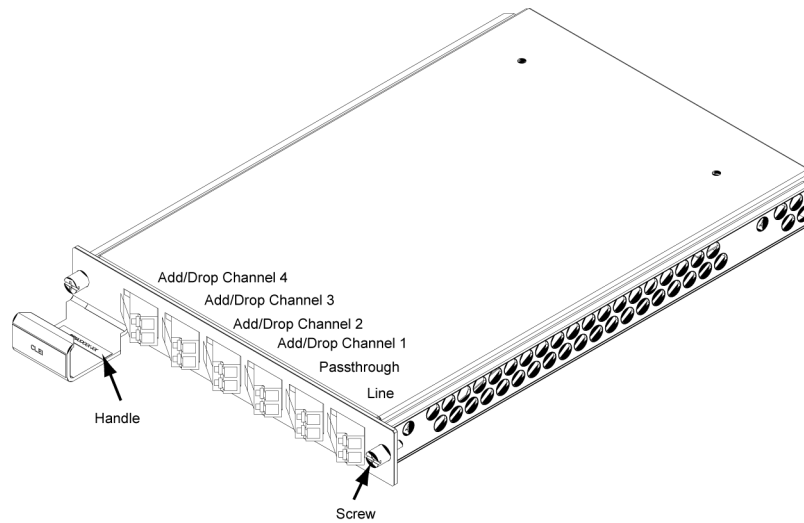
## 1-Channel OADM



## 2-Channel OADM



## 4-Channel OADM



### Replacement procedure

To replace a Multiplexing module, follow these steps:

#### Step 1 Move 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 2 Disconnect Optical Cables

Disconnect the optical cables from the optical ports on the faceplate of the module.

**Note** Ensure that the optical ports on the modules and the optical cables are protected with protective caps while disconnected.

#### Step 3 Loosen Faceplate Screws

- a) Facing the front of the shelf, locate the faceplate screws.
- b) Using a slot-head or Phillips screwdriver, loosen the screws.
- c) Push with sufficient pressure until the LEDs come on.

#### Step 4 Remove module

- a) Grasp the handles on the front of the module and firmly pull the module straight out.

**Note** An equipment missing alarm appears once you remove the module.

- b) Place the module on a flat work surface.

#### Step 5 Replace module

- a) Align the replacement module to the slot in which it is being replaced.
- b) Carefully push the module straight into the slot.

**Step 6 Replace 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 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 7 Reconnect Optical Cables**

Clean the optical cables and then connect them to the module.

**Step 8 Replace Cables**

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

You have successfully completed this procedure.





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