Infinera DTN and DTN-X

Hardware Description Guide

Release 8.0

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Infinera DTN-X, DTN, ATN, and Infinera Optical Line Amplifier Regulatory Compliance

FCC Class A

This device 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. Modifying the equipment without Infinera's written authorization may result in the equipment no longer complying with FCC requirements for Class A digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense.

DOC Class A

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard titled “Digital Apparatus," ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques," NMB-003 édictée par le Ministère des Communications.

Warning

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

FDA

This product complies with the DHHS Rules 21CFR 1040.10 and 1040.11, except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

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About this Document

This chapter provides an overview of the *Infinera DTN and DTN-X Hardware Description Guide*. It describes the following:

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Objective

This guide provides an introduction and reference to the Infinera® DTN-X, DTN, and Optical Line Amplifier network elements, its deployable configurations, and its hardware architecture. This guide also provides the details of the functional description, functional block diagrams, faceplate diagrams with status indicators and connectors, and the technical specification of all the components.

Audience

The primary audience for this manual includes network planners, network operations personnel, field technicians, and system administrators who are responsible for deploying and administering Infinera Digital Optical Network®. This manual assumes that the reader is familiar with the following topics and products:

- Basic internet and networking terminology and concepts
- Dense Wavelength Division Multiplexing (DWDM) technology and concepts

Document Organization

The following table lists the chapters and its description covered in this manual.

Chapter	Description
CHAPTER 1: "Introduction"	Provides a high level description of Infinera DTN-X, DTN, and Optical Line Amplifier network element features and their network configurations.
CHAPTER 2: "Infinera DTN-X"	Provides details of the Infinera DTN-X hardware and the functional description of various circuit packs the DTN-X houses. It covers the various audible and visual alarms on the faceplates that indicate the status of the circuit packs.
CHAPTER 3: "Infinera DTN"	Provides details of the Infinera DTN hardware and the functional description of various circuit packs the DTN houses. It covers the various audible and visual alarms on the faceplates that indicate the status of the circuit packs.
CHAPTER 4: "Infinera Optical Line Amplifier"	Provides details of the Infinera Optical Line Amplifier hardware and the functional description of various circuit packs it houses. It covers the various audible and visual alarms on the faceplates that indicate the status of the circuit packs.
CHAPTER 5: "Infinera Dispersion Management Chassis"	Provides details of the Infinera DMC hardware and its technical specifications.
Appendix A: "Infinera DTN-X, DTN, and Optical Line Amplifier PM Parameters"	Describes the Performance Monitoring (PM) parameters reported by Infinera DTN-X, DTN, and Optical Line Amplifier network elements.
Appendix B: "Acronyms"	Provides a list of acronyms and their definitions used in Infinera Technical Publications.

Documents for Release 8.0

The following documents are available for Infinera Digital Optical Network® systems:

Document Name	Document ID	Description
DTN and DTN-X Installation Guides Portfolio		
Infinera DTN and DTN-X Turn-up and Test Guide	1900-001061	Describes procedures for turning up, commissioning and testing the installed Infinera DTN-X, DTN, and Optical Line Amplifier network elements. Includes the description of circuit activation and end-end system testing procedures.
Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide	1900-001056	Describes the procedures for initial installation of the Infinera DTN-X, DTN, and Optical Line Amplifier network elements at any given site. Includes procedures for site preparation and site testing, system cabling, safety procedures and hand-over to provisioning activities.
DTN and DTN-X Procedure Guides Portfolio		
Infinera DTN and DTN-X Task Oriented Procedures (TOPs) Guide	1900-001059	Provides the routine task oriented procedures (TOPs) used in support of the Infinera DTN-X, DTN, and Optical Line Amplifier network elements.
DTN and DTN-X Reference Guides Portfolio		
Infinera DTN and DTN-X System Description Guide	1900-001058	Provides an overview of the Digital Optical Network and its principal elements, including the Infinera DTN-X, DTN, and the Optical Line Amplifier. Includes a description of the Infinera IQ Network Operating System and an overview of the management interfaces for Infinera products.
Infinera DTN and DTN-X Hardware Description Guide	1900-001055	Provides the hardware description of the Infinera DTN-X, DTN, and Optical Line Amplifier network elements which includes the description of chassis, common modules and circuit packs. It provides hardware block diagrams, functional descriptions, mechanical and electrical specifications for each module.
Infinera DTN and DTN-X SNMP Agent Reference Guide	1900-001057	Describes the user interface for the Infinera DTN-X and DTN Simple Network Management Protocol (SNMP) Agent. It provides detailed instructions to configure and operate the Infinera SNMP Agent from the Infinera network element.
DTN and DTN-X User Guides Portfolio		
Infinera GNM Overview Guide	1900-001064	Describes the Infinera Graphical Node Manager user interface. It also describes the new features, the hardware and software requirements required to launch the GNM. It also provides procedures to install and upgrade the software and database on the Infinera network elements.

Document Name	Document ID	Description
Infinera GNM Configuration Management Guide	1900-001062	Describes the procedures to use the Infinera GNM to configure the Infinera network elements and the network topology. It also provides a description on the Equipment Manager and Facility Manager.
Infinera GNM Fault Management and Diagnostics Guide	1900-001063	Describes the Fault Management inventories, Alarm Manager and Event Log. It also provides the procedures to perform diagnostic tests on Infinera network elements. In addition, it describes the alarms raised by the Infinera network elements and the corrective procedures to perform to clear the alarms.
Infinera GNM Performance Management Guide	1900-001065	Describes the procedures to use Infinera GNM to view performance monitoring (PM) data and modify PM thresholds for the Infinera DTN-X, DTN, and Optical Line Amplifier network elements. It also provides the PM parameters details reported by the Infinera network elements.
Infinera GNM Security Management Guide	1900-001066	Describes the procedures to perform security and access management tasks such as creating, deleting and managing user accounts on the Infinera network elements.
Infinera GNM Service Provisioning Guide	1900-001067	Describes the procedures to provision cross-connects, subnetwork connections (SNCs) and protected services on Infinera DTN-X and Infinera DTN network elements. It includes a description of the various inventory managers displayed in the Infinera GNM.
Infinera DTN and DTN-X TL1 User Guide	1900-001060	Describes the TL1 interface supported by the Infinera DTN-X, DTN, and Optical Line Amplifier network elements. It includes the description of the supported TL1 commands and the procedures for the commonly performed OAM&P functions.

Document Revision History

The following table lists the changes made in each version of the *Infinera DTN and DTN-X Hardware Description Guide* for the current product release.

Document Version Number	Document Updates Since Previous Version

002	• Removed all information regarding the XTC-10 air inlet bezel from the document (the bezel has been deleted and is no longer supported)
	• Removed all information regarding the AOLM-200 and AOLX-200 from the document
	• Replaced all instances of phase modulation (PM) with polarization multiplexed (PM) throughout the document (in the context of PM-QPSK and PM-BPSK modulation formats)
	• Added note in several places throughout the document regarding the installation of the DTN-X (XTC-10 and XTC-4) in open racks and Infinera supplied cabinets
	• Minor revisions to the following illustrations: Figure 1-1, Figure 2-2, Figure 2-3, Figure 2-4, Figure 2-5, Figure 2-6, Figure 2-7, Figure 2-8, and Figure 2-14
	• Reorganized the 'Documents for Release 8.0' table (added table headings to show the documents broken down into the respective PDF portfolio)
	• Updated Table 1-1 on page 1-5 with features added in Release 8.0.1 for DTN-X
	• Updated Table 1-2 on page 1-12 with features added in Release 8.0.1 for DTN
	• Updated Table 1-3 on page 1-13 for Release 8.0.1
	• Removed requirement 'ETS 300 753' listed under NEBS/ETSI compliancy from Table 2-2 on page 2-6 (XTC Hardware Compliancy)
	• Updated Table 2-8 on page 2-14 with PON X-DOOR-X10+
	• Updated Table 2-10 on page 2-17 with PON X-RM-ETSI-X10 and X-RM-ETSI-B2-X10
	• Minor updates to section 'XTC-10 Cabinet Overview' on page 2-18
	• Add note at the bottom of page 2-21 regarding the dimension of each vertical cable tray in the XTC-10 cabinet
	• Minor updates to Table 2-12 on page 2-23 (for width and depth)
	• Updated Table 2-13 on page 2-24 with PON X-BEZEL-PS and X-AIRFILTER-PS
	• Minor updates to section 'XTC-10 Power Entry Module (PEM) Shelf' on page 2-24
	• Added sub-sections 'Rack Mounting Ears' and 'Front Air Inlet Bezel/Air Filter' on page 2-25
	• Updated Table 2-35 in Chapter 2 on page 2-50 as follows:
	  • Removed PON X-AIRFILTER-PS-DC (moved to Table 2-38 on page 2-55)
	  • Added PON X-WRAPPER-B1-X4 (used for ANSI 23-inch rack mount)
	  • Updated description for PON X-WRAPPER-X4 (used for Pentair third-party cabinet mount)
	• Updated Table 2-38 on page 2-55 with PON X-AIRFILTER-PS-DC
	• Correction to Table 2-31 on page 2-48 and Table 2-32 on page 2-49
	(...continued)

<table>
<tr><th>Document Version Number</th><th>Document Updates Since Previous Version</th></tr>
<tr><td>002</td><td>(...continued)
• Minor updates to section ‘Power Entry Module (PEM)’ on page 2-58
• Minor update to section ‘Timing Source Guidelines’ on page 2-75 (4th bullet, added additional caveat regarding cold reset of an XCM)
• Added note to section ‘DTN-X Control Module (XCM)’ on page 2-76 (4th bullet) regarding cold reset of an XCM
• Added note to section ‘Timing Synchronization Module (TSM-X10)’ on page 2-83 regarding warm and cold reset of a TSM-X10
• Added note to section ‘Timing Synchronization Module (TSM-X4)’ on page 2-88 regarding warm and cold reset of a TSM-X4
• Added note to section ‘OTN Switch Module (OXM-X10)’ on page 2-93 regarding warm and cold reset of an OXM-X10
• Added note to section ‘OTN Switch Module (OXM-X4)’ on page 2-98 regarding warm and cold reset of an OXM-X4
• Added note to section ‘Tributary Interface Module (TIM)’ on page 2-135 regarding warm and cold reset of TIMs
• Added note to section ‘Tributary Interface Module 100GE (TIM-1-100GE)’ on page 2-136 regarding warm and cold reset of a TIM-1-100GE
• Added note to section ‘Tributary Interface Module 10GM (TIM-5-10GM)’ on page 2-140 regarding warm and cold reset of a TIM-5-10GM
• Added Ethernet interface to functional description for OTM-500 on page 2-131
• Updated the following sections in Chapter 2:
  • AOLM-500 on pages 2-100 and 2-101
  • AOLX-500 on pages 2-107 and 2-108
  • SOLM-500 on pages 2-114 and 2-115
  • SOLX-500 on pages 2-121 and 2-122
• Removed the following sections from Chapter 2:
  • AOLM-200
  • AOLX-200
• Add note to section ‘BMM Functional Description’ in Chapter 3 on page 3-91 regarding the supported bandwidth between a BMM2/BMM2P and an AOLM-500/AOLX-500/SOLM-500/SOLX-500
• Removed note from Chapter 4 on page 4-12 regarding Optical Line Amplifiers commissioned as GNE
• Updated Table 4-55 in Chapter 4 on page 4-63 (changed the ‘EDFA Gain’ and ‘Span Loss Range’ values listed for the ORM-CXH1-LL)
• Updated the Appendix A on page A-1 with OTUKi Section and Feed PTP PM parameters</td></tr>
</table>

Document Version Number	Document Updates Since Previous Version
V003	• Removed all information regarding the XTC-10 cabinet junction plates from the document (the junction plates have been deleted) • Minor revisions to the following illustrations: Figure 1-1, Figure 2-2, Figure 2-5, Figure 2-6, Figure 2-7, Figure 2-8, Figure 2-15, Figure 2-35, Figure 2-37, Figure 2-39, and Figure 2-41

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  - Toll-free within Germany/France/Benelux/United Kingdom: 00-800-4634-6372
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- Fax: +1-408-572-5458
- Infinera corporate website: http://www.infinera.com
- Infinera Customer Web Portal: https://customersupport.infinera.com

Infinera Customer Web Portal

A wealth of technical support resources are available 24x7 through the Infinera Customer Web Portal at: https://customersupport.infinera.com (login and password required).

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Download product documentation	Click **Documentation**
View training courses and/or sign up for training	Click **Training**
View important technical and product bulletins	Click **Technical Bulletins**
View data sheets and/or brochures regarding service portfolio offerings	Click **Service Portfolio Offerings**
View Infinera contact information	Click **Contact Us**

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Track and Update Service Requests

To check incident case status and make updates online through the Infinera Customer Web Portal, perform the following:

Step 1 Log in at: https://customersupport.infinera.com.

Step 2 Click **Link to CSM**.

Step 3 Click on your incident title or ID to check your incident case status.

Step 4 To update your incident case, perform the following:

Step 4a Enter your service request within the **Notes** field.

Step 4b Click **Submit** to update the incident case.

You can also track and update Infinera CSM cases by contacting the Infinera TAC via phone or email.

Information to Provide

When submitting service request(s), have the following information available:

- Caller Name, Company, and/or Contact Information
- Priority (for example, High, Medium, Low, and/or Informational)
- Network Impact (for example, service-affecting, non-service affecting, and/or intermittent)
- Network Status (for example, deployment in progress, field trial, and/or production live)
- Software Version (if relevant)
- Affected Hardware Chassis/Module/Cable Type
- Description of the problem and symptoms
- Network topology and configuration
- Supporting information (for example, data logs, troubleshooting steps taken, etc.)

Incident Classification/Handling/Response

All service requests are immediately assigned to an Infinera Tier 3+ TAC specialist, who ensures proper and timely handling of your request through closure. To facilitate flawless handling of customer-reported incidents, the Infinera TAC utilizes a customer relationship management (CRM) system called the Infinera Customer Service Module (CSM) to track and manage all reported incidents and service requests including RMAs.

Every service request is tracked as a unique case within the Infinera CSM, and is classified in accordance with the table below. The table below also describes the standard Service Level response and resolution targets supported by the Infinera TAC.

Priority	Definition	Handling and Escalation	Targeted Maximum Time for Resolution
1—High	Network service is "down", or extended (>30 minutes) loss of network management.	Infinera TAC coordinates all necessary resources, around-the-clock, to bring incident to closure. Engagement of higher-level specialists and management with highest level of priority, within 2 hours after incident report.	4 hours to find resolution, or 4 hours to attain workaround and downgrade to Major (if acceptable to customer). For software incidents with workaround, maintenance release to be issued as soon as possible with high priority engagement of Infinera engineering resources.
2—Medium	Network operation is degraded, or unacceptable levels of network performance. Significant impact on business operations.	Infinera TAC coordinates all necessary resources, around-the-clock, to bring incident to closure. Engagement of higher-level specialists and management within 4 hours after incident report.	8 hours to attain workaround and downgrade to Minor (if acceptable to customer). 8 hours for root cause identification. For software incidents, maintenance release to be issued at time of next scheduled maintenance release.
3—Low	Network operation is impaired, but causes little/no impact on business operations.	Infinera TAC coordinates all necessary resources during normal business hours. Engagement of higher-level specialists and management within 2.5 days after incident report.	72 hours for root cause identification. Fix issue in next major release, if committed by Infinera development resources.
4—Informational	An informational request that has little/no impact on business operations.	Infinera will commit resources and address during normal business hours.	Varies, depending upon nature of request.

Escalation

You may escalate your service request to higher levels of attention if you are not satisfied with its current handling. All service requests are routed to management within 15 minutes of receiving your notification.

To escalate by phone or email:

Step 1 Contact the Infinera TAC.

Step 2 Provide your Infinera CSM case number.

To escalate through the Infinera Customer Web Portal:

Step 1 Log in at: https://customersupport.infinera.com.

Step 2 Click **Link to CSM**.

Step 3 Click on your incident title or ID.

Step 4 Enter your escalation request within the **Notes** field.

Step 5 Click **Submit**.

Return Material Authorization (RMA)

Infinera supports the following types of RMAs:

- Advanced Replacement
- Repair and/or Replace
- Return for Credit
- Defective on Arrival
- Product Recall
- Takeback

To request a Return for Credit RMA, contact your Infinera Account Manager.

To request all other types of RMA, submit your RMA request to the Infinera TAC.

To download additional information on the Infinera RMA Handling Policy and Procedures, including return-module packing instructions:

Step 1 Log in at: https://customersupport.infinera.com.

Step 2 Click **How To Guides**.

Step 3 Under RMA Procedures, click one of the following documents:

- **RMA Procedure - Customer Quick Reference.pdf**
- **RMA Procedure.pdf**

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  140 Caspian Court

  Sunnyvale, CA 94089

When submitting comments, please include the following information:

- Document name and document ID written on the document cover page
- Document release number and version written on the document cover page
- Page number(s) in the document on which there are comments

CHAPTER 1

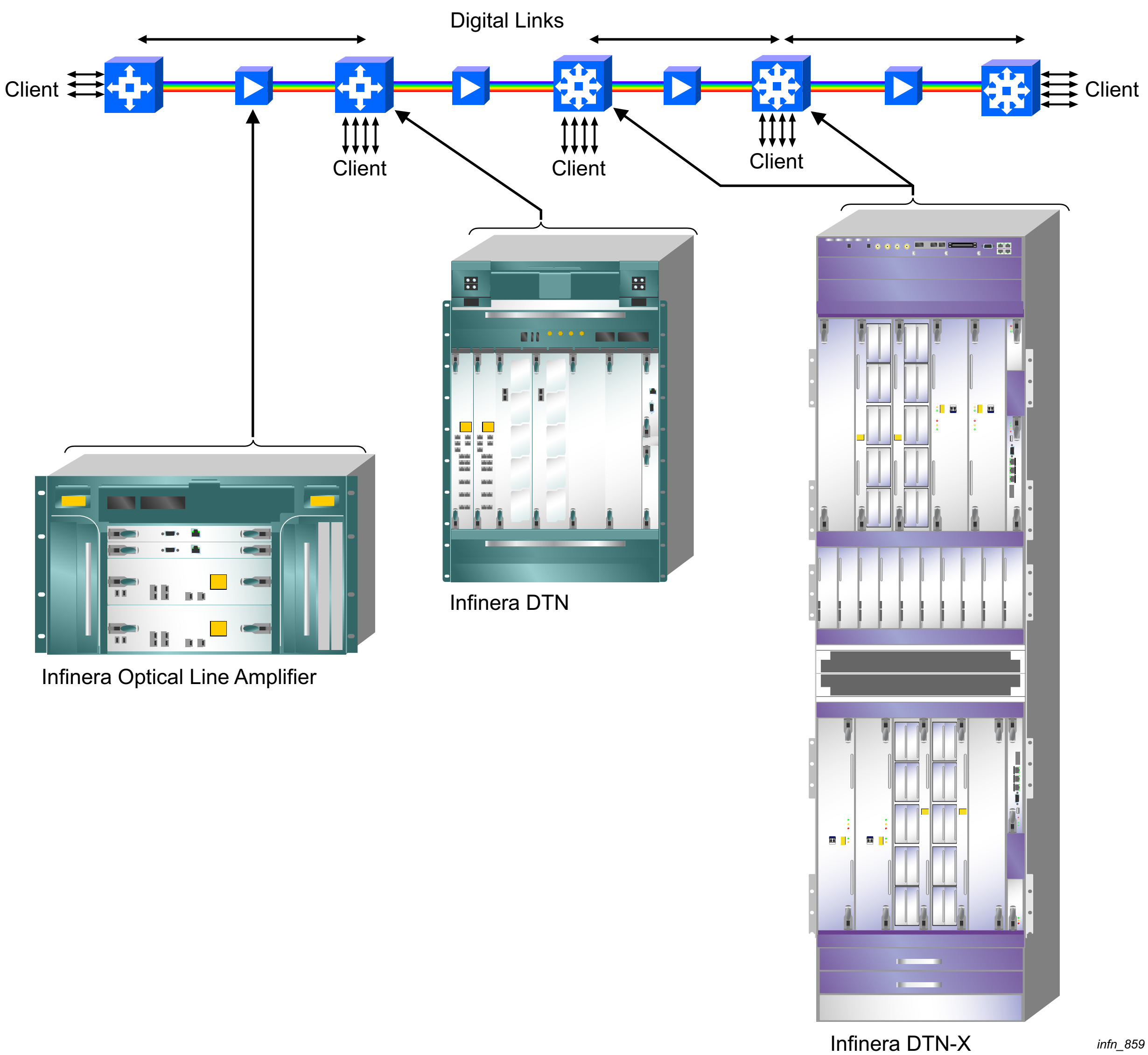
Introduction

Infinera delivers the Digital Optical Network solution, referred to as the Infinera Digital Optical Network®. The Infinera Digital Optical Network provides the ability to multiplex, transport, add, drop, groom, switch and protect SONET, SDH, Ethernet, and other services inexpensively, transparently, reliably, flexibly and quickly. The Infinera Digital Optical Network allows the construction of a single unified optical transport network that scales from metro to ultra long haul applications.

An Infinera Digital Optical Network, as shown in Figure 1-1 on page 1-2, is composed of DTN-X and DTN network elements deployed wherever client access is desired, and Optical Line Amplifiers where client access (between DTNs) is not anticipated. The links between the DTN-Xs and DTNs, referred to as Digital Links, isolate analog engineering and impairments within that Digital Link. Customers can progressively deploy the transport network with DTN-Xs and DTNs at more points of presence, interconnected by Digital Links, when and where capacity is required, without re-engineering the network.

Infinera offers the following Digital Optical Networking systems which help carriers build Digital Optical Networks. This chapter includes the following sections:

Figure 1-1 Infinera Digital Optical Network



Note: Note that in Release 8.0, client traffic originating on a DTC or MTC can be terminated only on a DTC or MTC. Likewise, client traffic originating on an XTC can be terminated only on an XTC, except for configurations using back-to-back TAM-TIM connections. In Figure 1-1, the DTN-X is able to originate/terminate DTC/MTC client traffic by way of a DTC/MTC Expansion Chassis on the DTN-X. On the DTN nodes, all client traffic originating from XTCs is passed through the DTN node via Optical Express.

Infinera DTN-X

The Infinera DTN-X® network element, referred to as the DTN-X, is a next generation, multi-terabit packet optical transport network (P-OTN) platform which provides Dense Wavelength Division Multiplexing (DWDM) transport and digital Reconfigurable Optical Add/Drop Multiplexer (ROADM) service. Its non-blocking, ODU0 granularity single-stage switch fabric covers transport and bandwidth management applications across core, regional core, and large metro spaces. In addition, the Infinera DTN-X provides digital bandwidth management within a Digital Optical Network. It provides a means for direct access to client data at 100Gbps, 40Gbps, and/or 10Gbps digital granularity at a site, allowing flexible selection of whether to multiplex, add/drop, amplify, groom, optically express, or switch individual data streams.

The DTN-X can be equipped in a variety of network configurations using a common set of circuit packs. The detailed description of DTN-X hardware is provided in “Infinera DTN-X” on page 2-1.

Infinera DTN

The Infinera DTN® network element, referred to as the DTN, provides digital ROADM service and bandwidth management capabilities. The Infinera DTN provides digital bandwidth management within a Digital Optical Network. It provides a means for direct access to client data at 100Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps digital granularity at a site, allowing flexible selection of whether to multiplex, add/drop, amplify, groom, optically express, or switch individual data streams.

The DTN can be equipped in a variety of network configurations using a common set of circuit packs. The detailed description of DTN hardware is provided in “Infinera DTN” on page 3-1.

Infinera Optical Line Amplifier

The Infinera Optical Line Amplifier® network element, referred to as the Optical Line Amplifier, is provided to extend the optical reach between DTNs. The detailed description of Optical Line Amplifier hardware is provided in “Infinera Optical Line Amplifier” on page 4-1.

Infinera ATN

The Infinera ATN® network element, referred to as the ATN, is a Coarse Wavelength Division Multiplexing (CWDM) and DWDM multi-service platform that provides digital add/drop and bandwidth management capabilities. The ATN has DWDM and CWDM capabilities and provides support for up to 40 DWDM channels and 8 CWDM channels. It provides the means at any site for direct access to client data at any of the supported signal rates, allowing flexible selection of whether to add/drop, amplify, or optically express individual data streams. For more information on the Infinera ATN, refer to the *Infinera ATN System Description Guide*.

The ATN can be equipped in a variety of network configurations using a common set of circuit packs. For a detailed description of ATN hardware, refer to the *Infinera ATN Hardware Description Guide*.

Infinera Dispersion Management Chassis

The Infinera Dispersion Management Chassis, referred to as the DMC, is an optional chassis which can be mounted in the same rack as the Digital Transport Chassis (DTC), MTC, ATN Transport Chassis (ATC), or the Optical Transport Chassis (OTC) for the purpose of dispersion compensation. The detailed description of DMC hardware is provided in “Infinera Dispersion Management Chassis” on page 5-1.

Release 8.0 New and Updated Features

The following tables list the features that are new or updated in IQ NOS Release 8.0.0:

- Table 1-1 lists the new features for DTN-X
- Table 1-2 lists the updates for DTN and Optical Line Amplifier

Note: Unless specifically noted otherwise, all references to “line module” will refer interchangeably to either the DLM, XLM, ADLM, AXLM, and/or SLM (DTC/MTC only) and AOLM, AOLX, SOLM, and/or SOLX (XTC only). All references to the “LM-80” will refer interchangeably to the AXLM-80, ADLM-80 and/or SLM-80 (DTC/MTC only). Note that the term “line module” does not refer to TEMs, as they do not have line-side capabilities and are used for tributary extension.

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Node Configuration	
Node Migration	Release 8.0.1 adds support for migration of a DTN node to a DTN-X node.
System Hardware	
Switching Transport Chassis (XTC)	The XTC houses the common equipment required for operations and the circuit packs that transport and terminate optical signals. The DTN-X support two types of XTC: • The XTC-10 supports a redundant and scalable switch fabric to provide up to 5Tbps of traffic (with ODU0 granularity). • The XTC-4 is a half-bay chassis that supports a redundant and scalable switch fabric to provide up to 2Tbps of traffic (with ODU0 granularity). **NOTE**: In this document, the generic term “XTC” is used to refer to both XTC-4 and XTC-10 chassis types. When referring specifically to only one type of chassis, the terms “XTC-4” and “XTC-10” will be used.
DTN-X Control Module (XCM)	The DTN-X Control Module (XCM) is a half-height module that provides shelf controller functionality for all modules residing in the XTC and node controller functionality for multi-chassis DTN-Xs. The XCM contains the system software and configuration database for the DTN-X.
Timing Synchronization Module (TSM)	The Timing Synchronization Module (TSM) provides a switch fabric synchronization (SF_SYNC) signal which is used as a common timing reference by the switch fabric. The XTC-4 and XTC-10 each have their own version of the TSM: • The TSM-X10 is a timing module for the XTC-10 that resides in the upper universal card cage occupying TSM slot A-6A and/or the lower universal card cage occupying TSM slot B-6A. • The TSM-X4 is a timing module for the XTC-4 that resides in the universal card cage occupying TSM slot A-6.

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
OTN Switch Module (OXM)	The OTN Switch Module (OXM) provides a distributed, fault-tolerant, non-blocking switch fabric architecture for switching traffic between any two universal card cage slots, or between links in a single tributary module. The XTC-4 and XTC-10 each have their own version of the OXM: • The OXM-X10 is a switching module for the XTC-10 that resides in the switch fabric card cage occupying OXM slots S-1 through S-10. The XTC-10 switch fabric houses a total of ten OXM-X10s (eight active OXM-X10s plus two standby OXM-X10s providing 8+2 redundancy). • The OXM-X4 is a switching module for the XTC-4 that resides in the switch fabric card cage occupying OXM slots S-1 through S-5. The XTC-4 switch fabric houses a total of five OXM-X4s (four active OXM-X4s plus one standby OXM-X4 providing 4+1 redundancy).
Advanced OTN Line Module (AOLM)	The AOLM supports DWDM multiplexed channels (with coherent detection) and per-channel software configurable modulation options. AOLMs are tunable line modules that can be configured for one of four Optical Carrier Groups (OCGs). The AOLM is optimized for one-way and two-way add/drop connections. Release 8.0.0 supports the following AOLMs on the XTC: • AOLM-500-T4-*n*-C5 (*n* = 1, 3, 5, or 7) • AOLM-500-T4-*n*-C6 (*n* = 1, 3, 5, or 7)
Advanced OTN Switching Line Module (AOLX)	The AOLX supports DWDM multiplexed channels (with coherent detection) and per-channel software configurable modulation options. AOLXs are tunable line modules that can be configured for one of four Optical Carrier Groups (OCGs). The AOLX is similar to the AOLM in all aspects except that the AOLX provides full line switching capacity (no restriction), opposed to the AOLM which is optimized for one-way and two-way add/drop connections only. Release 8.0.0 supports the following AOLXs on the XTC: • AOLX-500-T4-*n*-C5 (*n* = 1, 3, 5, or 7) • AOLX-500-T4-*n*-C6 (*n* = 1, 3, 5, or 7)
Submarine OTN Line Module (SOLM)	Newly added in Release 8.0.1, the SOLM supports DTN-X links operating in submarine line terminating equipment (SLTE) mode 1. SOLMs are tunable line modules that can be configured for one of four Optical Carrier Groups (OCGs). The SOLM is optimized for one-way and two-way add/drop connections. Release 8.0.1 supports the following SOLMs on the XTC: • SOLM-500-T4-*n*-C11 (*n* = 1, 3, 5, or 7)
Submarine OTN Switching Line Module (SOLX)	Newly added in Release 8.0.1, the SOLM supports DTN-X links operating in submarine line terminating equipment (SLTE) mode 1. SOLXs are tunable line modules that can be configured for one of four Optical Carrier Groups (OCGs). The SOLX is similar to the SOLM in all aspects except that the SOLX provides full line switching capacity (no restriction), opposed to the SOLM which is optimized for 1-way and 2-way add/drop connections only. Release 8.0.1 supports the following SOLXs on the XTC: • SOLX-500-T4-*n*-C11 (*n* = 1, 3, 5, or 7)

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Line Module Modulation	In Release 8.0.0, the AOLX and AOLM support dual carrier polarization multiplexed quadrature phase shift keying (DC-PM-QPSK). For Release 8.0.1, the AOLX, AOLM, SOLM, and SOLX support the following modulation formats: • Polarization multiplexed quadrature phase shift keying (DC-PM-QPSK) • Polarization multiplexed binary phase shift keying (DC-PM-BPSK) • Polarization multiplexed enhanced binary phase shift keying (DC-PM-eBPSK)
OTN Tributary Module (OTM)	The OTM houses the tributary interfaces for the XTC and connects to the XTC line modules over the backplane. Release R8.0.0 supports the OTM-500, which provides up to 500Gbps bidirectional capacity to the XTC backplane using pluggable Tributary Interface Modules (TIMs). The OTM-500 contains ten TIM sub-slots, each of which provides support for various tributary interfaces such as SONET, SDH, ODU, OTU, and/or Ethernet. The OTM-500 itself has no external connectors.
Tributary Interface Module (TIM)	The TIM maps the customer client optical signals into internal electrical signals for subsequent transmission through the OTN Tributary Module (OTM). Release 8.0.0 supports the following TIMs on the XTC: • TIM-5-10GM • TIM-1-100GE

Tributary Optical Module (TOM)	A TOM is an optical transceiver that is housed by a Tributary Adapter Module (TAM) on the DTN or a Tributary Interface Module (TIM) on the DTN-X and serves as the tributary interface for the system. A TOM converts an incoming client optical signal into a serial electrical signal for further processing in the TAM/TIM. The TOM also converts outgoing signals from electrical to optical for transport over tributary optical fibers.
	Release 8.0 supports the following TOM on the XTC:
	• Supported on the TIM-5-10GM:
	  • TOM-10G-SFPP-SR1
	  • TOM-10G-SFPP-IR2 (support added in Release 8.0.1)
	  • TOM-10G-SFPP-LR2 (support added in Release 8.0.1)
	• Supported on the TIM-1-100GE:
	  • TOM-100G-LR4
	  • TOM-100G-L10X
	  • TOM-100G-S10X
	  • TOM-100G-SR10

Blank Circuit Packs	Whenever a circuit pack is removed from an XTC, the blank space must be occupied by the corresponding blank circuit pack. The blank circuit pack prevents exposure to hazardous voltage and currents inside the chassis, contains any electromagnetic interference (EMI) that might damage other equipment, and directs the flow of cooling air through the chassis.

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Band Multiplexing Module (BMM)	In Release 8.0.0, the DTN-X supports the following BMMs on a DTC Expansion Chassis: • BMM2P-8-CH1-MS • BMM2P-8-CEH1 Release 8.0.1 adds support for the following BMMs on a DTC Expansion Chassis of a DTN-X: • BMM2-8-CH3-MS • BMM2-8-CEH3 • BMM2-8-CXH2-MS
Optical Amplification Module (OAM)	In Release 8.0.0, the DTN-X supports the following OAM on an OTC Expansion Chassis: • OAM-CXH1-MS Release 8.0.1 adds support for the following OAM on an OTC Expansion Chassis of a DTN-X: • OAM-CXH2-MS
Optical Raman Module (ORM)	In Release 8.0.0, the DTN-X supports the following ORMs on an OTC Expansion Chassis: • ORM-CXH1 • ORM-CXH1-MS
Raman Amplifier Module (RAM)	Release 8.0.1 adds support for the following RAMs on an OTC Expansion Chassis of a DTN-X: • RAM-1 • RAM-2-OR
Dynamic Spectrum Equalizer (DSE)	In Release 8.0.0, the DTN-X supports the following DSE on an OTC Expansion Chassis: • DSE-1 with optical power monitor (OPM) calibrated for open wave support Release 8.0.1 DTN-X also supports the following DSE configurations in an OTC Expansion Chassis: • DSE-1 without OPM calibration/open wave support • DSE-1 in SLTE configurations
Equipment Management	
Chassis Ambient Temperature Setting	In Release 8.0.1, the XTC supports the chassis ambient temperature setting to indicate the temperature in the system's environment. This setting determines how the system budgets power and allocates power to fans. The ambient temperature can be set to 25°C or 40°C.
Service Provisioning and Service Recovery	
Line Interfaces	In Release 8.0.1, a BMM on a DTN-X can carry a mix of traffic from line modules on a DTC/MTC (10Gbps) and line modules on an XTC (100Gbps).

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Client/Trib Interfaces	Release 8.0.0 supports the following new client/trib interfaces on the XTC: • SONET OC-192/10GbE WAN PHY • SDH STM-64 • 10GbE LAN • OTU2 (as OTU2 Clear Channel) • 100GbE LAN Release 8.0.1 adds support for cDTF transport as 11.1GHz Clear Channel.
Manual Cross-connect Provisioning	Release 8.0.0 supports bi-directional manual cross-connects for services on the XTC. Release 8.0.1 adds support for unidirectional manual cross-connects for services on the XTC.
Dynamically Signaled Sub-network Connection (SNC) Provisioning	Release 8.0.1 adds support for SNCs on the DTN-X for all supported payload types: • SNCs are supported between XTCs (an SNC that originates on an XTC must also terminate on an XTC). • SNCs are supported between DTCs and/or MTCs that are configured as Expansion Chassis of a DTN-X. • SNCs are supported between an DTC/MTC that is configured as an Expansion Chassis of a DTN-X and an DTC/MTC that is configured as an Expansion Chassis of a DTN.
Optical Express	In Release 8.0.0, the DTN-X supports Optical Express of AOLM/AOLX OCGs. Release 8.0.1 adds support for Optical Express of SOLM/SOLX OCGs.
Out-of-band GMPLS	Release 8.0.1 adds support for Out-of-band GMPLS on DTN-X for OTS to enable circuit provisioning in cases where in-band OSC is unavailable (e.g., submarine applications).
Fault Management	
Alarm Surveillance	In Release 8.0.1, the default severity setting for the TSM-NON-REDUNDANT alarm is updated from Minor (MN) to Not Reported (NR). Release 8.0.1 adds support for the following alarms for 100GbE payloads: • LF—Local fault • RF—Remote fault • DE-ENCAP-LF—De-encapsulated local fault • DE-ENCAP-RF—De-encapsulated remote fault
Maintenance and Trouble-shooting	R8.0.1 introduces support for G.709 formatting of TTI messages for OTUki section for both ASCII and HEX formats.
Digital Subnetwork Connection Protection (D-SNCP)	Release 8.0.1 adds support for 1 Port D-SNCP protection for DTN-X services.

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Equipment Management	
Tributary Disable Action	Release 8.0.1 supports a Send LF (send local fault) option for the tributary disable function for Ethernet clients on the TIM-5-10GM and for 100G Ethernet clients on the TIM-1-100GE.
Performance Monitoring	
Optical, Digital, and Client Performance Monitoring	Release 8.0 includes PM data for the new DTN-X modules listed above. Release 8.0.1 updates support for the following PM data: • Input Voltage data added for Feed PTP termination point on XTC PEMs. • Far-end Defect Seconds data added for OTUki and ODUki termination points. • CV-S data removed for OTUki termination points. • Far-end Errored Blocks data removed for OTUki and ODUki termination points.

Table 1-1 New and Updated Features for DTN-X in Release 8.0

Feature	Description
Network Management User Interfaces	

Infinera DTN Graphical Node Manager (GNM) GUI	Release 8.0 includes updates to the GNM to support all the Release 8.0 and 8.0.1 features and hardware listed above. In addition, Release 8.0 includes the following GNM-specific updates:
	• The Equipment View can be zoomed/unzoomed by using the slide bar.
	• The Quick View Browser has been enhanced to display information in a tabular format and displays the Administrative state, Operation state and Alarm Reporting icons.
	• The Link Manager is enhanced with the following:
	  • Support for new modules and termination points introduced in Release 8.0.
	  • The following new columns have been added for Bandwidth information: 1.25G, 40G, and 100G
	  • The following new columns have been added for TE Links: Link Capacity, Time Slot Type
	  • The Quick filter has been updated with a new filter for TE Links: Digital Span Utilization, Timeslot Type, TE Link Capacity, Availability Filter, Time slot Rate, Service Rate
	  • Right-click Options for the GMPLS have been enhanced in Release 8.0.
	  • The following new columns have been added for TE Interface: Availability State and Role
	  • The following new columns have been added for GMPLS Control Channel: Availability State
	Release 8.0.1 includes the following GNM-specific updates:
	• Support for the creation of unprotected and 1-port protected SNCs (circuits) originating/terminating on XTC.
	• Support for the creation of 1-port protected cross-connects originating/terminating on XTC.
	• Support for the creation of 1-port digital SNCP on DTN-X.
	• Support for a G.709 format of TTI that can handle both ASCII and HEX values.

Infinera SNMP Agent	Release 8.0.1 includes updates to the SNMP Agent to support all the Release 8.0 features listed above.
Transaction Language 1 (TL1) Interface	Release 8.0.1 includes updates to the TL1 interface to support the Release 8.0 features listed above.

Table 1-2 Updated Features for DTN and Optical Line Amplifier

Feature	Description
Fault Management	
Alarm Surveillance	Release 8.0 supports the following new alarms for 10GbE and 1GbE payloads: • LF—Local fault • RF—Remote fault • DE-ENCAP-LF—De-encapsulated local fault • DE-ENCAP-RF—De-encapsulated remote fault
Equipment Management	
Tributary Disable Action	The TAM-2-10GM/TAM-8-2.5GM support the SEND LF tributary disable option for 10GbE or 1GbE tributaries.
Encapsulated Client Disable Action	In addition to specifying tributary disable actions, Release 8.0 supports an option to configure a disable action for encapsulated Ethernet client interfaces on the TAM-2-10GM. The encapsulated client disable action specifies the replacement signal type for the encapsulated Ethernet client interface (either all zeroes or local fault signal). The encapsulated client disable action applies only to 10GbE signals that are adapted to ODUk signals (ODU2e or ODU1e).
Service Provisioning and Service Recovery	
OTN Adaptation Services	In Release 8.0, the DTN supports an option to configure a disable action for encapsulated Ethernet client interfaces on the TAM-2-10GM. The encapsulated client disable action specifies the replacement signal type for the encapsulated Ethernet client interface (either all zeroes or local fault signal). The encapsulated client disable action applies only to 10GbE signals that are adapted to ODUk signals (ODU2e or ODU1e).
Performance Monitoring	
Optical, Digital, and Client Performance Monitoring	Release 8.0 supports the Tx BEI and Rx BEI Count PM for ODUk and OTUk interfaces.
Network Management User Interfaces	
SNMP Agent	Release 8.0.1 includes updates to the SNMP Agent to support all the Release 8.0 features listed above.
Transaction Language 1 (TL1) Interface	Release 8.0.1 includes updates to the TL1 interface to support the Release 8.0 features listed above.

Features No Longer Supported in Release 8.0

Table 1-3 lists the features that are no longer supported in Release 8.0.

Table 1-3 Features No Longer Supported in Release 8.0

Feature	Description
GNM Updates	
Microsoft Windows 2000 and Microsoft Windows 2000 International Edition	GNM is no longer supported on Microsoft Windows 2000 and Microsoft Windows 2000 International Edition.
DNA Updates	
Microsoft Windows 2000 and Microsoft Windows 2000 International Edition	DNA is no longer supported on Microsoft Windows 2000 and Microsoft Windows 2000 International Edition.

CHAPTER 2

Infinera DTN-X

The Infinera DTN-X, referred to as the DTN-X, is a network element deployed in a Digital Optical Network. The DTN-X provides digital bandwidth management and client access to the Dense Wavelength Division Multiplexing (DWDM) transport bandwidth.

The DTN-X consists of one or more Switching Transport Chassis (XTC), Digital Transport Chassis (DTC), and/or MTC. Refer to "Infinera DTN" on page 3-1 for more details on the DTC/MTC.

This chapter provides a hardware description for the DTN-X including a functional description of the hardware, block diagram of the internal signal flow (where applicable), and technical specifications. This chapter includes the following sections:

For DTN-X installation procedures, refer to the *Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide.* For DTN-X turn-up and test procedures, refer to the *Infinera DTN and DTN-X Turn-up and Test Guide.*

For a description of module Light Emitting Diode (LED) status indicators, refer to the *Infinera GNM Fault Management and Diagnostics Guide*.

XTC System Specifications

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

This section contains system specifications for the XTC-10 and XTC-4, and includes the following:

- "XTC Power Consumption and Configuration Rules" on page 2-3
- "XTC Compliancy" on page 2-6
- "XTC Technical Specifications" on page 2-7

XTC Power Consumption and Configuration Rules

Power consumption numbers for the XTC-10 and XTC-4 are presented as two values:

- Typical Power Draw—characterizes average power usage under normal operating system conditions and can be used for estimating average power consumption over time (ongoing operational cost for power consumption)
- Maximum Power Draw—is worst-case power draw under severe equipment, environmental, and network conditions

Table 2-1 provides typical and maximum power draw numbers for supported XTC-10 and XTC-4 system components.

Table 2-1 XTC Power Consumption Numbers

Configuration	Typical Power Draw (Watts)	Maximum Power Draw at 40º C (Watts)	Maximum Power Draw at 55º C (Watts)
Base XTC-10 (1 XCM, 2 PEMs, and 4 fan trays)	1054	2142	4490
Base XTC-4 (1 XCM, 2 PEMs, and 2 fan trays)	642	1192	2370
XCM	110	116	120
TSM-X10 or TSM-X4	12	15	15
OXM-X10 or OXM-X4	60	63	65
AOLM-500, AOLX-500, SOLM-500, or SOLX-500	390	440	470
OTM-500	120	126	130
TIM-1-100GE with LR4 TOM type	90	100	110
TIM-1-100GE with SR10, S10X, or L10X TOM types	84	91	100
TIM-5-10GM with LR2 TOM type	48	50	52
TIM-5-10GM with SR1 or IR2 TOM types	46	48	50

Maximum Power Draw

The XTC requires two or more 60A feeds, depending on the customer configuration, not including redundant power connections.

The user can configure the system software to calculate per-chassis worst-case power draw based on shelf configuration, and escalate a standing condition for an XTC when this configuration is exceeded. The power draw limit is compared against the total estimated power draw for all of the equipment provisioned (and pre-provisioned) in the chassis.

The chassis raises an alarm if the sum of the power values for the provisioned/pre-provisioned equipment in the chassis exceeds the user configured maximum power draw value. This raised alarm does not indicate actual power draw, but indicates that the system is configured in such a way that should all environmental, network and system conditions be worst-case—that this is the potential total maximum power draw of the system under those conditions.

Note: The active XCM controls the power up for most of the installed modules (i.e. line modules and TIMs). If not enough power feeds are connected, the system software will not power up the modules and notify the user via the management interfaces. Refer to “XTC Chassis Power Control” on page 2-77 for more details.

Inrush Current

Inrush current refers to the maximum, instantaneous current drawn by the XTC at initial system power up (or by a module inserted into an XTC already powered up). The inrush current for the XTC will not exceed the worst-case power consumption current for the particular shelf configuration (or module) within the appropriate ambient selected (normal or short-term operation). For example:

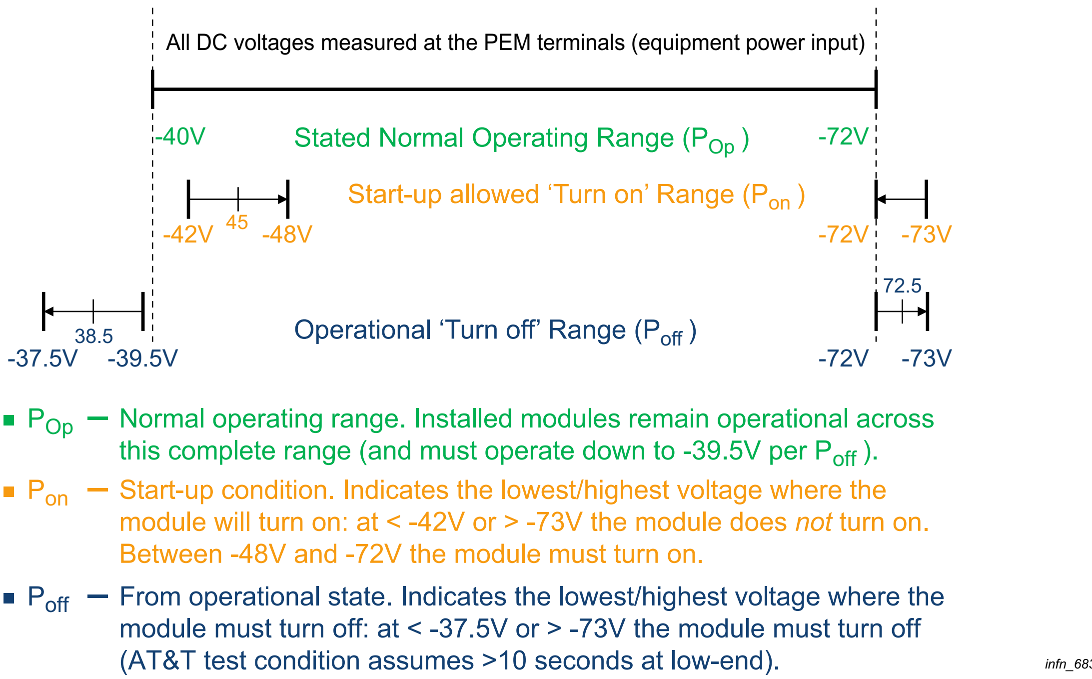
- For environments under 40º C (normal operation), the inrush current will not exceed that for the 40º C worst-case power consumption
- For environments under 55º C (short-term operation), the inrush current will not exceed that for the 55º C worst-case power consumption

Input Voltage Operating Range and Thresholds

The XTC DC input voltage operating range and thresholds are shown in Figure 2-1. The thresholds comply with the ATT-TP-76200 standard.

The thresholds shown in Figure 2-1 do not apply to fan trays which operate over a wider voltage range.

Figure 2-1 Input Voltage Operating Range and Thresholds



XTC Compliancy

The XTC complies with many industry standard specifications as described in Table 2-2.

Table 2-2 XTC Hardware Compliancy

Category	Approval Agency / Requirement
Safety Certifications	• IEC/EN/UL 60950: Safety of Information Technology Equipment • CAN/CSA C22.2 No. 60950: Safety of Information Technology Equipment • AS/NZS 60950: Approval & Test specification - Safety of Information Technology Equipment • UL Class II: Fire Safety (air filters)

NEBS/ETSI Compliancy	• NEBS Level 1/3
	  • GR-63-CORE: Network Equipment Building Systems - Physical Protection
	  • GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety - Generic requirement for Network Telecommunications Equipment
	• ETS 300 386
	• ETS 300 019-2-1, 2, 3, and 4 A1 (earthquake test methods)

EMC Emissions	• CISPR 22/EN55022 Class A, FCC-A, VCCI-A
EMC Immunity	• CISPR 24/EN55024

Laser Safety	• IEC/EN 60825 Series: Safety of Laser Products
	  • IEC/EN 60825-1: 2007
	  • IEC/EN 60825-2: 2004+A1
	• FDA 21 CFR 1040: Performance Standard of Light Emitting Products

General Compliancy	• ETSI ETS 300 119-2 • ETSI ETS 300 119-4 • GR-78-CORE • GR-253-CORE • GR-1209-CORE • GR-1221-CORE • ANSI T1.315 • ANSI T1.304 • ATT-TP-76200

XTC Technical Specifications

Table 2-3 provides electrical and environmental specifications for the XTC, common components, and all supported circuit packs.

Table 2-3 XTC Technical Specifications

Type	Parameter	Specification
Electrical specifications	Power consumption	XTC-10: • Typical dissipation (at 25º C): 7838W • Maximum dissipation (at 40º C): 9336W • Maximum dissipation (at 55º C): 12,211W Refer to Table 2-1 on page 2-3 for module level power consumption numbers
		XTC-4: • Typical dissipation (at 25º C): 3380W • Maximum dissipation (at 40º C): 4107W • Maximum dissipation (at 55º C): 5522W Refer to Table 2-1 on page 2-3 for module level power consumption numbers
	Input voltage range	-40V DC to -72V DC (Worldwide except for Australia/New Zealand) IEC/EN/UL/CSA 60950 See Figure 2-1 on page 2-5 for detailed information regarding the input voltage operating range and thresholds
		-40V DC to -60V DC (Australia/New Zealand only) ANZ60950-1
Environmental specifications	Operating temperature range	Normal operation (including system power up): 5º C to 40º C Short term operation: -5º C to 50º C
	Storage temperature range	-40º C to 70º C
	High relative humidity	90% non-condensing

XTC-10 Overview

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

The Switching Transport Chassis (XTC) is available in two variants:

- XTC-10—is a single bay chassis option providing ten universal card slots to house line modules and/or OTM-500s. In addition, the XTC-10 is a nominal ETSI (600mm) width chassis type with an available 23-inch mounting option
- XTC-4—is a half-bay chassis option providing four universal card slots to house line modules and/or OTM-500s. In addition, the XTC-4 is an ANSI 19-inch width chassis type with an available ETSI (600mm) and 23-inch mounting option. For more details on the XTC-4, see "XTC-4 Overview" on page 2-44

Note: The DTN-X (XTC-10 and XTC-4) is designed to operate in open frame racks or Infinera supplied cabinets. Contact your Infinera account team or the Infinera deployment team if a third-party cabinet is considered for installation as Infinera will need to review the cabinet specifications.

Table 2-4 provides a list of the common components that make up an XTC-10 (some components are field-replaceable).

Table 2-5 on page 2-9 provides a list of the supported circuit packs on an XTC-10 (circuit packs are field-replaceable).

Table 2-4 XTC-10 Common Components

Name	Description
Rack Mounting Ears	See page 2-17
XTC-10 Cabinet	See page 2-18
XTC-10 Power Entry Module (PEM) Shelf	See page 2-24
Power Entry Module (PEM)	See page 2-27
Input/Output Timing and Alarm Panel (IOTAP)	See page 2-31
Fan Tray	See page 2-38
Air Filter	See page 2-40
Card Cage	See page 2-41

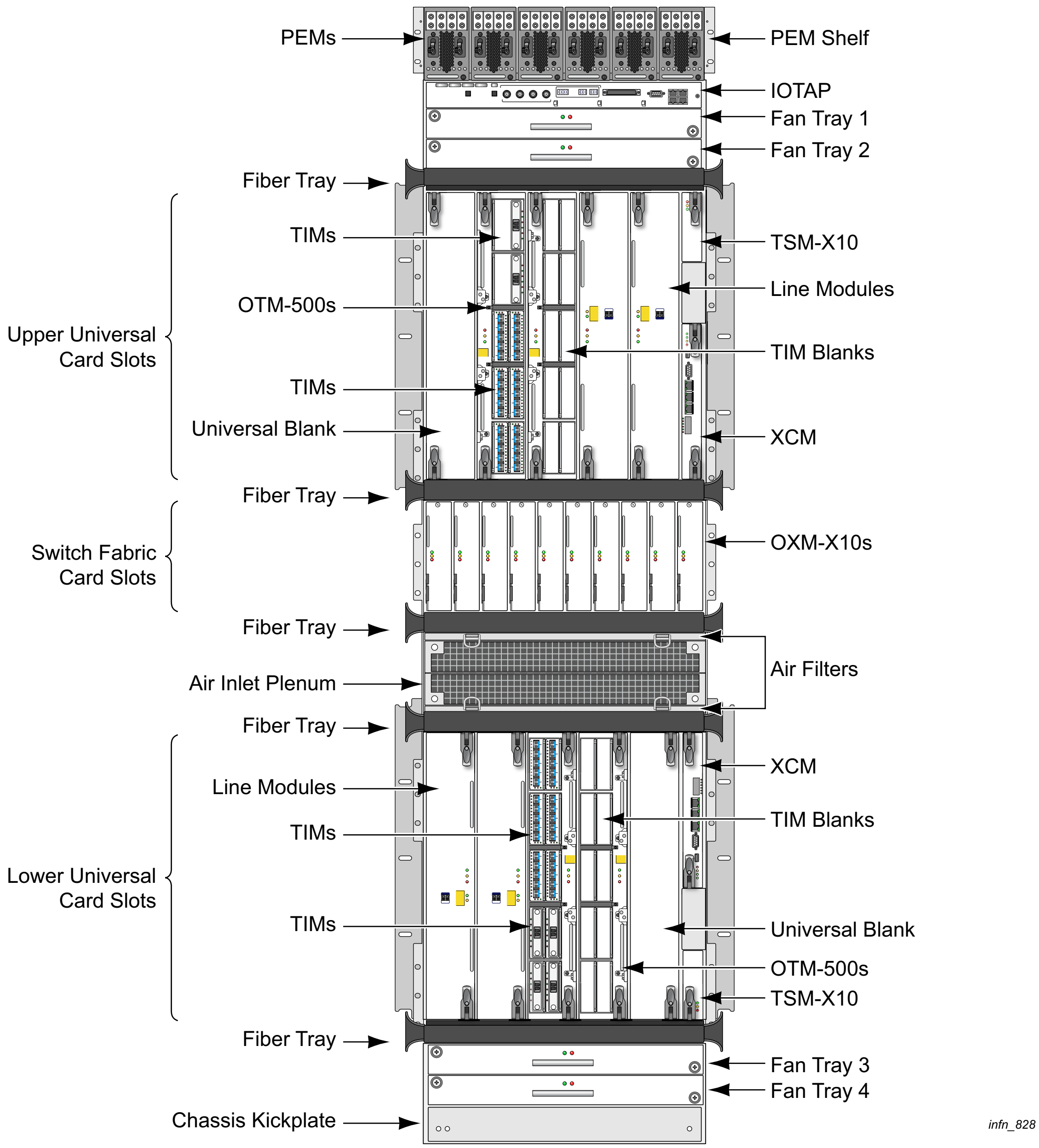
Table 2-5 XTC-10 Supported Circuit Packs

Name	Description
DTN-X Control Module (XCM)	See page 2-76
Timing Synchronization Module (TSM-X10)	See page 2-83
OTN Switch Module (OXM-X10)	See page 2-93
Advanced OTN Line Module 500G (AOLM-500)	See page 2-103
Advanced OTN Switching Line Module 500G (AOLX-500)	See page 2-110
Submarine OTN Line Module 500G (SOLM-500)	See page 2-117
Submarine OTN Switching Line Module 500G (SOLX-500)	See page 2-124
OTN Tributary Module 500G (OTM-500)	See page 2-131
Tributary Interface Module 100GE (TIM-1-100GE)	See page 2-136
Tributary Interface Module 10GM (TIM-5-10GM)	See page 2-140
Tributary Optical Module 100G (TOM-100G-SR10)	See page 2-148
Tributary Optical Module 100G (TOM-100G-S10X)	See page 2-151
Tributary Optical Module 100G (TOM-100G-LR4)	See page 2-154
Tributary Optical Module 100G (TOM-100G-L10X)	See page 2-157
Tributary Optical Module 10G (TOM-10G-SFPP-SR1)	See page 2-160
Tributary Optical Module 10G (TOM-10G-SFPP-IR2)	See page 2-163
Tributary Optical Module 10G (TOM-10G-SFPP-LR2)	See page 2-166
Blank Circuit Packs	See page 2-169

Front View

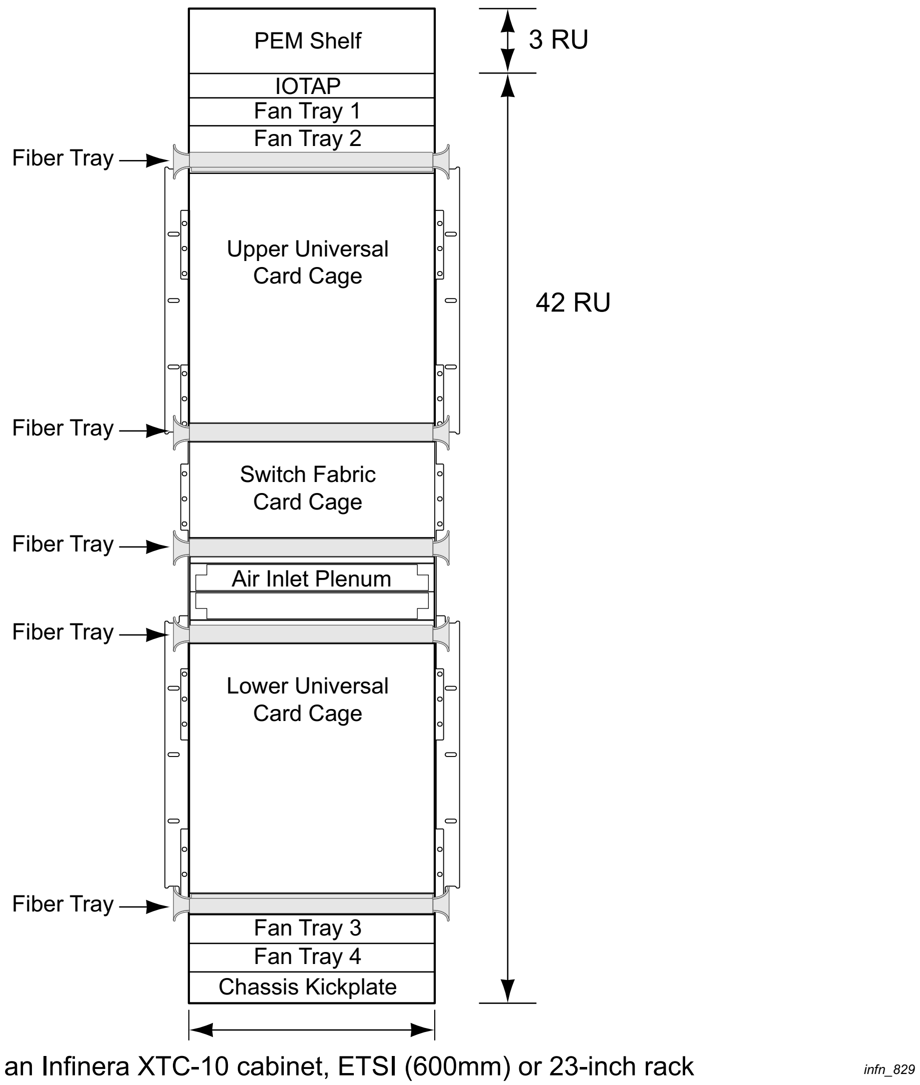
A front view of the XTC-10, with components and circuit packs, is shown in Figure 2-2.

Figure 2-2 XTC-10 Front View



A single bay can accommodate one XTC-10 PEM shelf and one XTC-10 as shown in Figure 2-3.

Figure 2-3 XTC-10 on a Cabinet or Rack



XTC-10 Thermal Loading

Table 2-6 provides typical heat release information (calculated for feet) for the XTC-10 housed in a 23-inch frame.

Table 2-6 XTC-10 Typical Heat Release (Calculated for Feet)

XTC-10 Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	5760								
Frame Depth (feet)	2.0								
Frame Width (feet)	2.167								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	886.0	817.9	759.4	708.8	664.5	625.4	590.7	559.6	531.6
1.5	817.9	759.4	708.8	664.5	625.4	590.7	559.6	531.6	506.3
2.0	759.4	708.8	664.5	625.4	590.7	559.6	531.6	506.3	483.3
2.5	708.8	664.5	625.4	590.7	559.6	531.6	506.3	483.3	462.3
3.0	664.5	625.4	590.7	559.6	531.6	506.3	483.3	462.3	443.0
3.5	625.4	590.7	559.6	531.6	506.3	483.3	462.3	443.0	425.3
4.0	590.7	559.6	531.6	506.3	483.3	462.3	443.0	425.3	408.9
4.5	559.6	531.6	506.3	483.3	462.3	443.0	425.3	408.9	393.8
5.0	531.6	506.3	483.3	462.3	443.0	425.3	408.9	393.8	379.7

Table 2-7 provides typical heat release information (calculated for meters) for the XTC-10 housed in a 23-inch frame.

Table 2-7 XTC-10 Typical Heat Release (Calculated for Meters)

XTC-10 Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	5760								
Frame Depth (meters)	0.610								
Frame Width (meters)	0.660								
Maintenance Aisle (meters)	**Wiring Aisle (meters)**								
	0.305	**0.457**	**0.610**	**0.762**	**0.914**	**1.067**	**1.219**	**1.372**	**1.524**
	Heat Release (Watts/m^2)								
0.305	9538.0	8806.5	8175.4	7632.1	7156.4	6734.0	6361.0	6025.0	5724.7
0.457	8806.5	8179.3	7632.1	7156.4	6736.6	6361.0	6027.1	5724.7	5452.8
0.610	8175.4	7632.1	7153.5	6734.0	6361.0	6025.0	5724.7	5451.1	5204.1
0.762	7632.1	7156.4	6734.0	6361.0	6027.1	5724.7	5452.8	5204.1	4978.5
0.914	7156.4	6736.6	6361.0	6027.1	5726.6	5452.8	5205.7	4978.5	4771.6
1.067	6734.0	6361.0	6025.0	5724.7	5452.8	5204.1	4978.5	4770.3	4580.0
1.219	6361.0	6027.1	5724.7	5452.8	5205.7	4978.5	4771.6	4580.0	4404.4
1.372	6025.0	5724.7	5451.1	5204.1	4978.5	4770.3	4580.0	4403.3	4240.7
1.524	5724.7	5452.8	5204.1	4978.5	4771.6	4580.0	4404.4	4240.7	4089.6

XTC-10 Product Details

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

Table 2-8 lists the name and a brief description of the XTC-10 and the supported options.

Table 2-8 XTC-10 Product Details

Product Ordering Name (PON)	Description
XTC-10	Switching Transport Chassis; includes 10 universal card slots for I/O, switch, timing, and control modules
X-DOOR-U-X10	XTC-10 front chassis door kit for upper and lower universal card slots
X-DOOR-S-X10	XTC-10 front chassis door kit for switch fabric card slots
X-DOOR-X10+	XTC-10 door kit; contains two X-DOOR-U-X10, one X-DOOR-S-X10, and one X-RM-ETSI-X10
X-AIRBAFFLE-X10	XTC-10 air baffles kit
X-FIBERGUIDE-X10	XTC-10 fiber management kit

Functional Description

The XTC-10 houses the common equipment required for operations and the circuit packs that transport and terminate optical signals. The XTC-10 provides a redundant and scalable switch fabric with ODU0 switching granularity to support customer traffic from line-to-trib, trib-to-trib, and/or line-to-line. The XTC-10 supports the following functions:

- The XTC-10 can be deployed as a Main Chassis or an Expansion Chassis within a DTN-X. A DTN-X can support up to 44 interconnected chassis (4 XTCs, 28 DTC/MTCs, and 12 OTCs). The Main Chassis must be an XTC; the Expansion Chassis can be any combination of XTC/DTC/MTC/OTCs
- The XTC-10 is used in Digital Terminal, Digital Add/Drop, and Digital Repeater configurations

The XTC-10 is composed of the following components (see Figure 2-2 on page 2-10 for an illustration):

- “Rack Mounting Ears” on page 2-17
- “XTC-10 Cabinet” on page 2-18
- “XTC-10 Power Entry Module (PEM) Shelf” on page 2-24
- “Power Entry Module (PEM)” on page 2-27
- “Input/Output Timing and Alarm Panel (IOTAP)” on page 2-31
- “Fan Tray” on page 2-38
- “Air Filter” on page 2-40

❑ "Card Cage" on page 2-41

Mechanical Specifications

Table 2-9 provides the mechanical specifications for the XTC-10.

Table 2-9 XTC-10 Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	73.50 inches / 1867.00mm (42 RU)
	Width	19.44 inches / 493.78mm
	Depth	18.37 inches / 466.60mm
	Depth (including fiber management trays; excluding doors)	21.32 inches / 541.53mm
	Weight - chassis only	200.0lb / 90.7kg
	Weight - fully loaded chassis (including PEM shelf and six PEMs)	944.5lb / 428.4kg (approximately)

Electrical Grounding Points

The XTC-10 contains four electrical grounding points located as follows:

- One at the front, lower left section of the chassis (on the chassis kickplate)
- One at the rear, upper left section of the chassis
- Two at the left side, upper and lower rear sections of the chassis

Electrostatic Discharge (ESD) Grounding Jacks

The XTC-10 contains several ESD grounding jacks located as follows:

- One at the upper right section of the IOTAP
- One at each of the two panels located between the XCM and TSM-X10 at the right section of the universal card cages
- One at the front, lower right section of the chassis (on the chassis kickplate)

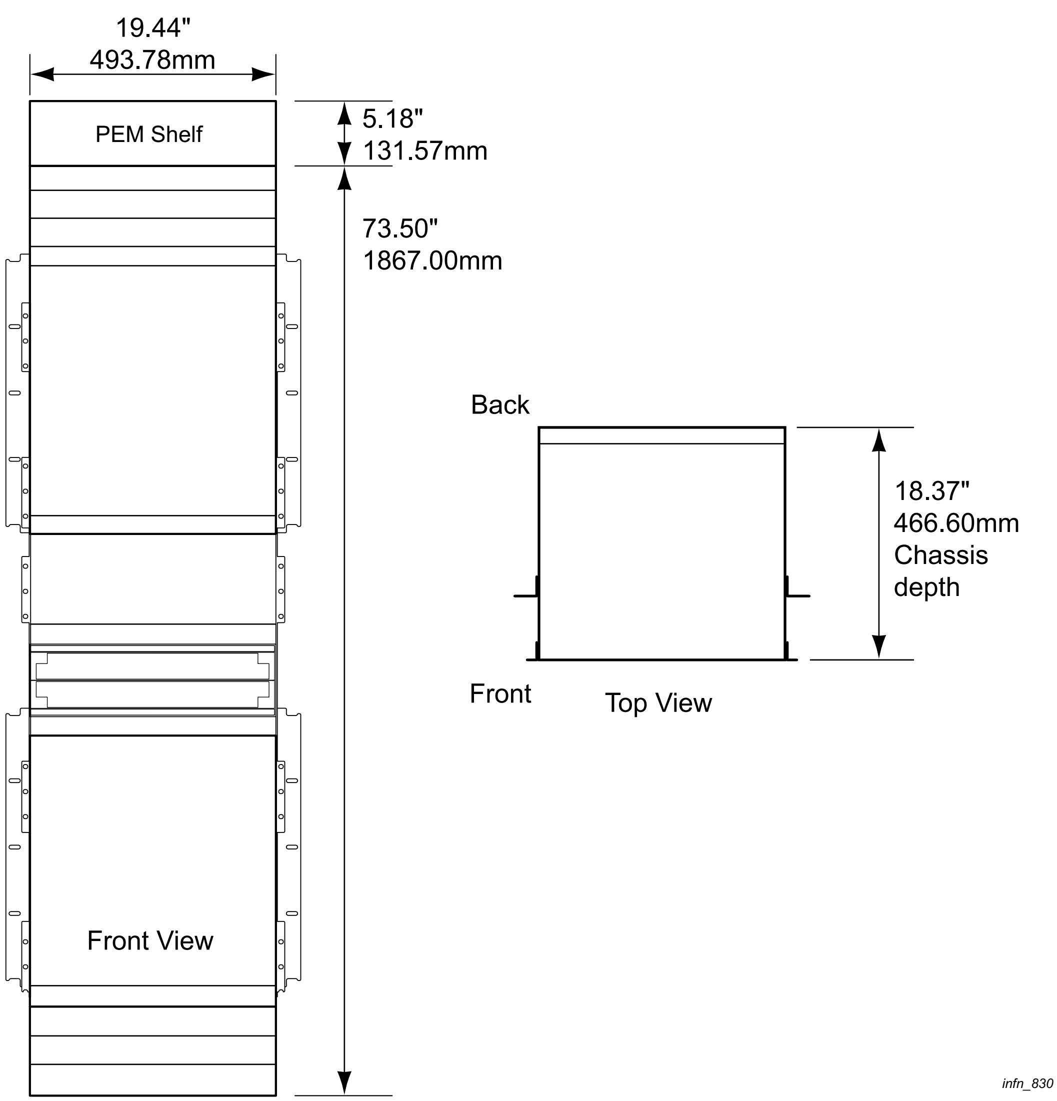
Fiber Management Trays

Fiber management trays are provided to route fibers away from the circuit packs in a manner that protects the fibers and allows for any circuit pack to be inserted, removed, and/or replaced without disturbing another circuit pack's fibers. A fiber tray is located above and below each universal card cage. The fiber trays at the top of each card cage are inverted. Fibers from the top half of each circuit pack are routed to the upper tray and fibers from the bottom half of each circuit pack are routed to the lower tray.

XTC-10 Dimensions

The XTC-10 (shown with PEM shelf) top and front dimensions of the chassis are provided in Figure 2-4.

Figure 2-4 XTC-10 Dimensions



Rack Mounting Ears

Table 2-10 XTC-10 Rack Mounting Product Details

Product Ordering Name (PON)	Description
X-RM-ETSI-X10	XTC-10 external rack mounting option; ETSI (600mm) rack mount package. Required for installing the XTC-10 doors on the XTC-10. Also shipped as part of the XTC-10 door kit (PON X-DOOR-X10+) **NOTE**: ETSI (600mm) rack mounting ears are not shipped as part of the XTC-10.
X-RM-ETSI-B2-X10	XTC-10 cabinet mounting option; required for installing the XTC-10 in the XTC-10 cabinet **NOTE**: XTC-10 cabinet mounting ears are pre-installed as part of the XTC-10.
X-RM-ANSI-X10	XTC-10 external rack mounting option; ANSI 23-inch rack mount package **NOTE**: ANSI 23-inch rack mounting ears are pre-installed as part of the XTC-10.

The XTC-10 includes cabinet mounting ears used to mount the chassis in the XTC-10 cabinet.

Additionally, external rack mounting ears are included to provide flush and mid-mounting configurations for ANSI 23-inch racks at flush, 1, 2, 4, 5, 7, and 8 inches rearward of the flush mount position.

Note: ETSI (600mm) rack mounting ears are not shipped as part of the XTC-10 but are required to flush mount the XTC-10 on an industry standard ETSI (600mm) rack or when installing the XTC-10 doors on the XTC-10.

XTC-10 Cabinet

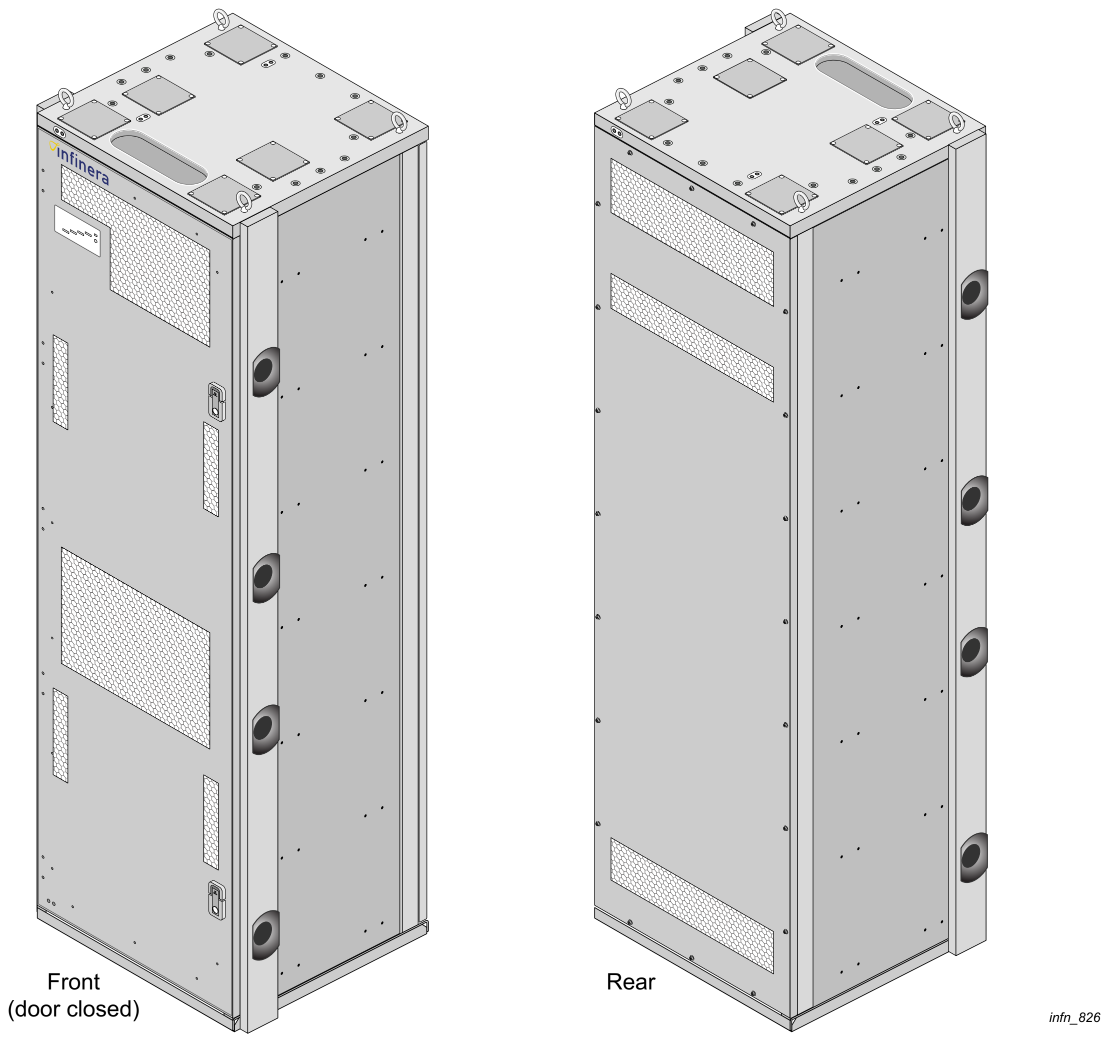
Table 2-11 XTC-10 Cabinet Product Details

Product Ordering Name (PON)	Description
X-CABINET-X10	Infinera custom cabinet used to house an XTC-10 and an XTC-10 PEM shelf hosting up to 6 PEMs. The cabinet is 600mm x 600mm floor, ETSI compliant

The XTC-10 cabinet (Figure 2-5 on page 2-19), referred to as cabinet, consists of a seven foot steel enclosure on a skeletal frame including top, base, side and rear panels, lockable front door, air baffles, and mounting hardware. The cabinet details are listed as follows:

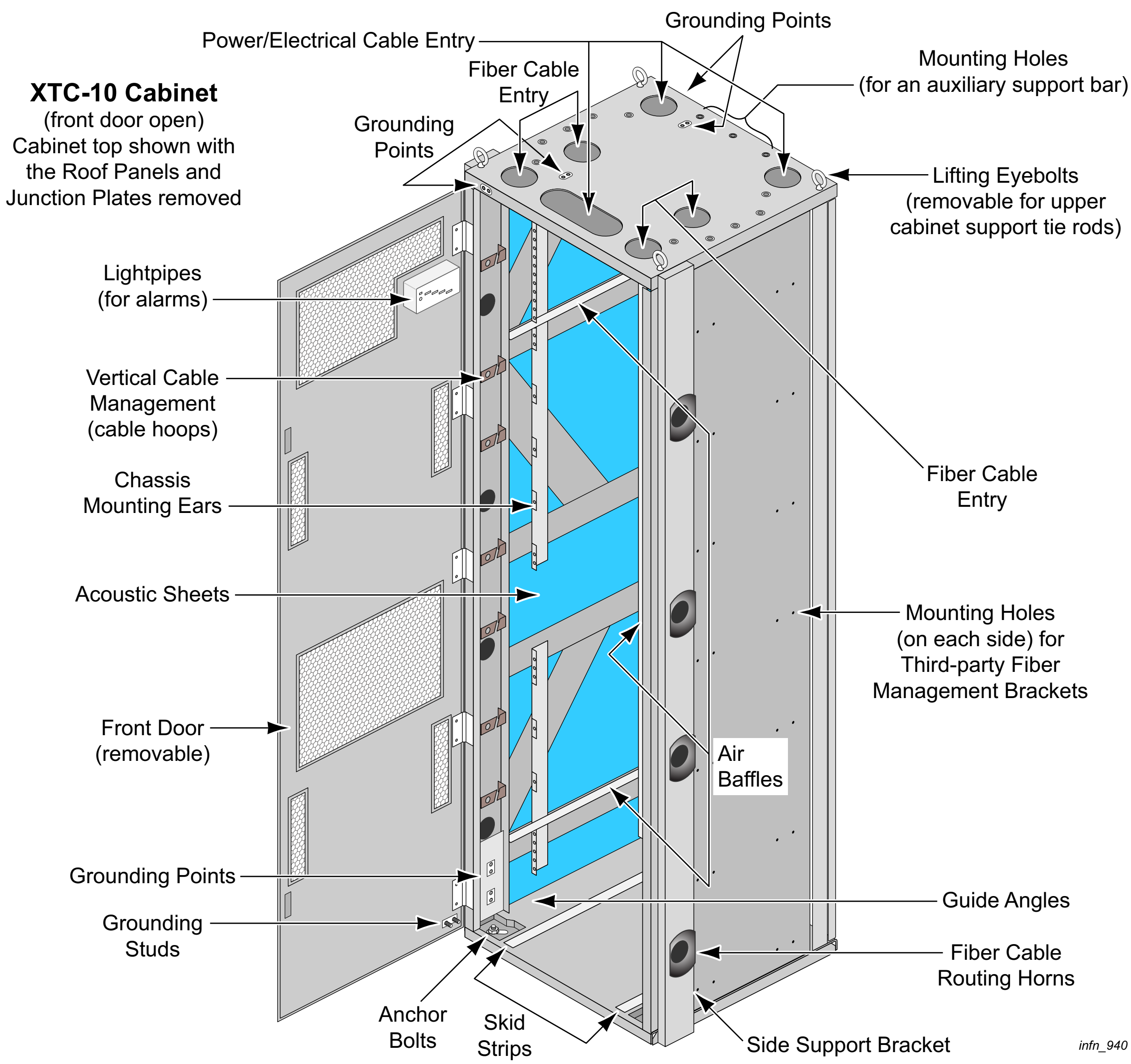
- The cabinet interior provides up to 45 RU of rack space to accommodate an XTC-10 PEM shelf (in the upper 3 RU) and an XTC-10 (in the lower 42 RU)
- Rack mounting ears are located in the cabinet to mount the XTC-10 PEM shelf and XTC-10
- The top panel has lifting eyebolts and removable roof panels for network, power, and grounding cable access
- The base contains customizable mounting holes for cabinet grouting. In addition, the base contains skid strips and guide angles to facilitate installation of the XTC-10 in the cabinet
- The front door, side and rear panels contain acoustic material mounted on the inside for noise reduction
- The front door and rear panel are both removable and include perforated honeycomb steel to facilitate airflow through the cabinet. Light pipes and an alarm cutoff (ACO) reset button are provided on the front door
- Air baffles are located in the cabinet to prevent heated exhaust air from mixing with cooler inlet air. The rack mounting ears also serve as air baffles
- Vertical cable trays with integrated cable hoops are provided on the interior of each side panel for vertical cable management
- Side support brackets are provided on the exterior of each side panel with cutouts containing fiber horns for external fiber routing. Mounting holes are also provided on the exterior of each side panel for attachment of third-party fiber management brackets
- Internal and external electrical grounding points are located on the cabinet as follows:
  - Internal—two at the front, lower left section; one on the front door, lower right section
  - External—two on the top panel; one at the front, upper left section (above the front door); one at the rear, upper left section (above the rear panel)

Figure 2-5 XTC-10 Cabinet



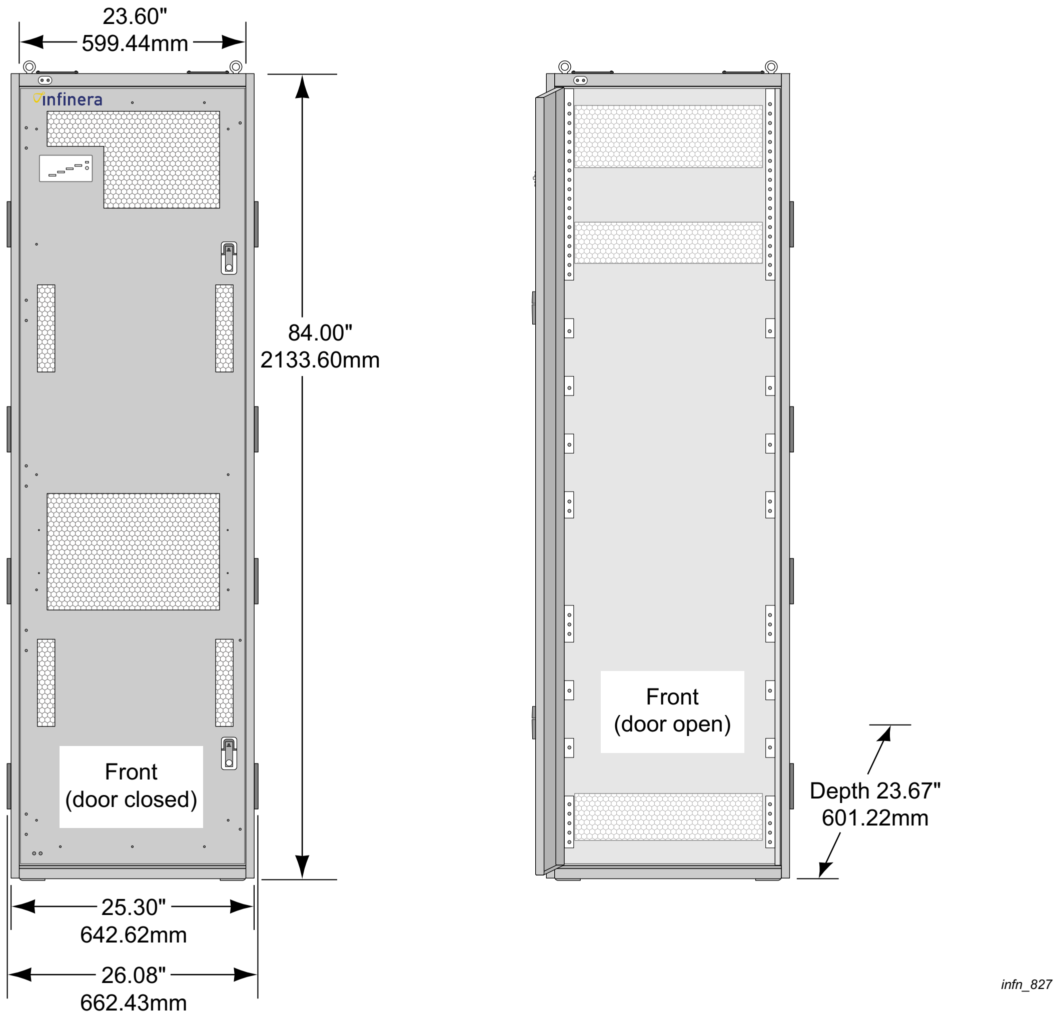
The XTC-10 cabinet details are provided in Figure 2-6.

Figure 2-6 XTC-10 Cabinet Details



The XTC-10 cabinet dimensions are provided in Figure 2-7.

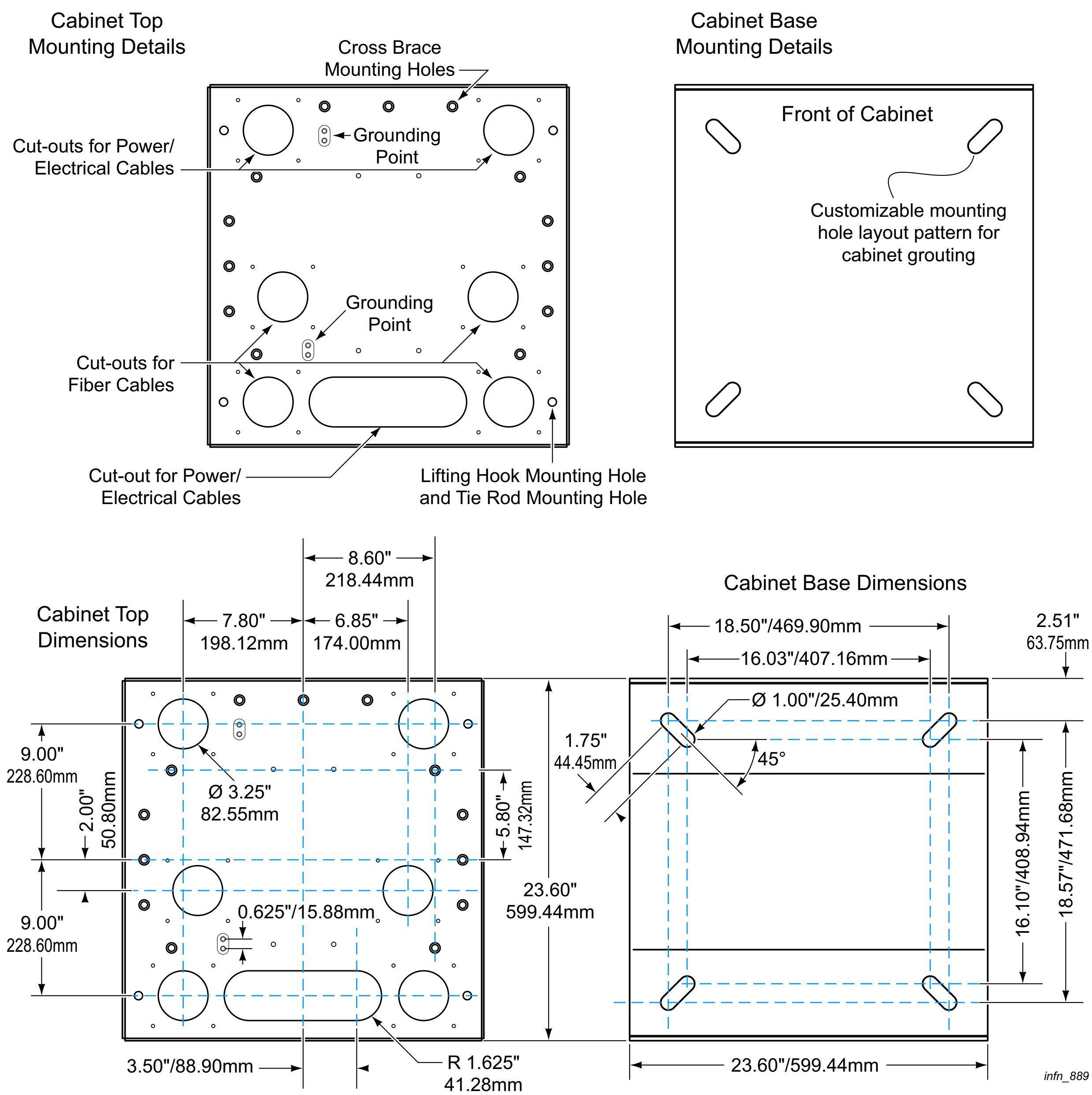
Figure 2-7 XTC-10 Cabinet Dimensions



Note: The dimension (width x depth) of each internal vertical cable tray is approximately 1.25 inches x 3.50 inches (31.75mm x 88.90mm).

The XTC-10 cabinet top and base mounting details are provided in Figure 2-8.

Figure 2-8 XTC-10 Cabinet Top and Base Mounting Details



Mechanical Specifications

Table 2-12 provides the mechanical specifications for the XTC-10 cabinet.

Table 2-12 XTC-10 Cabinet Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	84.00 inches / 2133.60mm
	Width	23.60 inches / 599.44mm
	Width (including side support brackets)	25.30 inches / 642.62mm
	Width (including side support brackets and fiber routing horns)	26.08 inches / 662.43mm
	Depth	23.67 inches / 601.22mm
	Dimension (width x depth) of each internal vertical cable tray	1.25 inches x 3.50 inches 31.75mm x 88.90mm
	Weight - empty cabinet including front door, top, base, rear and side panels	280.0lb / 127.0kg
	Useable load (i.e. weight of the equipment installed in the cabinet)	800.0lb / 362.9kg

XTC-10 Power Entry Module (PEM) Shelf

Table 2-13 XTC-10 PEM Shelf Product Details

Product Ordering Name (PON)	Description
X-PS-SHELF	XTC-10 Power Entry Module (PEM) shelf hosting up to 6 PEMs, providing N+N redundancy
X-BEZEL-PS	XTC-10 PEM shelf front air inlet bezel
X-AIRFILTER-PS	XTC-10 PEM shelf replacement air filter

The XTC-10 PEM shelf (Figure 2-9), referred to as PEM shelf, is used exclusively with the XTC-10 and houses up to six PEMs (providing N+N redundancy) depending on system load requirements and the customer's configuration. The three PEMs occupying the left half of the shelf comprise feed A, and the three PEMs occupying the right half of the shelf comprise feed B. The PEM shelf slots are individually labeled, A1 (center slot) through A3 (left-most slot) and B1 (center slot) through B3 (right-most slot).

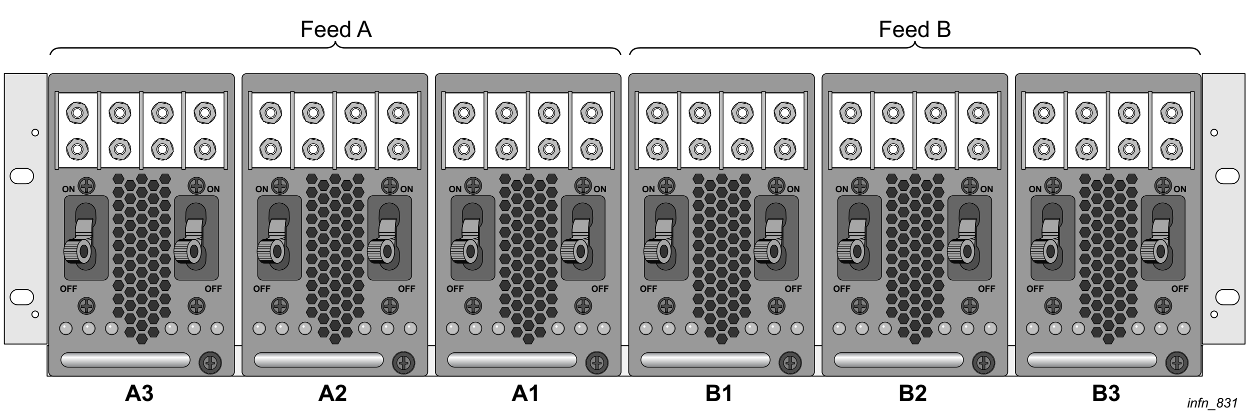
The PEM shelf is typically mounted inside the XTC-10 cabinet (occupying the upper 3 RU of rack space above the XTC-10) or on an industry standard ETSI (600mm) or 23-inch rack.

Note: The XTC-10 PEM shelf can be "colocated" with the XTC-10 (i.e. XTC-10 and XTC-10 PEM shelf reside on the same cabinet/rack) or "non-colocated" (i.e. XTC-10 resides on a local cabinet/rack and the PEM shelf resides on a remote cabinet/rack, located within a maximum distance of 10 feet).

External Indicators

The PEM shelf has no external indicators (status LEDs are located on each individual PEM).

Figure 2-9 XTC-10 PEM Shelf



Connectors

The PEM shelf provides a total of eight sets of dual 1/4-20 studs on 5/8” centers located at the rear of the shelf for power distribution to the XTC-10 (for additional information on power distribution, see “XTC-10 Power Distribution Architecture” on page 2-30). Two sets of studs provide -48V DC Power for feed A and two sets provide its Return. An additional two sets of studs provide -48V DC Power for feed B and two sets provide its Return. The studs are capable of accommodating industry standard two-hole compression lugs on 5/8” centers.

CAUTION

To prevent damage to the PEM shelf, the compression lugs used must have 1/4 inch diameter stud hole size, 5/8 inch hole spacing, and the lug width must not exceed 0.60 inch.

The PEM shelf communicates with the XTC-10 through two SCSI-3 cables. Two 68-pin SCSI connectors are located at the lower rear section of the PEM shelf; the right side connector (P1) is for the feed A PEMs and the left side connector (P2) is for the feed B PEMs.

Electrical Grounding Points

The PEM shelf contains two electrical grounding points, one on each side, rear section of the shelf.

Output Fuses

To protect the system against high current output loads (~240A) on a fully loaded XTC-10 or if a fault in the system occurs that causes a short on either of the power legs, two current limiting fuses are used on each power leg (A and B); Littelfuse JLLN, Class T, 300V AC, rated for 200A.

Rack Mounting Ears

The PEM shelf includes integrated rack mounting ears located at the front of the shelf.

Additionally, external rack mounting ears (short ears for ETSI (600mm) racks and long ears for 23-inch racks) are included for mid-mounting configurations. The long ears are pre-installed on the PEM shelf.

Front Air Inlet Bezel/Air Filter

The PEM shelf contains a replaceable air filter which is located on the front air inlet bezel. A replaceable air filter is necessary to filter out dust particles at the air intake of the PEM shelf. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the PEM shelf and each PEM, the air filter must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filter once every six months.

Note: The PEM shelf front air inlet bezel is packaged separately from the PEM shelf and includes mounting brackets which allow the attachment of the bezel to the PEM shelf. The mounting brackets must be installed prior to installing the PEM shelf into the XTC-10 cabinet or on an industry standard ETSI (600mm) or 23-inch rack. Refer to the *Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide*.

Technical Specifications

Table 2-14 provides the mechanical and electrical specifications for the PEM shelf.

Table 2-14 XTC-10 PEM Shelf Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	5.18 inches / 131.57mm (3 RU)
	Width	19.61 inches / 498.09mm
	Depth	19.85 inches / 504.19mm
	Weight	18.5lb / 8.4kg
Electrical specifications	Power consumption	Included as part of base XTC-10 system; see Table 2-1 on page 2-3

Power Entry Module (PEM)

Table 2-15 XTC-10 PEM Product Details

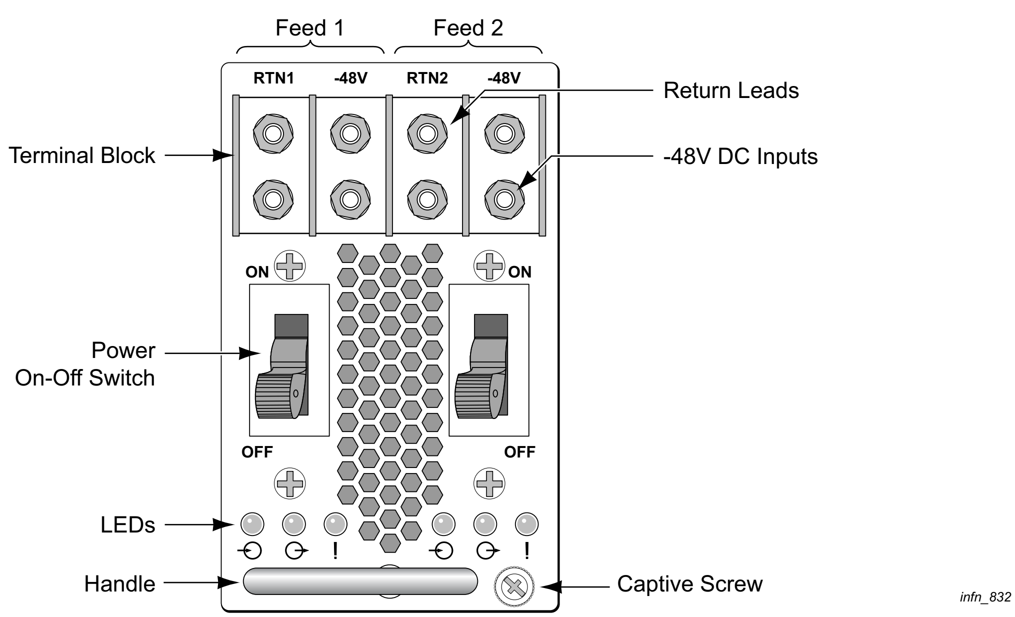
Product Ordering Name (PON)	Description
X-PS-DC	Power Entry Module with dual 60A power feeds, provides DC power to the XTC-10. **Note**: PON X-PS-DC is applicable to both the XTC-10 and XTC-4.

The PEM provides DC power to the XTC-10 and contains dual 60A circuit breaker switches for over-current protection on two independent power feeds as shown in Figure 2-10. Additionally, the PEM contains thermal sensors that monitor the internal temperature of the PEM to protect internal components from overheating or catching fire. An internal cooling fan mechanism is provided that draws air in through a front vent and forces air out through a rear vent.

PEMs are installed in the XTC-10 PEM shelf which is typically mounted inside the XTC-10 cabinet (occupying the upper 3 RU of rack space above the XTC-10) or on an industry standard ETSI (600mm) or 23-inch rack. The PEM shelf houses up to six PEMs (providing N+N redundancy) depending on system load requirements and the customer's configuration.

External Indicators

Figure 2-10 XTC-10 PEM Faceplate



Power LEDs

The PEMs provide three status LEDs (per power feed): Input, Output, and Fault. The LEDs indicate whether the power levels are within specified limits. The significance of an illuminated LED is described in Table 2-16.

Table 2-16 XTC-10 PEM Visual Alarm Indicators

INPUT (Green)	OUTPUT (Green)	FAULT (Red)	Description
		!	• Front panel icons
ON	ON	OFF	• Power input to the PEM as per specifications • Power output from the PEM as per specifications • No fault detected
ON	ON	ON	• Power input to the PEM as per specifications • Power output from the PEM as per specifications • Minor fault detected
ON	OFF	ON	• Power input to the PEM as per specifications • No power output from the PEM due to internal fault(s)
OFF	OFF	ON	• Power input to the PEM not per specifications • No power output from the PEM • PEM is detecting power from neighboring units in the same feed
OFF	OFF	OFF	• Power input to the PEM not per specifications • No power output from the PEM • PEM is not detecting power from neighboring units in the same feed

Connectors

Each PEM accommodates two power feeds and provides a total of four sets of dual 1/4-20 studs on 5/8” centers. Two sets of studs are for connection to -48V DC Power and two sets for connection to its Return. The studs are capable of accommodating industry standard two-hole compression lugs on 5/8” centers. A plastic safety cover is provided to prevent inadvertent contact with the terminals once installed.

CAUTION

To prevent damage to the PEM, the compression lugs used must have 1/4 inch diameter stud hole size, 5/8 inch hole spacing, and the lug width must not exceed 0.60 inch.

Technical Specifications

Table 2-17 provides the mechanical and electrical specifications for the XTC-10 PEM.

Table 2-17 XTC-10 PEM Technical Specifications

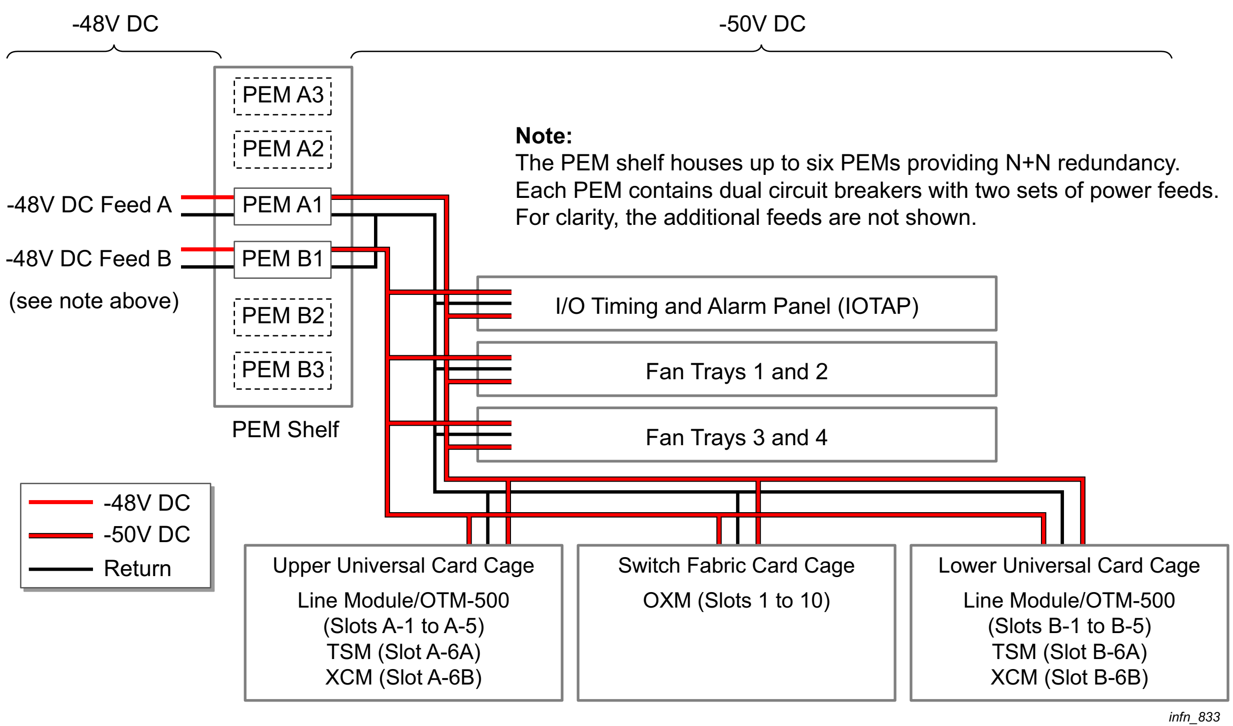
Type	Parameter	Specification
Mechanical specifications	Height	5.17 inches / 131.32mm
	Width	3.15 inches / 80.01mm
	Depth	16.87 inches / 428.50mm
	Weight	13.0lb / 5.9kg
Electrical specifications	Power consumption	Included as part of base XTC-10 system; see Table 2-1 on page 2-3

XTC-10 Power Distribution Architecture

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

-50V DC power is distributed from the PEM shelf to the upper chassis backplane across two sets of PEM-to-XTC busbars which carry redundant A and B power feeds. DC power is distributed to the common components and circuit packs as shown in Figure 2-11.

Figure 2-11 XTC-10 Power Distribution Diagram



The XTC-10 hardware modules combine the power feed by diode-ORing and ORing FET. The -50V DC inputs are individually fused on the circuit packs, IOTAP, and fan trays to protect it from overcurrent conditions. The fuse is not field-replaceable. The status of each fuse is monitored before the ORing diodes and FETs.

Input/Output Timing and Alarm Panel (IOTAP)

Note: In a multi-chassis configuration the DCN and AUX ports on the Main Chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

The IOTAP is part of the XTC-10 and houses the management and operations interfaces as described below. The front view of the IOTAP is shown in Figure 2-12 on page 2-32.

- Two 10/100/1000Mbps auto-negotiating Data Communication Network (DCN) RJ-45 Ethernet interfaces, labeled as DCN. This interface provides ports for Ethernet network connectivity
- Two 10/100/1000Mbps auto-negotiating Administrative Inter-LAN RJ-45 Ethernet interfaces, labeled as AUX. This interface provides ports for Datawire services
- One Craft RS-232 Serial port, labeled as Craft DTE. This interface provides a port for remote management

Note: There is no modem port support on the IOTAP. The Craft RS-232 serial port is used as a redundant serial port connection to the active XCM.

- Chassis level alarm LEDs (Power, Critical, Major, and Minor)

Note: The IOTAP does not provide bay level alarm LEDs.

- One Lamp Test button
- One Alarm Cutoff (ACO) button
- One ACO LED
- External timing interface, labeled as External Timing. This interface provides ports for connecting external T1/E1 timing references:
  - Four BNC connectors (labeled as A IN/OUT, B IN/OUT), 75 Ohms
  - Set of wire wrap pins (labeled as A IN/OUT, B IN/OUT), 75 Ohms
  - Set of wire wrap pins (labeled as A IN/OUT, B IN/OUT), 100/120 Ohms

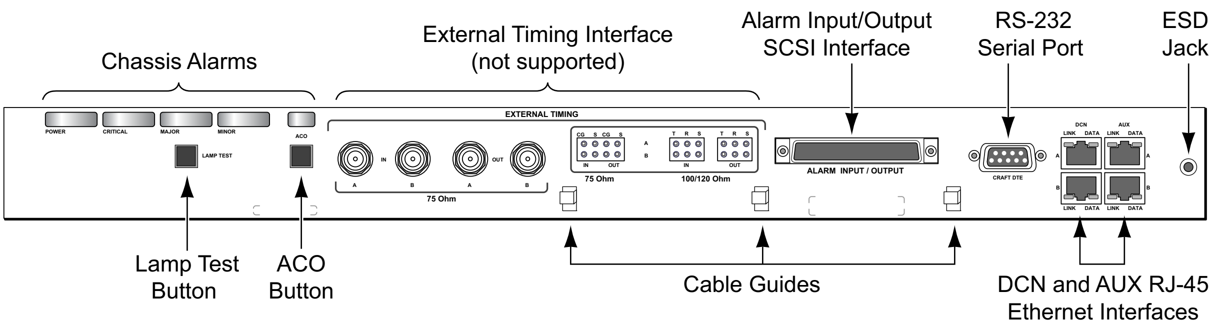
Note: The external timing interfaces are not currently supported.

- Alarm input/output SCSI interface, labeled as Alarm Input/Output. This interface is used for connecting an external alarm wire wrap panel for monitoring environmental and office alarms:
  - Alarm Input—Bay Critical, Major, Minor, Alarm Cutoff
  - Alarm Output—Bay Critical, Major, Minor, Audible Critical, Major, Minor, Visual Power, Critical, Major, Minor

■ One Electrostatic Discharge (ESD) grounding jack for attachment of an ESD wrist strap

External Indicators

Figure 2-12 XTC-10 IOTAP Front View



Chassis Level Alarm LEDs

The IOTAP provides chassis level alarms, POWER, CRITICAL, MAJOR, and MINOR LEDs. These indicate the severities of the current outstanding alarms within the chassis. The POWER LED indicates the power-on status. The significance of an illuminated LED is described in Table 2-18.

Table 2-18 XTC-10 Visual Alarm Indicators - Chassis Level

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply within the specified operating range to the chassis
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in the chassis
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in the chassis
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in the chassis

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding chassis level LED functions.

DCN and AUX Port LEDs

The IOTAP provides DCN and AUX port visual indicators: a DATA and a LINK LED. The significance of an illuminated LED is described in Table 2-19.

Table 2-19 XTC-10 Visual Alarm Indicators on the DCN and AUX Ports

DATA (Green)	LINK (Green)	Description
ON	ON	• Link established • The port is active
OFF	OFF	• Link not established
OFF	ON	• Link established • The port is not active

Lamp Test

The IOTAP contains a lamp test button for testing the LEDs. When the lamp test button is pressed, all LEDs on the IOTAP and the circuit packs on the chassis are lit (power LEDs illuminate Green and fault LEDs illuminate Red) and bi-color LEDs will toggle between two colors (Green and Yellow) until the lamp test button is released. Once the lamp test button is released, all LEDs will return to the previous condition.

Alarm Cutoff (ACO) Indicators

The IOTAP contains one ACO button and an ACO LED. The ACO feature allows muting of the external audible alarms. When the ACO button is pressed, all current critical, major, and minor audio alarms are muted and the ACO LED is lit. Table 2-20 provides a description of the alarm state and the ACO LED state.

Table 2-20 XTC-10 Audio Alarm Indicators - Chassis Level

Condition	ACO LED State	Audio Alarm
There are no external alarms on the chassis	OFF	Not present
An external alarm is raised on the chassis	OFF	Present
ACO button is pressed	ON	Muted
An external alarm is cleared	OFF	Not present

Note: In a multi-chassis configuration the DCN and AUX ports on the Main chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

Chassis Level Audio Indicators

The IOTAP provides output alarm contacts for CRITICAL, MAJOR, and MINOR audible alarms. Audible alert is triggered when an alarm is raised on the chassis.

External Timing and Alarm Input/Output

The IOTAP provides interfaces for external timing synchronization and environmental alarm contacts. The IOTAP does not contain any active components. External timing interfaces are not currently supported. However, the IOTAP houses Telcordia and ITU Building Integrated Timing Supply (BITS) input and output timing interfaces. The BITS interfaces are labeled using the “A/B” convention for indicating paired interfaces. The configuration of the timing synchronization mode (T1 versus E1) determines which of the physical ports is referenced.

The IOTAP contains a 68-pin SCSI connector that connects to a customer-supplied external alarm wire wrap panel using a customer-supplied SCSI cable. See Table 2-22 on page 2-35 for connector pinout assignment.

I/O Connectors

The IOTAP has a total of four RJ-45 ports, one RS-232 port, four BNC ports, three sets of wire wrap connectors, and one SCSI connector as described in Table 2-21.

Table 2-21 XTC-10 IOTAP Connectors

Connector	Type	Purpose
DCN A, DCN B	10/100/1000Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors with redundancy for remote management through DCN
AUX A, AUX B	10/100/1000Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors for datawire service to carry customer management traffic
CRAFT DTE	9600 baud RS-232 DTE DB-9 Male	Used for remote management
EXTERNAL TIMING (A and B)	BNC, 75 Ohms	Used for connecting external T1/E1 timing references. **NOTE**: The external timing interfaces are not currently supported.
	Wire wrap, 75 Ohms	
	Wire wrap, 100/120 Ohms	
ALARM INPUT/OUTPUT	SCSI, 68-pin	Used for connecting a customer-supplied external alarm wire wrap panel for monitoring environmental and office alarms; see Table 2-22 on page 2-35 for connector pinout assignment

Note: Cable guides are available on the IOTAP for cable management as shown in Figure 2-12 on page 2-32.

Alarm Input/Output Connector Pinout

Table 2-22 lists the assignment of the alarm input/output SCSI connector pins for the XTC-10.

Table 2-22 XTC-10 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
1	ALM_IN_GEN0_N50V	Negative 50V reference for ALM_IN_GEN0	N/A
2	ALM_IN_GEN0	General Purpose Alarm Input 0	Input
3	ALM_IN_GEN2_N50V	Negative 50V reference for ALM_IN_GEN2	N/A
4	ALM_IN_GEN2	General Purpose Alarm Input 2	Input
5	ALM_IN_GEN4_N50V	Negative 50V reference for ALM_IN_GEN4	N/A
6	ALM_IN_GEN4	General Purpose Alarm Input 4	Input
7	ALM_BAY_CRIT_IN_N50V	Negative 50V reference for ALM_BAY_CRIT_IN_L	N/A
8	ALM_BAY_CRIT_IN_L	Bay Critical Alarm Input	Input
9	ALM_BAY_MIN_IN_N50V	Negative 50V reference for ALM_BAY_MIN_IN_L	N/A
10	ALM_BAY_MIN_IN_L	Bay Minor Alarm Input	Input
11	N/C	N/A	N/A
12	N/C	N/A	N/A
13	N/C	N/A	N/A
14	ALM_OUT_GEN2_NC	General Purpose Alarm Output 2 - Normally Closed	Output
15	ALM_OUT_GEN2_NO	General Purpose Alarm Output 2 - Normally Open	Output
16	ALM_OUT_GEN2_CT	General Purpose Alarm Output 2 - Common Terminal	Output
17	ALM_OUT_BAY_CRIT_NC	Bay Critical Alarm Output - Normally Closed	Output
18	ALM_OUT_BAY_CRIT_NO	Bay Critical Alarm Output - Normally Open	Output
19	ALM_OUT_BAY_CRIT_CT	Bay Critical Alarm Output - Common Terminal	Output
20	ALM_OUT_BAY_MIN_NC	Bay Minor Alarm Output - Normally Closed	Output
21	ALM_OUT_BAY_MIN_NO	Bay Minor Alarm Output - Normally Open	Output
22	ALM_OUT_BAY_MIN_CT	Bay Minor Alarm Output - Common Terminal	Output
23	ALM_OUT_VIS_MAJ_NC	Visual Major Alarm Output - Normally Closed	Output
24	ALM_OUT_VIS_MAJ_NO	Visual Major Alarm Output - Normally Open	Output
25	ALM_OUT_VIS_MAJ_CT	Visual Major Alarm Output - Common Terminal	Output
26	ALM_OUT_AUD_CRIT_NC	Audible Critical Alarm Output - Normally Closed	Output
27	ALM_OUT_AUD_CRIT_NO	Audible Critical Alarm Output - Normally Open	Output
28	ALM_OUT_AUD_CRIT_CT	Audible Critical Alarm Output - Common Terminal	Output
29	ALM_OUT_AUD_MIN_NC	Audible Minor Alarm Output - Normally Closed	Output
30	ALM_OUT_AUD_MIN_NO	Audible Minor Alarm Output - Normally Open	Output
31	ALM_OUT_AUD_MIN_CT	Audible Minor Alarm Output - Common Terminal	Output
32	ALM_OUT_GEN0_NC	General Purpose Alarm Output 0 - Normally Closed	Output

Table 2-22 XTC-10 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
33	ALM_OUT_GEN0_NO	General Purpose Alarm Output 0 - Normally Open	Output
34	ALM_OUT_GEN0_CT	General Purpose Alarm Output 0 - Common Terminal	Output
35	ALM_IN_GEN1_N50V	Negative 50V reference for ALM_IN_GEN1	N/A
36	ALM_IN_GEN1	General Purpose Alarm Input 1	Input
37	ALM_IN_GEN3_N50V	Negative 50V reference for ALM_IN_GEN3	N/A
38	ALM_IN_GEN3	General Purpose Alarm Input 3	Input
39	ALM_IN_GEN5_50V	Negative 50V reference for ALM_IN_GEN5	N/A
40	ALM_IN_GEN5	General Purpose Alarm Input 5	Input
41	ALM_BAY_MAJ_IN_N50V	Negative 50V reference for ALM_BAY_MAJ_IN_L	N/A
42	ALM_BAY_MAJ_IN_L	Bay Major Alarm Input	Input
43	ALM_ACO_EXT_N50V	Negative 50V reference for ALM_ACO_EXT_L	N/A
44	ALM_ACO_EXT_L	External Alarm Cutoff Alarm Input	Input
45	N/C	N/A	N/A
46	N/C	N/A	N/A
47	N/C	N/A	N/A
48	ALM_OUT_GEN3_NC	General Purpose Alarm Output 3 - Normally Closed	Output
49	ALM_OUT_GEN3_NO	General Purpose Alarm Output 3 - Normally Open	Output
50	ALM_OUT_GEN3_CT	General Purpose Alarm Output 3 - Common Terminal	Output
51	ALM_OUT_BAY_MAJ_NC	Bay Major Alarm Output - Normally Closed	Output
52	ALM_OUT_BAY_MAJ_NO	Bay Major Alarm Output - Normally Open	Output
53	ALM_OUT_BAY_MAJ_CT	Bay Major Alarm Output - Common Terminal	Output
54	ALM_OUT_VIS_CRIT_NC	Visual Critical Alarm Output - Normally Closed	Output
55	ALM_OUT_VIS_CRIT_NO	Visual Critical Alarm Output - Normally Open	Output
56	ALM_OUT_VIS_CRIT_CT	Visual Critical Alarm Output - Common Terminal	Output
57	ALM_OUT_VIS_MIN_NC	Visual Minor Alarm Output - Normally Closed	Output
58	ALM_OUT_VIS_MIN_NO	Visual Minor Alarm Output - Normally Open	Output
59	ALM_OUT_VIS_MIN_CT	Visual Minor Alarm Output - Common Terminal	Output
60	ALM_OUT_AUD_MAJ_NC	Audible Major Alarm Output - Normally Closed	Output
61	ALM_OUT_AUD_MAJ_NO	Audible Major Alarm Output - Normally Open	Output
62	ALM_OUT_AUD_MAJ_CT	Audible Major Alarm Output - Common Terminal	Output
63	ALM_OUT_PWR_FLT_NC	Power Fault Alarm Output - Normally Closed	Output
64	ALM_OUT_PWR_FLT_NO	Power Fault Alarm Output - Normally Open	Output
65	ALM_OUT_PWR_FLT_CT	Power Fault Alarm Output - Common Terminal	Output
66	ALM_OUT_GEN1_NC	General Purpose Alarm Output 1 - Normally Closed	Output

Table 2-22 XTC-10 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
67	ALM_OUT_GEN1_NO	General Purpose Alarm Output 1 - Normally Open	Output
68	ALM_OUT_GEN1_CT	General Purpose Alarm Output 1 - Common Terminal	Output

Fan Tray

Table 2-23 XTC-10 Fan Tray Product Details

Product Ordering Name (PON)	Description
X-FANTRAY-X10	XTC-10 replacement fan tray

The XTC-10 contains four removable fan trays which are located at the top and bottom of the chassis. Each fan tray (Figure 2-13 on page 2-39) consists of four individually controlled, variable speed fans.

Fan speed is regulated by the active XCM (or by local sensors if external control is unavailable). On initial system startup, the fans are spun up to a predetermined percentage of maximum speed to cool the system to a normal operating temperature of 27º C; once normal operation is achieved, fan speed is decreased to reduce noise levels in compliance with OSHA, ETSI, and NEBS standards, and to increase fan MTBF. Fan speed will increase at any time during normal operation if the ambient temperature goes up.

The XTC-10 is split into two individual cooling zones, one for the upper half and one for the lower half of the chassis, each with independent thermal operating properties. The top two fan trays operate as a set and are referred to as Fan Tray 1 and 2, and the bottom set of fan trays are referred to as Fan Tray 3 and 4. Each set of fan trays operate in series to achieve the best combination of working in a high back pressure setup while providing the most uniform airflow. The thermal system employs a pull-pull approach to move air through the system. The airflow enters the system from the center of the XTC-10 (through a central inlet air plenum, split in half) and is pulled up by the top set of fan trays and forced out through the top rear and side exhaust vents. The bottom set of fan trays pull air down from the center of the XTC-10 and force it out through the bottom rear and side exhaust vents.

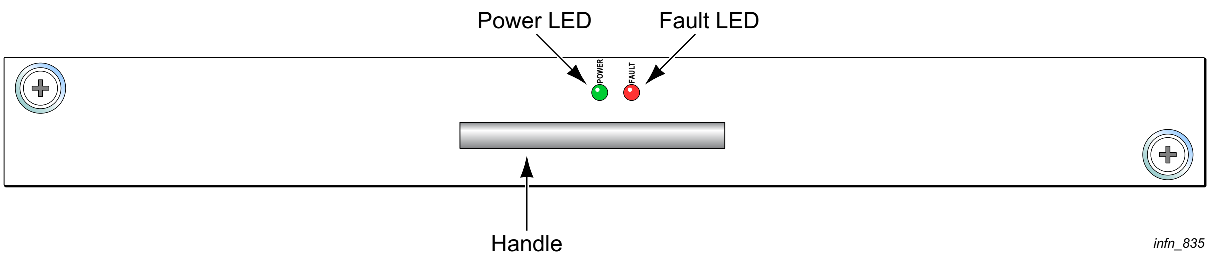
Four fan trays are required for normal operation on the XTC-10 and are redundant. Individual fans within a fan tray are N+1 redundant with power hot-swap controllers. If an individual fan on a fan tray has failed, the XTC-10 system can operate indefinitely in an environment up to 50ºC. An alarm will be generated via the management interfaces that indicates one of the fans has failed. Although the system can run reliably with a single fan failure on a fan tray, the user should change the fan tray at the earliest convenience to ensure against a second fan failure.

The faulted fan tray should be kept installed inside the XTC-10 until a replacement fan tray is available. The fan trays should never be partially removed from the system unless performing air filter maintenance (when performing air filter maintenance, the fan trays should not be removed from the system for more than one minute).

External Indicators

A POWER LED and a FAULT LED are provided on each fan tray as shown in Figure 2-13.

Figure 2-13 XTC-10 Fan Tray Faceplate



The significance of an illuminated LED is described in Table 2-24.

Table 2-24 XTC-10 Fan Tray Visual Alarm Indicators

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the fan tray
FAULT	Red	Indicates the presence (lit) or absence (dimmed) of a fault condition with the fan tray. Flashing Red indicates that the fan is not under control of the active XCM (for example, the active XCM has been reset or physically removed from the system)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding fan tray LED functions.

Technical Specifications

Table 2-25 provides the mechanical and electrical specifications for the XTC-10 fan tray.

Table 2-25 XTC-10 Fan Tray Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	2.14 inches / 54.36mm
	Width	18.95 inches / 481.33mm
	Depth	17.50 inches / 444.50mm
	Weight	18.5lb / 8.4kg
Electrical specifications	Power consumption	Included as part of base XTC-10 system; see Table 2-1 on page 2-3

Air Filter

Table 2-26 XTC-10 Air Filter Product Details

Product Ordering Name (PON)	Description
X-AIRFILTER-X10	XTC-10 replacement air filter

The XTC-10 contains two replaceable air filters which are located behind the front air inlet at the center of the chassis. Replaceable air filters are necessary to filter out dust particles at the air intake of the XTC-10. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the XTC-10 the air filters must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filters once every six months.

Mechanical Specifications

Table 2-27 provides the mechanical specifications for the XTC-10 air filter.

Table 2-27 XTC-10 Air Filter Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.25 inches / 6.35mm
	Width	17.30 inches / 439.42mm
	Depth	18.90 inches / 480.06mm
	Weight	Less than 0.5lb / 0.2kg
	Dust arrestance	80%

Card Cage

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

The XTC-10 contains three individual card cages: upper universal, switch fabric, and lower universal as shown in Figure 2-14 on page 2-42.

For information on the IOTAP and/or fan trays, refer to “Input/Output Timing and Alarm Panel (IOTAP)” on page 2-31 and/or “Fan Tray” on page 2-38 respectively.

Upper Universal Card Cage

The upper universal card cage contains seven chassis slots that provide the optical and digital transport, timing synchronization, and management and control functions of the system. Slots A-1 through A-5 are full-height slots reserved for line modules and/or OTM-500s, slot A-6A is a slot reserved for TSM-X10s, and slot A-6B is a half-height slot reserved for XCMs. Table 2-28 on page 2-43 outlines the upper universal card slot assignments.

Switch Fabric Card Cage

The switch fabric card cage contains ten chassis slots that provide the switching functions of the system. Slots S-1 through S-10 are slots reserved for OXM-X10s. Table 2-28 on page 2-43 outlines the switch fabric card slot assignments.

Lower Universal Card Cage

The lower universal card cage contains seven chassis slots that provide the optical and digital transport, timing synchronization, and management and control functions of the system. Slots B-1 through B-5 are full-height slots reserved for line modules and/or OTM-500s, slot B-6A is a slot reserved for TSM-X10s, and slot B-6B is a slot reserved for XCMs. Table 2-28 on page 2-43 outlines the lower universal card slot assignments.

Figure 2-14 XTC-10 Card Cage

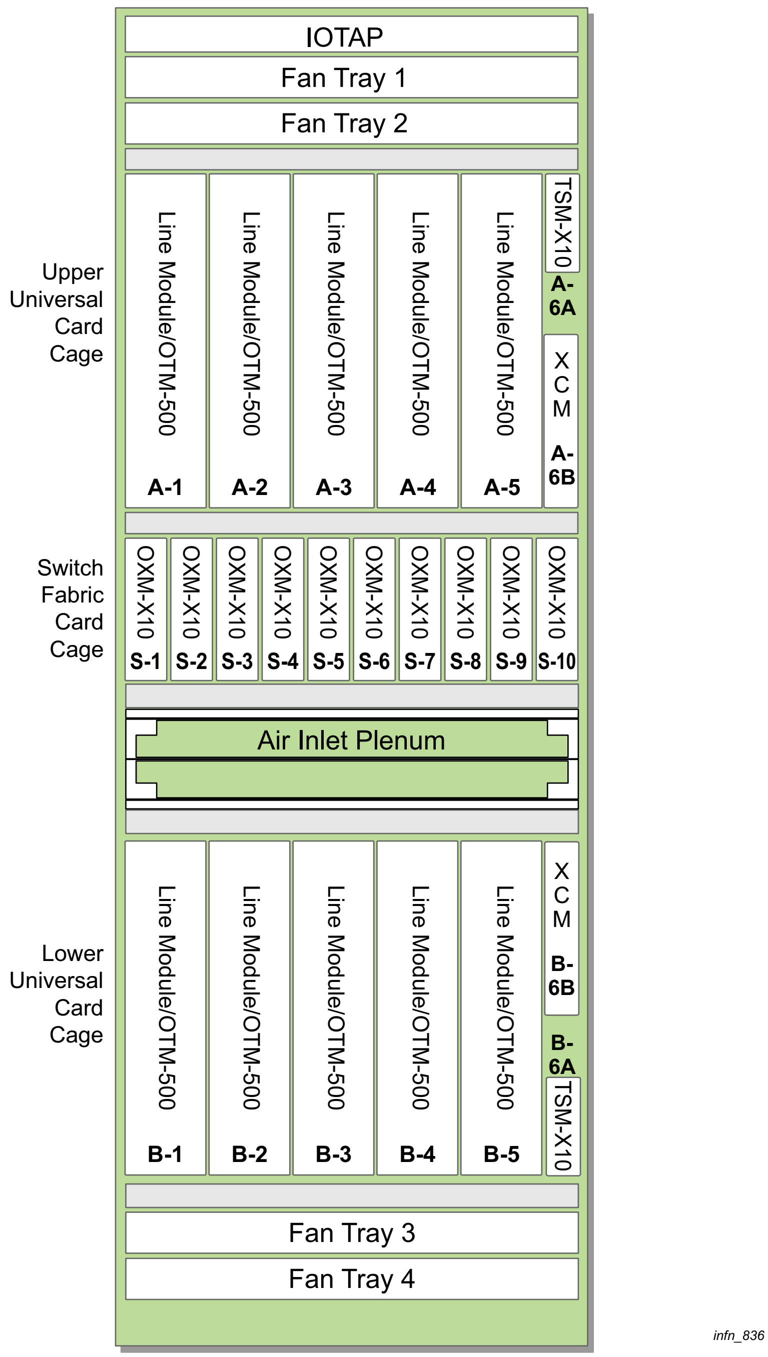


Table 2-28 XTC-10 Card Slot Assignments

Slot Number	Module Type
Upper Universal Card Slot Assignments	
A-1	Line Module/OTM-500
A-2	
A-3	
A-4	
A-5	
A-6A	TSM-X10
A-6B	XCM
Switch Fabric Card Slot Assignments	
S-1	OXM-X10
S-2	
S-3	
S-4	
S-5	
S-6	
S-7	
S-8	
S-9	
S-10	
Lower Universal Card Slot Assignments	
B-1	Line Module/OTM-500
B-2	
B-3	
B-4	
B-5	
B-6B	XCM
B-6A	TSM-X10

XTC-4 Overview

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

The Switching Transport Chassis (XTC) is available in two variants:

- XTC-4—is a half-bay chassis option providing four universal card slots to house line modules and/or OTM-500s. In addition, the XTC-4 is an ANSI 19-inch width chassis type with an available ETSI (600mm) and 23-inch mounting option
- XTC-10—is a single bay chassis option providing ten universal card slots to house line modules and/or OTM-500s. In addition, the XTC-10 is a nominal ETSI (600mm) width chassis type with an available 23-inch mounting option. For more details regarding the XTC-10, see “XTC-10 Overview” on page 2-8

Note: The DTN-X (XTC-10 and XTC-4) is designed to operate in open frame racks or Infinera supplied cabinets. Contact your Infinera account team or the Infinera deployment team if a third-party cabinet is considered for installation as Infinera will need to review the cabinet specifications.

Table 2-29 provides a list of the common components that make up an XTC-4 (some components are field-replaceable).

Table 2-30 on page 2-45 provides a list of the supported circuit packs on an XTC-4 (circuit packs are field-replaceable).

Table 2-29 XTC-4 Common Components

Name	Description
Rack Mounting Ears	See page 2-55
Power Entry Module (PEM)	See page 2-56
Input/Output Panel (I/O Panel)	See page 2-61
Timing and Alarm Panel (TAP)	See page 2-66
Fan Tray	See page 2-69
Air Filter	See page 2-71
Card Cage	See page 2-72

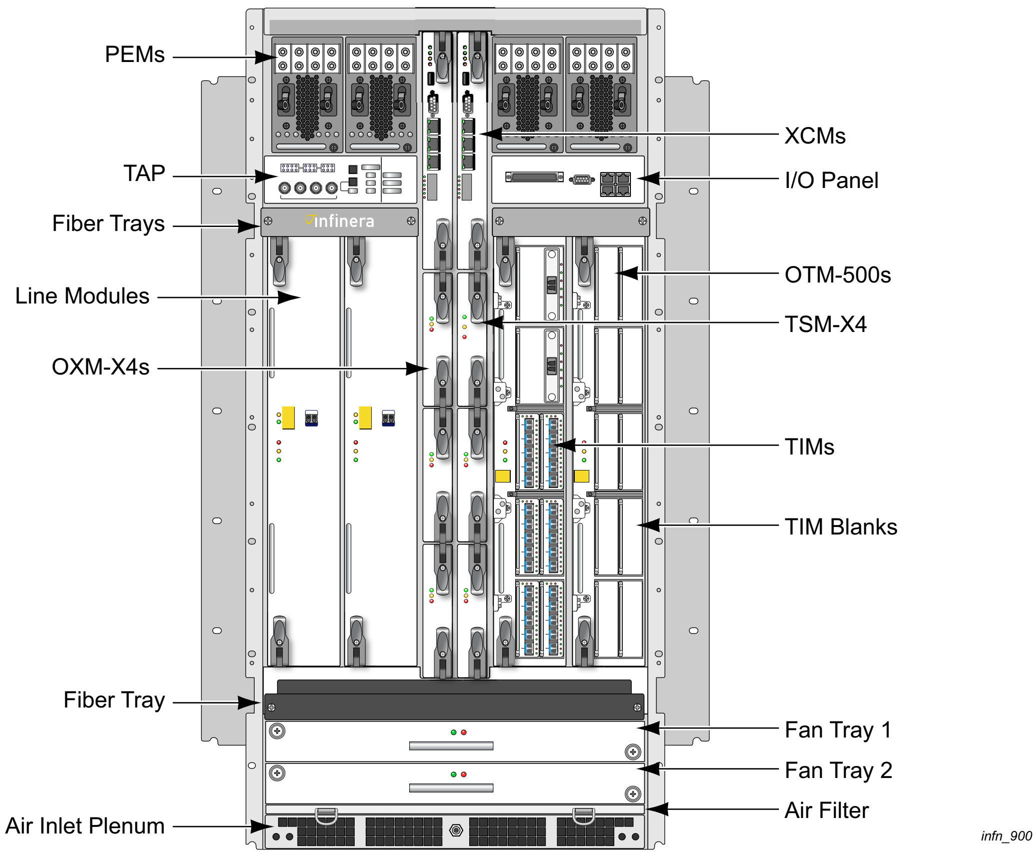
Table 2-30 XTC-4 Supported Circuit Packs

Name	Description
DTN-X Control Module (XCM)	See page 2-76
Timing Synchronization Module (TSM-X4)	See page 2-88
OTN Switch Module (OXM-X4)	See page 2-98
Advanced OTN Line Module 500G (AOLM-500)	See page 2-103
Advanced OTN Switching Line Module 500G (AOLX-500)	See page 2-110
Submarine OTN Line Module 500G (SOLM-500)	See page 2-117
Submarine OTN Switching Line Module 500G (SOLX-500)	See page 2-124
OTN Tributary Module 500G (OTM-500)	See page 2-131
Tributary Interface Module 100GE (TIM-1-100GE)	See page 2-136
Tributary Interface Module 10GM (TIM-5-10GM)	See page 2-140
Tributary Optical Module 100G (TOM-100G-SR10)	See page 2-148
Tributary Optical Module 100G (TOM-100G-S10X)	See page 2-151
Tributary Optical Module 100G (TOM-100G-LR4)	See page 2-154
Tributary Optical Module 100G (TOM-100G-L10X)	See page 2-157
Tributary Optical Module 10G (TOM-10G-SFPP-SR1)	See page 2-160
Tributary Optical Module 10G (TOM-10G-SFPP-IR2)	See page 2-163
Tributary Optical Module 10G (TOM-10G-SFPP-LR2)	See page 2-166
Blank Circuit Packs	See page 2-169

Front View

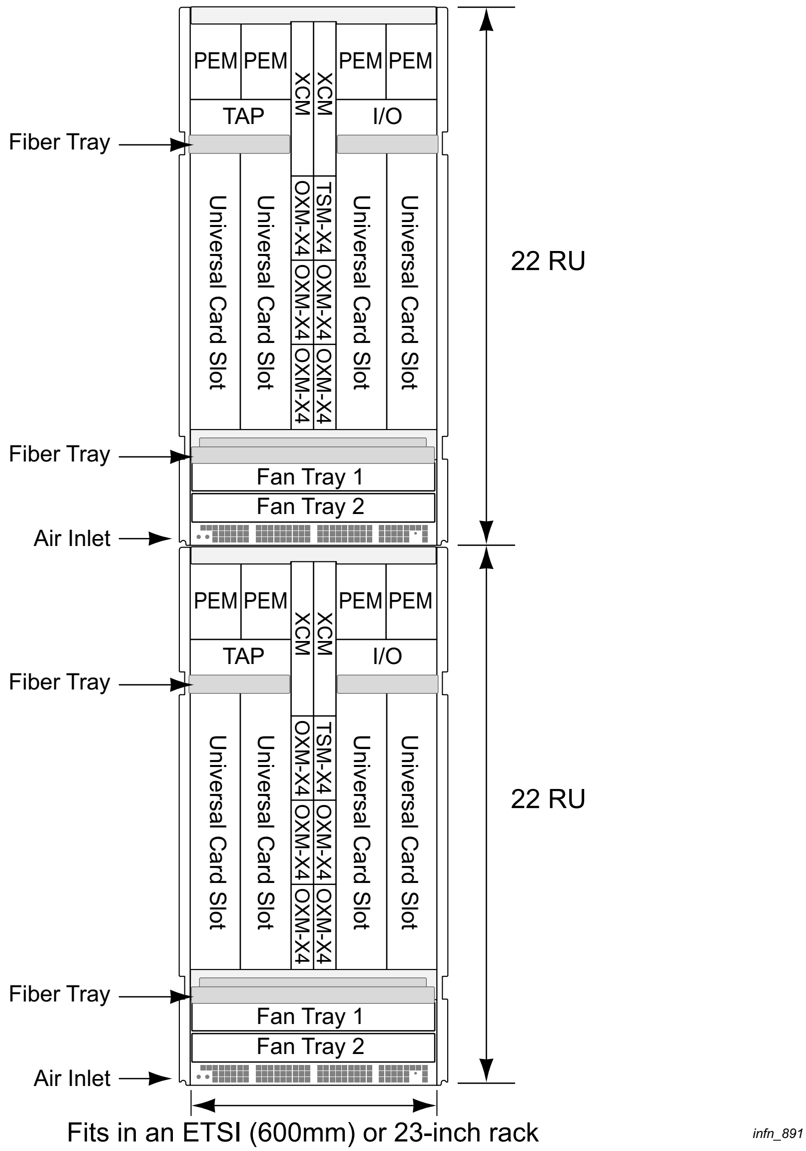
A front view of the XTC-4, with components and circuit packs, is shown in Figure 2-15.

Figure 2-15 XTC-4 Front View



A single bay can accommodate two XTC-4s as shown in Figure 2-16.

Figure 2-16 Two XTC-4s on a Rack



Note: In order for two XTC-4s to fit into a single bay, a minimum of 44 RU of free rack space is required on the ETSI (600mm), 23-inch, or 19-inch rack. Infinera recommends that the first XTC-4 be installed in the top half of the rack whenever possible.

XTC-4 Thermal Loading

Table 2-31 provides typical heat release information (calculated for feet) for the XTC-4 housed in a 19-inch frame.

Table 2-31 XTC-4 Typical Heat Release (Calculated for Feet)

XTC-4 Typical Heat Release Calculation for 19-inch (483mm) Frame									
Power Consumption (Watts)	2405								
Frame Depth (feet)	2.0								
Frame Width (feet)	1.837								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	436.5	402.9	374.1	349.2	327.4	308.1	291.0	275.7	261.9
1.5	402.9	374.1	349.2	327.4	308.1	291.0	275.7	261.9	249.4
2.0	374.1	349.2	327.4	308.1	291.0	275.7	261.9	249.4	238.1
2.5	349.2	327.4	308.1	291.0	275.7	261.9	249.4	238.1	227.7
3.0	327.4	308.1	291.0	275.7	261.9	249.4	238.1	227.7	218.2
3.5	308.1	291.0	275.7	261.9	249.4	238.1	227.7	218.2	209.5
4.0	291.0	275.7	261.9	249.4	238.1	227.7	218.2	209.5	201.4
4.5	275.7	261.9	249.4	238.1	227.7	218.2	209.5	201.4	194.0
5.0	261.9	249.4	238.1	227.7	218.2	209.5	201.4	194.0	187.1

Table 2-32 provides typical heat release information (calculated for meters) for the XTC-4 housed in a 19-inch frame.

Table 2-32 XTC-4 Typical Heat Release (Calculated for Meters)

XTC-4 Typical Heat Release Calculation for 19-inch (483mm) Frame									
Power Consumption (Watts)	2405								
Frame Depth (meters)	0.610								
Frame Width (meters)	0.560								
Maintenance Aisle (meters)	**Wiring Aisle (meters)**								
	0.305	**0.457**	**0.610**	**0.762**	**0.914**	**1.067**	**1.219**	**1.372**	**1.524**
	Heat Release (Watts/m^2)								
0.305	5637.0	5125.7	4696.9	4336.6	4027.5	3758.0	3523.7	3315.6	3131.9
0.457	5125.7	4699.5	4336.6	4027.5	3759.6	3523.7	3316.9	3131.9	2967.4
0.610	4696.9	4336.6	4025.6	3758.0	3523.7	3315.6	3131.9	2966.4	2818.5
0.762	4336.6	4027.5	3758.0	3523.7	3316.9	3131.9	2967.4	2818.5	2684.6
0.914	4027.5	3759.6	3523.7	3316.9	3133.0	2967.4	2819.4	2684.6	2562.9
1.067	3758.0	3523.7	3315.6	3131.9	2967.4	2818.5	2684.6	2562.1	2451.0
1.219	3523.7	3316.9	3131.9	2967.4	2819.4	2684.6	2562.9	2451.0	2349.1
1.372	3315.6	3131.9	2966.4	2818.5	2684.6	2562.1	2451.0	2348.5	2254.8
1.524	3131.9	2967.4	2818.5	2684.6	2562.9	2451.0	2349.1	2254.8	2168.3

Table 2-33 provides typical heat release information (calculated for feet) for the XTC-4 housed in a 23-inch frame.

Table 2-33 XTC-4 Typical Heat Release (Calculated for Feet)

XTC-4 Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	2405								
Frame Depth (feet)	2.0								
Frame Width (feet)	2.167								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	370.0	341.5	317.1	296.0	277.5	261.2	246.7	233.7	222.0
1.5	341.5	317.1	296.0	277.5	261.2	246.7	233.7	222.0	211.4
2.0	317.1	296.0	277.5	261.2	246.7	233.7	222.0	211.4	201.8
2.5	296.0	277.5	261.2	246.7	233.7	222.0	211.4	201.8	193.0
3.0	277.5	261.2	246.7	233.7	222.0	211.4	201.8	193.0	185.0
3.5	261.2	246.7	233.7	222.0	211.4	201.8	193.0	185.0	177.6
4.0	246.7	233.7	222.0	211.4	201.8	193.0	185.0	177.6	170.8
4.5	233.7	222.0	211.4	201.8	193.0	185.0	177.6	170.8	164.4
5.0	222.0	211.4	201.8	193.0	185.0	177.6	170.8	164.4	158.6

Table 2-34 provides typical heat release information (calculated for meters) for the XTC-4 housed in a 23-inch frame.

Table 2-34 XTC-4 Typical Heat Release (Calculated for Meters)

XTC-4 Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	2405								
Frame Depth (meters)	0.610								
Frame Width (meters)	0.660								
Maintenance Aisle (meters)	**Wiring Aisle (meters)**								
	0.305	**0.457**	**0.610**	**0.762**	**0.914**	**1.067**	**1.219**	**1.372**	**1.524**
	Heat Release (Watts/m^2)								
0.305	3983.1	3677.6	3414.1	3187.2	2988.6	2812.1	2656.4	2516.1	2390.6
0.457	3677.6	3415.7	3187.2	2988.6	2813.2	2656.4	2517.0	2390.6	2277.1
0.610	3414.1	3187.2	2987.3	2812.1	2656.4	2516.1	2390.6	2276.4	2173.3
0.762	3187.2	2988.6	2812.1	2656.4	2517.0	2390.6	2277.1	2173.3	2079.0
0.914	2988.6	2813.2	2656.4	2517.0	2391.4	2277.1	2173.9	2079.0	1992.6
1.067	2812.1	2656.4	2516.1	2390.6	2277.1	2173.3	2079.0	1992.1	1912.6
1.219	2656.4	2517.0	2390.6	2277.1	2173.9	2079.0	1992.6	1912.6	1839.3
1.372	2516.1	2390.6	2276.4	2173.3	2079.0	1992.1	1912.6	1838.8	1770.9
1.524	2390.6	2277.1	2173.3	2079.0	1992.6	1912.6	1839.3	1770.9	1707.8

XTC-4 Product Details

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

Table 2-35 lists the name and a brief description of the XTC-4 and the supported options.

Table 2-35 XTC-4 Product Details

Product Ordering Name (PON)	Description
XTC-4	Switching Transport Chassis; includes 4 universal card slots for I/O, switch, timing, and control modules
X-DOOR-X4	XTC-4 front chassis door kit
X-AIRBAFFLE-X4	XTC-4 air baffles kit
X-FIBERGUIDE-X4	XTC-4 fiber management kit
X-WRAPPER-B1-X4	XTC-4 exhaust panels kit for ANSI 23-inch rack mount
X-WRAPPER-X4	XTC-4 exhaust panels kit for Pentair third-party cabinet mount

Functional Description

The XTC-4 houses the common equipment required for operations and the circuit packs that transport and terminate optical signals. The XTC-4 provides a redundant and scalable switch fabric with ODU0 switching granularity to support customer traffic from line-to-trib, trib-to-trib, and/or line-to-line. The XTC-4 supports the following functions:

- The XTC-4 can be deployed as a Main Chassis or an Expansion Chassis within a DTN-X. A DTN-X can support up to 44 interconnected chassis (4 XTCs, 28 DTC/MTCs, and 12 OTCs). The Main Chassis must be an XTC; the Expansion Chassis can be any combination of XTC/DTC/MTC/OTCs
- The XTC-4 is used in Digital Terminal, Digital Add/Drop, and Digital Repeater configurations

The XTC-4 is composed of the following components (see Figure 2-15 on page 2-46 for an illustration):

- "Rack Mounting Ears" on page 2-55
- "Power Entry Module (PEM)" on page 2-56
- "Input/Output (I/O) Panel" on page 2-61
- "Timing and Alarm Panel (TAP)" on page 2-66
- "Fan Tray" on page 2-69
- "Air Filter" on page 2-71
- "Card Cage" on page 2-72

Mechanical Specifications

Table 2-36 provides the mechanical specifications for the XTC-4.

Table 2-36 XTC-4 Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	38.44 inches / 976.38mm (22 RU)
	Width	17.50 inches / 444.50mm
	Depth	18.53 inches / 470.66mm
	Depth (including fiber management trays; excluding doors)	21.39 inches / 543.31mm
	Weight - chassis only	100.0lb / 45.4kg
	Weight - fully loaded chassis (including four PEMs)	430.4lb / 195.2kg (approximately)

Electrical Grounding Points

The XTC-4 contains four electrical grounding points located as follows:

- Two at the front, lower left and right sections of the chassis
- One on each side, lower rear section of the chassis

Electrostatic Discharge (ESD) Grounding Jack

The XTC-4 contains an ESD grounding jack located at the front of the chassis, lower section (middle of the central inlet air plenum).

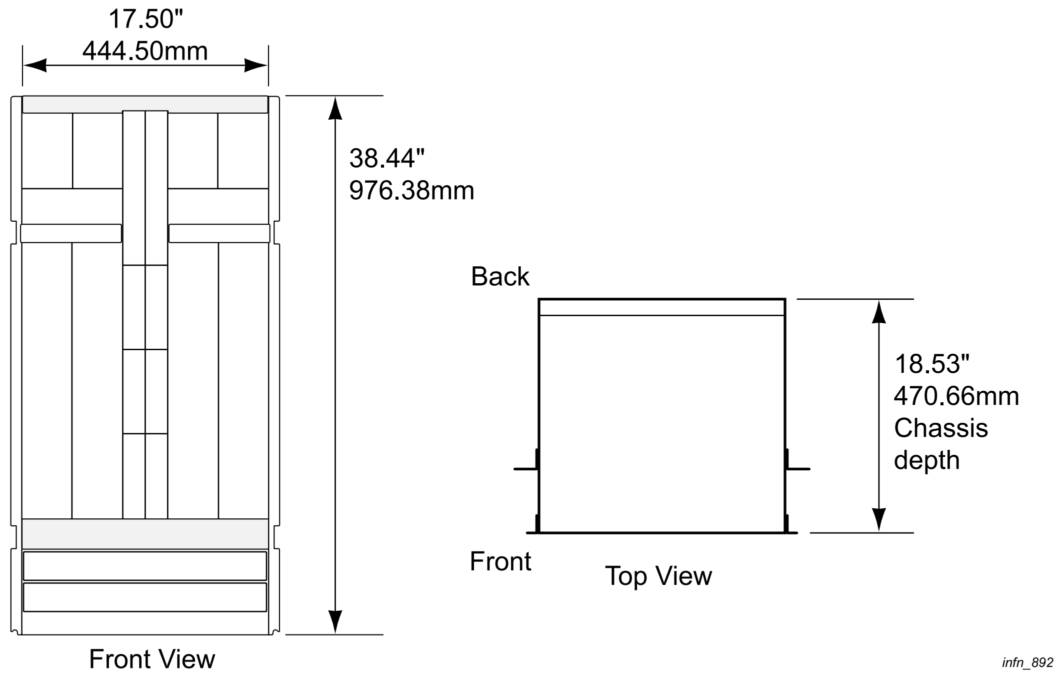
Fiber Management Trays

Fiber management trays are provided to route fibers away from the circuit packs in a manner that protects the fibers and allows for any circuit pack to be inserted, removed, and/or replaced without disturbing another circuit pack's fibers. A fiber tray is located above and below the universal card cage. The fiber trays at the top of the card cage are inverted. Fibers from the top half of each circuit pack are routed to the upper tray and fibers from the bottom half of each circuit pack are routed to the lower tray.

XTC-4 Dimensions

The XTC-4 top and front dimensions of the chassis are provided in Figure 2-17.

Figure 2-17 XTC-4 Dimensions



Rack Mounting Ears

Table 2-37 XTC-4 Rack Mounting Product Details

Product Ordering Name (PON)	Description
X-RM-ETSI-X4	XTC-4 external rack mounting option; ETSI (600mm) rack mount package **NOTE**: ETSI (600mm) rack mounting ears are shipped as part of the XTC-4 (but not pre-installed).
X-RM-ANSI-X4	XTC-4 external rack mounting option; ANSI 23-inch rack mount package **NOTE**: ANSI 23-inch rack mounting ears are shipped as part of the XTC-4 (but not pre-installed).

The XTC-4 includes integrated rack mounting ears used to flush mount the chassis on an industry standard ANSI 19-inch rack.

Additionally, external rack mounting ears are included to provide flush and mid-mounting configurations for ETSI (600mm) and ANSI 23-inch racks at flush, 5 and 7 inches rearward of the flush mount position. Rear support brackets are also available for both configurations.

Power Entry Module (PEM)

Table 2-38 XTC-4 PEM Product Details

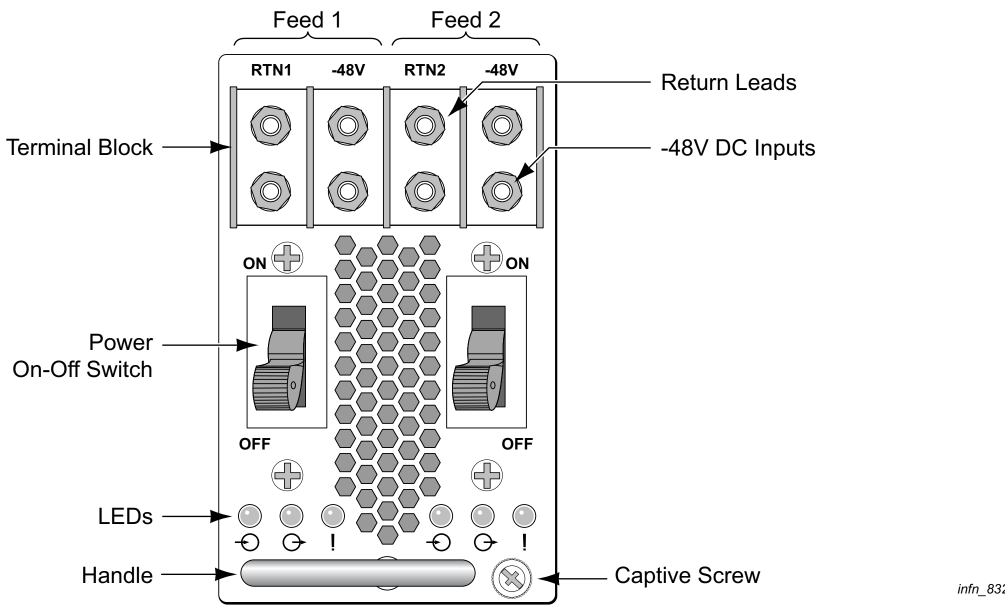
Product Ordering Name (PON)	Description
X-PS-DC	Power Entry Module with dual 60A power feeds, provides DC power to the XTC-4. **Note**: PON X-PS-DC is applicable to both the XTC-4 and XTC-10.
X-AIRFILTER-PS-DC	XTC-4 PEM air filter kit **Note**: PON X-AIRFILTER-PS-DC is applicable to the XTC-4 only. The XTC-4 must be installed in an open frame rack or cabinet *without* the front chassis door installed (PON X-DOOR-X4).

The PEM provides DC power to the XTC-4 and contains dual 60A circuit breaker switches for over-current protection on two independent power feeds as shown in Figure 2-18 on page 2-57. Additionally, the PEM contains thermal sensors that monitor the internal temperature of the PEM to protect internal components from overheating or catching fire. An internal cooling fan mechanism is provided that draws air in through a front vent and forces air out through a rear vent.

The top position of the XTC-4 accommodates up to four PEMs providing N+N redundancy depending on system load requirements and the customer's configuration. The two PEMs occupying the top left half comprise feed A and are labeled PA1 (center position) and PA2 (left-most position), and the two PEMs occupying the top right half comprise feed B and are labeled PB1 (center position) and PB2 (right-most position).

External Indicators

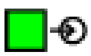
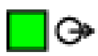
Figure 2-18 XTC-4 PEM Faceplate



Power LEDs

The PEMs provide three status LEDs (per power feed): Input, Output, and Fault. The LEDs indicate whether the power levels are within specified limits. The significance of an illuminated LED is described in Table 2-39.

Table 2-39 XTC-4 PEM Visual Alarm Indicators

INPUT (Green)	OUTPUT (Green)	FAULT (Red)	Description
			• Front panel icons
ON	ON	OFF	• Power input to the PEM as per specifications • Power output from the PEM as per specifications • No fault detected
ON	ON	ON	• Power input to the PEM as per specifications • Power output from the PEM as per specifications • Minor fault detected
ON	OFF	ON	• Power input to the PEM as per specifications • No power output from the PEM due to internal fault(s)
OFF	OFF	ON	• Power input to the PEM not per specifications • No power output from the PEM • PEM is detecting power from neighboring units in the same feed
OFF	OFF	OFF	• Power input to the PEM not per specifications • No power output from the PEM • PEM is not detecting power from neighboring units in the same feed

Connectors

Each PEM accommodates two power feeds and provides a total of four sets of dual 1/4-20 studs on 5/8" centers. Two sets of studs are for connection to -48V DC Power and two sets for connection to its Return. The studs are capable of accommodating industry standard two-hole compression lugs on 5/8" centers. A plastic safety cover is provided to prevent inadvertent contact with the terminals once installed.

CAUTION

To prevent damage to the PEM, the compression lugs used must have 1/4 inch diameter stud hole size, 5/8 inch hole spacing, and the lug width must not exceed 0.60 inch.

Air Filter

CAUTION

Do not install the front door on the XTC-4 if a PEM air filter is installed on the PEM(s). Failure to do so will result in an unsafe operating environment for the XTC-4.

The PEM may contain a replaceable air filter on the front faceplate (requires XTC-4 PEM Air Filter Kit, PON X-AIRFILTER-PS-DC). A replaceable air filter is necessary to filter out dust particles at the air intake of the PEM. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the PEM, the air filter must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filter once every six months.

Technical Specifications

Table 2-40 provides the mechanical and electrical specifications for the XTC-4 PEM.

Table 2-40 XTC-4 PEM Technical Specifications

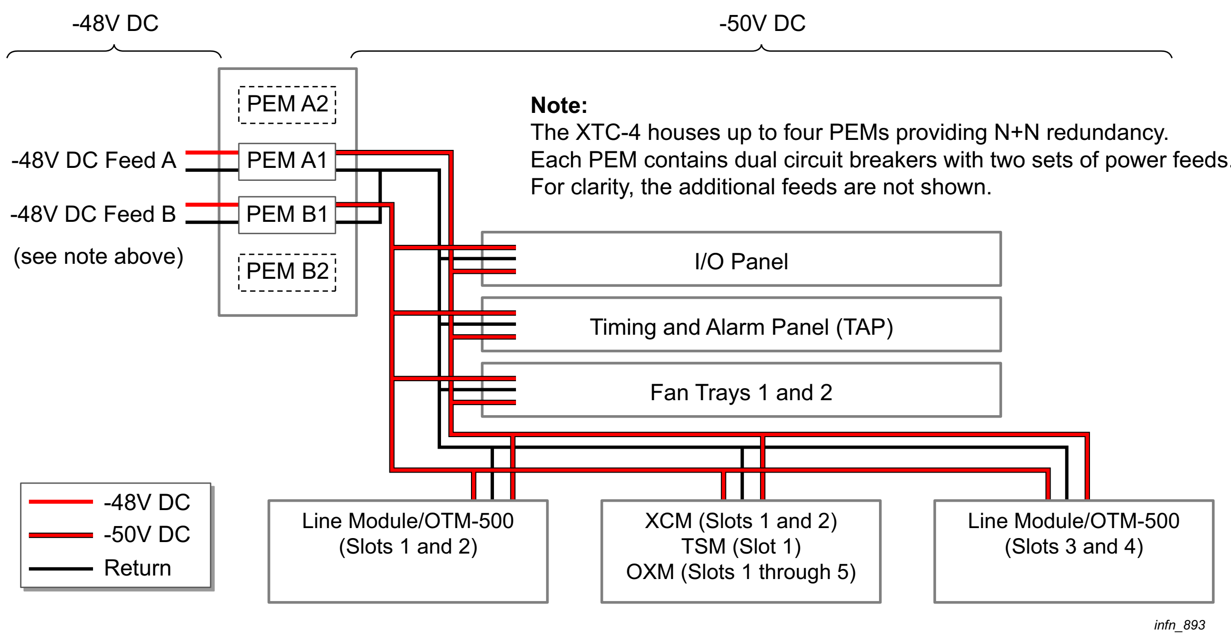
Type	Parameter	Specification
Mechanical specifications	Height	5.17 inches / 131.32mm
	Width	3.15 inches / 80.01mm
	Depth	16.87 inches / 428.50mm
	Weight	13.0lb / 5.9kg
Electrical specifications	Power consumption	Included as part of base XTC-4 system; see Table 2-1 on page 2-3

XTC-4 Power Distribution Architecture

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

-50V DC power is distributed from the PEMs to the upper chassis backplane across PEM-to-XTC busbars which carry redundant A and B power feeds. DC power is distributed to the common components and circuit packs as shown in Figure 2-19.

Figure 2-19 XTC-4 Power Distribution Diagram



The XTC-4 hardware modules combine the power feed by diode-ORing and ORing FET. The -50V DC inputs are individually fused on the circuit packs, I/O panel, TAP, and fan trays to protect it from overcurrent conditions. The fuse is not field-replaceable. The status of each fuse is monitored before the ORing diodes and FETs.

Input/Output (I/O) Panel

Note: In a multi-chassis configuration the DCN and AUX ports on the Main Chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

The I/O panel is part of the XTC-4. The I/O functions are divided into two physically separate panels which together support the same functionality as the XTC-10 IOTAP. The management and operations are described below. The front view of the I/O panel is shown in Figure 2-20.

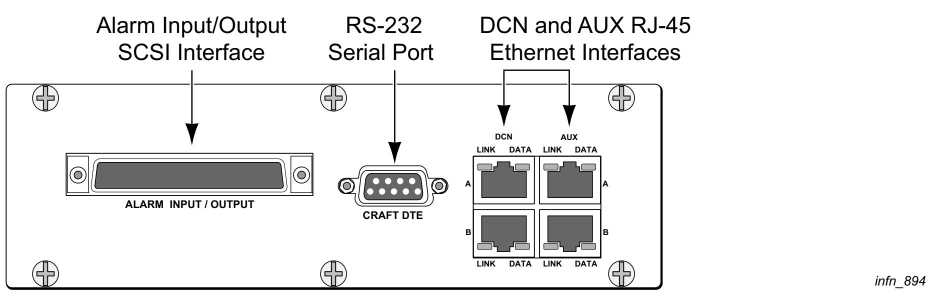
- Two 10/100/1000Mbps auto-negotiating Data Communication Network (DCN) RJ-45 Ethernet interfaces, labeled as DCN. This interface provides ports for Ethernet network connectivity
- Two 10/100/1000Mbps auto-negotiating Administrative Inter-LAN RJ-45 Ethernet interfaces, labeled as AUX. This interface provides ports for Datawire services
- One Craft RS-232 Serial port, labeled as Craft DTE. This interface provides a port for remote management

Note: There is no modem port support on the I/O panel. The Craft RS-232 serial port is used as a redundant serial port connection to the active XCM.

- Alarm input/output SCSI interface, labeled as Alarm Input/Output. This interface is used for connecting an external alarm wire wrap panel for monitoring environmental and office alarms:
  - ❑ Alarm Input—Bay Critical, Major, Minor, Alarm Cutoff
  - ❑ Alarm Output—Bay Critical, Major, Minor, Audible Critical, Major, Minor, Visual Power, Critical, Major, Minor

External Indicators

Figure 2-20 XTC-4 I/O Panel Front View



DCN and AUX Port LEDs

The I/O panel provides DCN and AUX port visual indicators: a DATA and a LINK LED. The significance of an illuminated LED is described in Table 2-41.

Table 2-41 XTC-4 Visual Alarm Indicators on the DCN and AUX Ports

DATA (Green)	LINK (Green)	Description
ON	ON	• Link established • The port is active
OFF	OFF	• Link not established
OFF	ON	• Link established • The port is not active

Note: In a multi-chassis configuration the DCN and AUX ports on the Main chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

Alarm Input/Output

The I/O panel contains a 68-pin SCSI connector that connects to a customer-supplied external alarm wire wrap panel using a customer-supplied SCSI cable. See Table 2-43 on page 2-63 for connector pinout assignment.

I/O Connectors

The I/O panel has a total of four RJ-45 ports, one RS-232 port, and one SCSI connector as described in Table 2-42.

Table 2-42 XTC-4 I/O Connectors

Connector	Type	Purpose
DCN A, DCN B	10/100/1000Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors with redundancy for remote management through DCN
AUX A, AUX B	10/100/1000Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors for datawire service to carry customer management traffic
CRAFT DTE	9600 baud RS-232 DTE DB-9 Male	Used for remote management
ALARM INPUT/OUTPUT	SCSI, 68-pin	Used for connecting a customer-supplied external alarm wire wrap panel for monitoring environmental and office alarms; see Table 2-43 for connector pinout assignment

Alarm Input/Output Connector Pinout

Table 2-43 lists the assignment of the alarm input/output SCSI connector pins for the XTC-4.

Table 2-43 XTC-4 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
1	ALM_IN_GEN0_N50V	Negative 50V reference for ALM_IN_GEN0	N/A
2	ALM_IN_GEN0	General Purpose Alarm Input 0	Input
3	ALM_IN_GEN2_N50V	Negative 50V reference for ALM_IN_GEN2	N/A
4	ALM_IN_GEN2	General Purpose Alarm Input 2	Input
5	ALM_IN_GEN4_N50V	Negative 50V reference for ALM_IN_GEN4	N/A
6	ALM_IN_GEN4	General Purpose Alarm Input 4	Input
7	ALM_BAY_CRIT_IN_N50V	Negative 50V reference for ALM_BAY_CRIT_IN_L	N/A
8	ALM_BAY_CRIT_IN_L	Bay Critical Alarm Input	Input
9	ALM_BAY_MIN_IN_N50V	Negative 50V reference for ALM_BAY_MIN_IN_L	N/A
10	ALM_BAY_MIN_IN_L	Bay Minor Alarm Input	Input
11	N/C	N/A	N/A
12	N/C	N/A	N/A
13	N/C	N/A	N/A
14	ALM_OUT_GEN2_NC	General Purpose Alarm Output 2 - Normally Closed	Output
15	ALM_OUT_GEN2_NO	General Purpose Alarm Output 2 - Normally Open	Output

Table 2-43 XTC-4 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
16	ALM_OUT_GEN2_CT	General Purpose Alarm Output 2 - Common Terminal	Output
17	ALM_OUT_BAY_CRIT_NC	Bay Critical Alarm Output - Normally Closed	Output
18	ALM_OUT_BAY_CRIT_NO	Bay Critical Alarm Output - Normally Open	Output
19	ALM_OUT_BAY_CRIT_CT	Bay Critical Alarm Output - Common Terminal	Output
20	ALM_OUT_BAY_MIN_NC	Bay Minor Alarm Output - Normally Closed	Output
21	ALM_OUT_BAY_MIN_NO	Bay Minor Alarm Output - Normally Open	Output
22	ALM_OUT_BAY_MIN_CT	Bay Minor Alarm Output - Common Terminal	Output
23	ALM_OUT_VIS_MAJ_NC	Visual Major Alarm Output - Normally Closed	Output
24	ALM_OUT_VIS_MAJ_NO	Visual Major Alarm Output - Normally Open	Output
25	ALM_OUT_VIS_MAJ_CT	Visual Major Alarm Output - Common Terminal	Output
26	ALM_OUT_AUD_CRIT_NC	Audible Critical Alarm Output - Normally Closed	Output
27	ALM_OUT_AUD_CRIT_NO	Audible Critical Alarm Output - Normally Open	Output
28	ALM_OUT_AUD_CRIT_CT	Audible Critical Alarm Output - Common Terminal	Output
29	ALM_OUT_AUD_MIN_NC	Audible Minor Alarm Output - Normally Closed	Output
30	ALM_OUT_AUD_MIN_NO	Audible Minor Alarm Output - Normally Open	Output
31	ALM_OUT_AUD_MIN_CT	Audible Minor Alarm Output - Common Terminal	Output
32	ALM_OUT_GEN0_NC	General Purpose Alarm Output 0 - Normally Closed	Output
33	ALM_OUT_GEN0_NO	General Purpose Alarm Output 0 - Normally Open	Output
34	ALM_OUT_GEN0_CT	General Purpose Alarm Output 0 - Common Terminal	Output
35	ALM_IN_GEN1_N50V	Negative 50V reference for ALM_IN_GEN1	N/A
36	ALM_IN_GEN1	General Purpose Alarm Input 1	Input
37	ALM_IN_GEN3_N50V	Negative 50V reference for ALM_IN_GEN3	N/A
38	ALM_IN_GEN3	General Purpose Alarm Input 3	Input
39	ALM_IN_GEN5_50V	Negative 50V reference for ALM_IN_GEN5	N/A
40	ALM_IN_GEN5	General Purpose Alarm Input 5	Input
41	ALM_BAY_MAJ_IN_N50V	Negative 50V reference for ALM_BAY_MAJ_IN_L	N/A
42	ALM_BAY_MAJ_IN_L	Bay Major Alarm Input	Input
43	ALM_ACO_EXT_N50V	Negative 50V reference for ALM_ACO_EXT_L	N/A
44	ALM_ACO_EXT_L	External Alarm Cutoff Alarm Input	Input
45	N/C	N/A	N/A
46	N/C	N/A	N/A
47	N/C	N/A	N/A
48	ALM_OUT_GEN3_NC	General Purpose Alarm Output 3 - Normally Closed	Output
49	ALM_OUT_GEN3_NO	General Purpose Alarm Output 3 - Normally Open	Output
50	ALM_OUT_GEN3_CT	General Purpose Alarm Output 3 - Common Terminal	Output

Table 2-43 XTC-4 Alarm Input/Output Connector Pin Assignments

Pin	Signal	Description	I/O
51	ALM_OUT_BAY_MAJ_NC	Bay Major Alarm Output - Normally Closed	Output
52	ALM_OUT_BAY_MAJ_NO	Bay Major Alarm Output - Normally Open	Output
53	ALM_OUT_BAY_MAJ_CT	Bay Major Alarm Output - Common Terminal	Output
54	ALM_OUT_VIS_CRIT_NC	Visual Critical Alarm Output - Normally Closed	Output
55	ALM_OUT_VIS_CRIT_NO	Visual Critical Alarm Output - Normally Open	Output
56	ALM_OUT_VIS_CRIT_CT	Visual Critical Alarm Output - Common Terminal	Output
57	ALM_OUT_VIS_MIN_NC	Visual Minor Alarm Output - Normally Closed	Output
58	ALM_OUT_VIS_MIN_NO	Visual Minor Alarm Output - Normally Open	Output
59	ALM_OUT_VIS_MIN_CT	Visual Minor Alarm Output - Common Terminal	Output
60	ALM_OUT_AUD_MAJ_NC	Audible Major Alarm Output - Normally Closed	Output
61	ALM_OUT_AUD_MAJ_NO	Audible Major Alarm Output - Normally Open	Output
62	ALM_OUT_AUD_MAJ_CT	Audible Major Alarm Output - Common Terminal	Output
63	ALM_OUT_PWR_FLT_NC	Power Fault Alarm Output - Normally Closed	Output
64	ALM_OUT_PWR_FLT_NO	Power Fault Alarm Output - Normally Open	Output
65	ALM_OUT_PWR_FLT_CT	Power Fault Alarm Output - Common Terminal	Output
66	ALM_OUT_GEN1_NC	General Purpose Alarm Output 1 - Normally Closed	Output
67	ALM_OUT_GEN1_NO	General Purpose Alarm Output 1 - Normally Open	Output
68	ALM_OUT_GEN1_CT	General Purpose Alarm Output 1 - Common Terminal	Output

Timing and Alarm Panel (TAP)

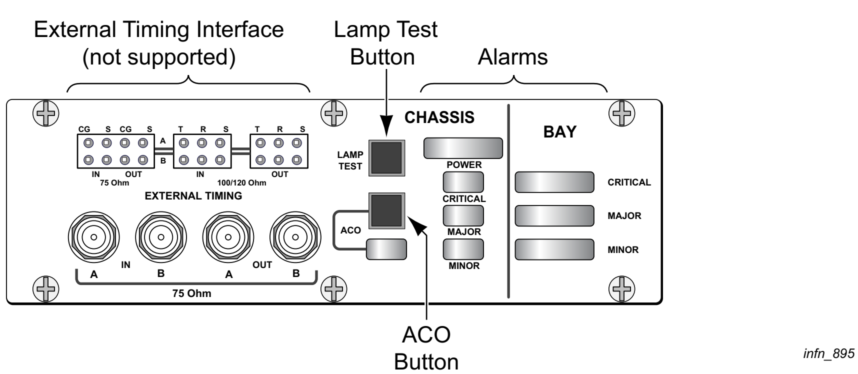
The TAP is part of the XTC-4 and houses the external timing and alarm interfaces as described below. The front view of the TAP is shown in Figure 2-21.

- Bay level alarm LEDs (Critical, Major, and Minor)
- Chassis level alarm LEDs (Power, Critical, Major, and Minor)
- One Lamp Test button
- One Alarm Cutoff (ACO) button
- One ACO LED
- External timing interface, labeled as External Timing. This interface provides ports for connecting external T1/E1 timing references:
  - Four BNC connectors (labeled as A IN/OUT, B IN/OUT), 75 Ohms
  - Set of wire wrap pins (labeled as A IN/OUT, B IN/OUT), 75 Ohms
  - Set of wire wrap pins (labeled as A IN/OUT, B IN/OUT), 100/120 Ohms

Note: The external timing interfaces are not currently supported.

External Indicators

Figure 2-21 XTC-4 TAP Front View



Bay Level Alarm LEDs

The TAP provides bay level alarms, CRITICAL, MAJOR, and MINOR LEDs. These indicate the severities of the current outstanding alarms with all chassis in a bay. The significance of an illuminated LED is described in Table 2-44.

Table 2-44 XTC-4 Visual Alarm Indicators - Bay Level

LED	Color	Description
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in any of the chassis in the bay
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in any of the chassis in the bay
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in any of the chassis in the bay

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding bay level and chassis level LED functions.

Chassis Level Alarm LEDs

The TAP provides chassis level alarms, POWER, CRITICAL, MAJOR, and MINOR LEDs. These indicate the severities of the current outstanding alarms within the chassis. The POWER LED indicates the power-on status. The significance of an illuminated LED is described in Table 2-45.

Table 2-45 XTC-4 Visual Alarm Indicators - Chassis Level

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply within the specified operating range to the chassis
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in the chassis
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in the chassis
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in the chassis

Lamp Test

The TAP contains a lamp test button for testing the LEDs. When the lamp test button is pressed, all LEDs on the TAP and the circuit packs on the chassis are lit (power LEDs illuminate Green and fault LEDs illuminate Red) and bi-color LEDs will toggle between two colors (Green and Yellow) until the lamp test button is released. Once the lamp test button is released, all LEDs will return to the previous condition.

Alarm Cutoff (ACO) Indicators

The TAP contains one ACO button and an ACO LED. The ACO feature allows muting of the external audible alarms. When the ACO button is pressed, all current critical, major, and minor audio alarms are muted and the ACO LED is lit. Table 2-46 provides a description of the alarm state and the ACO LED state.

Table 2-46 XTC-4 Audio Alarm Indicators - Chassis Level

Condition	ACO LED State	Audio Alarm
There are no external alarms on the chassis	OFF	Not present
An external alarm is raised on the chassis	OFF	Present
ACO button is pressed	ON	Muted
An external alarm is cleared	OFF	Not present

Chassis Level Audio Indicators

The TAP provides output alarm contacts for CRITICAL, MAJOR, and MINOR audible alarms. Audible alert is triggered when an alarm is raised on the chassis.

External Timing and Alarm Input/Output

The TAP provides interfaces for external timing synchronization and environmental alarm contacts. The TAP does not contain any active components. External timing interfaces are not currently supported. However, the TAP houses Telcordia and ITU Building Integrated Timing Supply (BITS) input and output timing interfaces. The BITS interfaces are labeled using the “A/B” convention for indicating paired interfaces. The configuration of the timing synchronization mode (T1 versus E1) determines which of the physical ports is referenced.

Fan Tray

Table 2-47 XTC-4 Fan Tray Product Details

Product Ordering Name (PON)	Description
X-FANTRAY-X4	XTC-4 replacement fan tray

The XTC-4 contains two removable fan trays which are both located at the bottom of the chassis. Each fan tray (Figure 2-22 on page 2-70) consists of four individually controlled, variable speed fans.

Fan speed is regulated by the active XCM (or by local sensors if external control is unavailable). On initial system startup, the fans are spun up to a predetermined percentage of maximum speed to cool the system to a normal operating temperature of 27° C; once normal operation is achieved, fan speed is decreased to reduce noise levels in compliance with OSHA, ETSI, and NEBS standards, and to increase fan MTBF. Fan speed will increase at any time during normal operation if the ambient temperature goes up.

The fan trays are referred to as Fan Tray 1 and 2. The airflow enters the system through a central inlet air plenum at the bottom of the chassis and is pushed up by the two fan trays and forced out through the top rear and side exhaust vents.

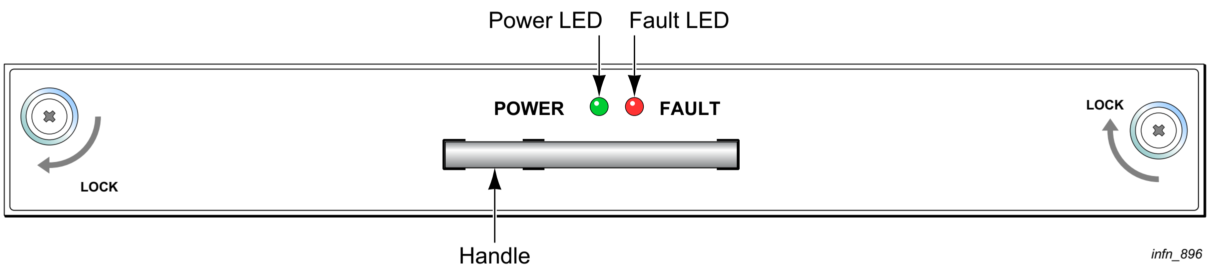
Two fan trays are required for normal operation on the XTC-4 and are redundant. Individual fans within a fan tray are N+1 redundant with power hot-swap controllers. If an individual fan on a fan tray has failed, the XTC-4 system can operate indefinitely in an environment up to 50ºC. An alarm will be generated via the management interfaces that indicates one of the fans has failed. Although the system can run reliably with a single fan failure on a fan tray, the user should change the fan tray at the earliest convenience to ensure against a second fan failure.

The faulted fan tray should be kept installed inside the XTC-4 until a replacement fan tray is available. The fan trays should never be partially removed from the system unless performing air filter maintenance (when performing air filter maintenance, the fan trays should not be removed from the system for more than one minute).

External Indicators

A POWER LED and a FAULT LED are provided on each fan tray as shown in Figure 2-22.

Figure 2-22 XTC-4 Fan Tray Faceplate



The significance of an illuminated LED is described in Table 2-48.

Table 2-48 XTC-4 Fan Tray Visual Alarm Indicators

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the fan tray
FAULT	Red	Indicates the presence (lit) or absence (dimmed) of a fault condition with the fan tray. Flashing Red indicates that the fan is not under control of the active XCM (for example, the active XCM has been reset or physically removed from the system)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding fan tray LED functions.

Technical Specifications

Table 2-49 provides the mechanical and electrical specifications for the XTC-4 fan tray.

Table 2-49 XTC-4 Fan Tray Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	2.14 inches / 54.36mm
	Width	17.00 inches / 431.80mm
	Depth	18.26 inches / 463.80mm
	Weight	18.5lb / 8.4kg
Electrical specifications	Power consumption	Included as part of base XTC-4 system; see Table 2-1 on page 2-3

Air Filter

Table 2-50 XTC-4 Air Filter Product Details

Product Ordering Name (PON)	Description
X-AIRFILTER-X4	XTC-4 replacement air filter

The XTC-4 contains one replaceable air filter located behind the front air inlet at the bottom of the chassis. Replaceable air filters are necessary to filter out dust particles at the air intake of the XTC-4. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the XTC-4 the air filters must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filters once every six months.

Mechanical Specifications

Table 2-51 provides the mechanical specifications for the XTC-4 air filter.

Table 2-51 XTC-4 Air Filter Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.25 inches / 6.35mm
	Width	17.00 inches / 431.80mm
	Depth	18.30 inches / 464.82mm
	Weight	Less than 0.5lb / 0.2kg
	Dust arrestance	80%

Card Cage

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

The XTC-4 contains a single card cage consisting of twelve chassis slots which house the circuit packs that provide the optical and digital transport, timing synchronization, switching, and management and control functions of the system as shown in Figure 2-23.

Universal slots A-1 through A-4 are full-height slots reserved for line modules and/or OTM-500s, XCM slots A-5A and A-5B are half-height slots reserved for XCMs, TSM slot A-6 is a slot reserved for a TSM-X4, and OXM slots S-1 through S-5 are slots reserved for OXM-X4s. Table 2-52 on page 2-73 outlines the XTC-4 card slot assignments.

Figure 2-23 XTC-4 Card Cage

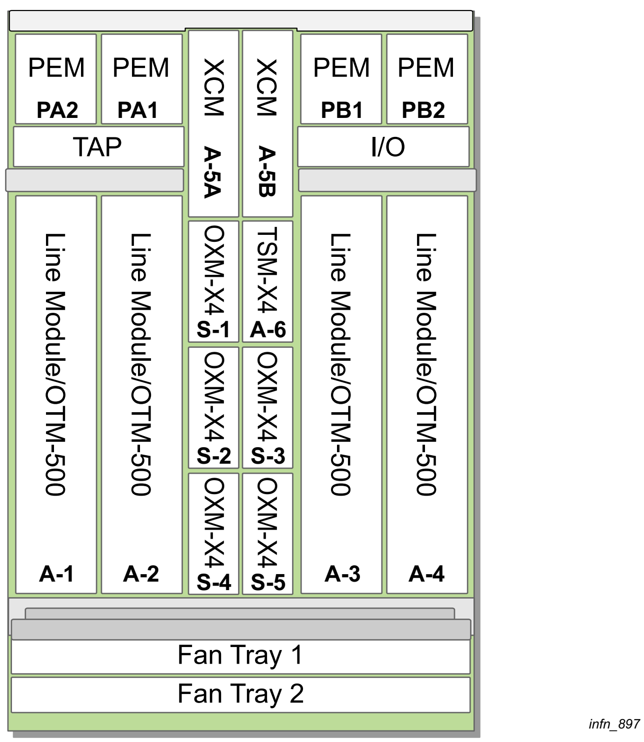


Table 2-52 XTC-4 Card Slot Assignments

Slot Number	Module Type
Universal Card Slot Assignments	
A-1	Line Module/OTM-500
A-2	
A-3	
A-4	
XCM Card Slot Assignments	
A-5A	XCM
A-5B	
TSM Card Slot Assignment	
A-6	TSM-X4
OXM Card Slot Assignments	
S-1	OXM-X4
S-2	
S-3	
S-4	
S-5	

XTC Data Plane

Note: Unless specifically note otherwise:

- All references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.
- All references to the line module will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.
- All references to the OXM will refer to the OXM-X10 and/or OXM-X4 interchangeably.
- All references to the TSM will refer to the TSM-X10 and/or TSM-X4 interchangeably.

The XTC-10 data plane comprises the switch fabric card slots containing ten OXM-X10s, and the upper universal and lower universal card slots containing up to ten line modules and/or OTM-500s.

The XTC-4 data plane comprises the switch fabric card slots containing five OXM-X4s and the universal card slots containing up to four line modules and/or OTM-500s.

The XTC data plane is described in the following sections:

- “Switch Fabric Overview“
- “Switch Fabric Synchronization” on page 2-74

Switch Fabric Overview

The XTC switch fabric is the core of the XTC. The switch fabric is implemented through OXMs installed in the XTC and provides a distributed, fault-tolerant, non-blocking architecture for switching traffic between any two universal card slots or between any ports in a tributary module.

The switch fabric on the XTC-10 houses ten OXM-X10s (eight active OXM-X10s plus two standby OXM-X10s providing 8+2 redundancy) and the switch fabric on the XTC-4 houses five OXM-X4s (four active OXM-X4s plus one standby OXM-X4 providing 4+1 redundancy).

The switch fabric on the XTC-10 supports up to 500Gbps bidirectional traffic per universal card slot for a total of 5Tbps per XTC-10 while the switch fabric on the XTC-4 supports up to 500Gbps bidirectional traffic per universal card slot for a total of 2Tbps per XTC-4.

Switch Fabric Synchronization

The switch fabric is completely synchronous where all switch link timing is locked to a common timing reference in the XTC. Ingress links are nominally phase-aligned to each other (i.e. switch frames start at the same time). Egress links are also nominally phase-aligned to each other and may have a phase delay relative to ingress links. Both ingress and egress frame start times are coordinated by a common switch fabric synchronization signal referred to as the active timing source. The operation of the entire switch fabric depends on the correct generation, selection, and reception of a single active timing source.

The active timing source signal can be generated by a TSM or an XCM (TSMs are the primary timing sources and XCMs are the secondary/backup timing sources). The XTC-10 supports up to four timing sources: TSM-A, TSM-B, XCM-A, or XCM-B, and the XTC-4 supports up to three timing sources: TSM-A, XCM-A, or XCM-B.

The selected timing source is based on a priority table maintained by the XTC system software. The priority table is used to keep track of the active and standby timing sources available to the XTC, prioritized (highest to lowest) in the following order: TSM-A, TSM-B, XCM-A, and XCM-B. Note that the priority order is modified if a TSM/XCM incurs a fault or is physically removed from the XTC, or administratively set to Lock by the user (from the management interfaces). Refer to the *Infinera DTN and DTN-X GNM Configuration Management Guide* for more information.

In the event of a fault on the active timing source, a timing switchover to the next highest priority source (listed in the priority table) will occur.

Timing Source Guidelines

- There are four possible timing sources for an XTC-10 (two TSMs and two XCMs) and three possible timing sources for an XTC-4 (one TSM and two XCMs). A valid timing source must be available at all times. If all timing sources fail, all traffic on the chassis will fail
- The XTC will always use a TSM as a timing source whenever a TSM is available as a valid timing source
- If both TSMs are unavailable as a timing source, the DTN-X will use the active XCM as the timing source. If the active XCM and both TSMs are unavailable, the DTN-X will use the standby XCM as a timing source. If at any point a TSM becomes available as a timing source, the DTN-X will automatically switch to the TSM as a timing source
- An XCM can be used as a timing source even if the XCM is undergoing a warm reset or XCM switchover (an XCM does not provide timing during a cold reset). An active XCM can be cold reset only if another valid timing source is available
- Once an XCM is identified as the timing source, the active/standby status of the XCM is independent of the XCM's status as a timing source. Meaning that if an active XCM is used as a timing source and then if an XCM switchover is performed, all control plane activities will be switched to the other XCM, but the timing source is not switched over to the other XCM; the timing source remains on the XCM that is now the standby XCM
- The management interfaces will not allow a TSM/XCM to be administratively set to Lock if the module is the only valid timing source on the chassis, or if any of the line module/OTM-500s on the chassis are unable to synch to another timing source
- Any line module that is unable to synch to the new active timing source will continue to use its previous timing source

DTN-X Control Module (XCM)

Note: Unless specifically noted otherwise, all references to the "line module" will refer to the AOLM-500, AOLX-500, SOLM-500, and/or SOLX-500 interchangeably.

Table 2-53 XCM Product Details

Product Ordering Name (PON)	Description
XCM	DTN-X Control Module

Functional Description

The DTN-X Control Module, referred to as XCM, is a half-height module that resides in the upper universal card cage occupying XCM slot A-6B and/or the lower universal card cage occupying XCM slot B-6B of the XTC-10, and/or XCM slot A-5A and/or XCM slot A-5B of the XTC-4. The XTC-10 and XTC-4 each must have at least one XCM.

The XCM provides shelf controller functionality for all modules resident within the XTC. The XCM contains the system software and configuration database for the DTN-X and performs the following:

- Management gateway functions to the external DCN in the Main Chassis
- Contains an Ethernet switch to establish Ethernet links with each OXM-X10/OXM-X4, line module, and/or OTM-500
- Provides data control functionality for each OXM
- Provides a switch fabric synchronization signal (Stratum 3 level) which can be used as a common timing reference by the switch fabric (in the case a TSM-X10/TSM-X4 is not available to provide system timing). For more information on the switch fabric, refer to "XTC Data Plane" on page 2-74

Note: An active XCM can be cold reset only if another valid timing source is available.

- Provides data plane circuit protection switching
- Fine tunes the fan speed for each fan tray
- Adapts to system power supply changes, verifies the power requirements for newly-installed line modules and TIMs, and provides power up of the modules if available power is sufficient, refer to "XTC Chassis Power Control" on page 2-77
- Coordinates the system lamp test
- In a multi-chassis configuration, the XCM in the Main Chassis performs node controller functions controlling all chassis within the DTN-X

Note: Only XCMs in a Main Chassis will contain the configuration database.

The XCMs in the Main Chassis and Expansion Chassis are interconnected through nodal control (NC) ports located on the XCM front panel. For high-availability, two (redundant) XCMs can be deployed providing 1+1 redundant control for the XTC. One XCM actively performs the node/shelf control functions while the other XCM is in the standby mode. In a multi-chassis configuration, the interconnected redundant XCMs provide the inter-chassis redundancy. In addition, the XCM supports the local craft interfaces for local management access.

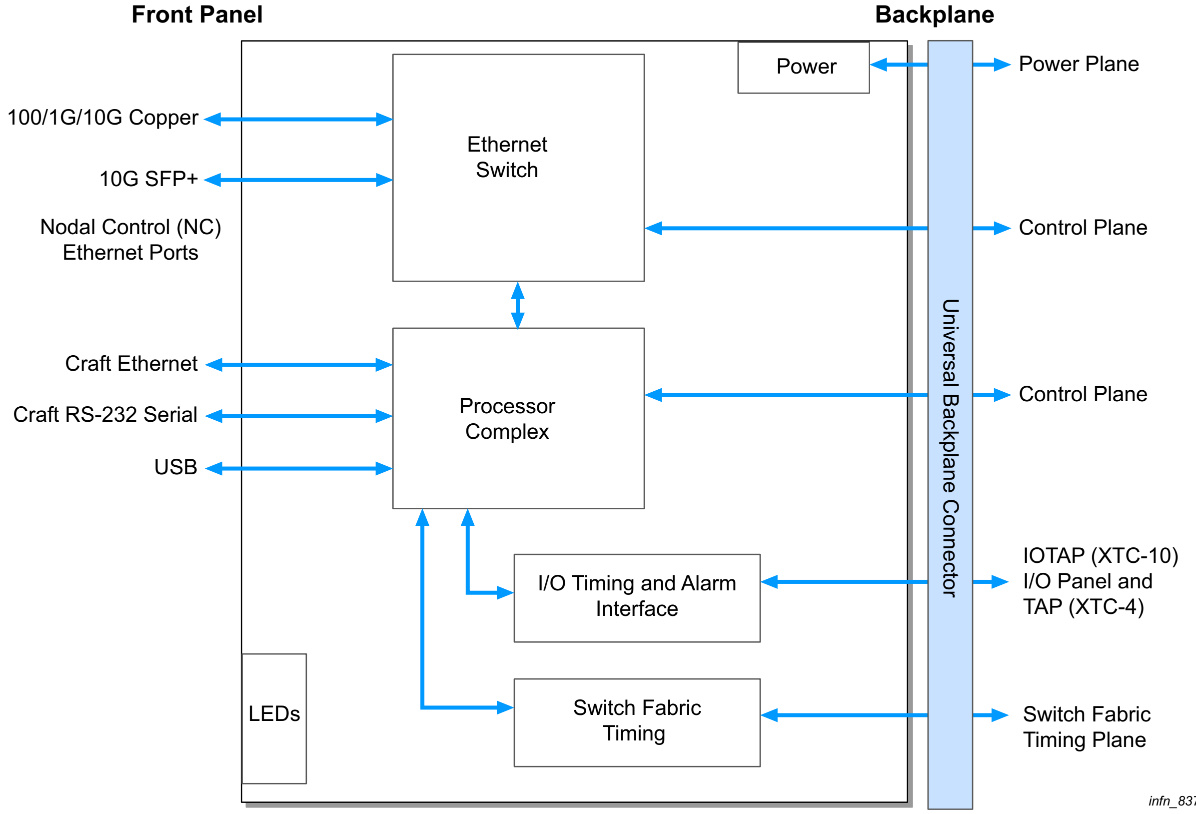
XTC Chassis Power Control

When a line module or TIM is installed in an XTC, the active XCM recognizes the module and calculates the module's power requirements, then verifies whether the power available to the system is sufficient to support the new module. Once the XCM determines that the available power is sufficient, the XCM allows the new module to power up. If the current available power is not sufficient, the XCM will not allow the module to fully power up; the module remains in a reset state and consumes a minimal amount of power. Once available power increases sufficiently, the XCM will automatically power up modules in the reset state.

This applies only to newly-installed or re-seated line modules or TIMs; if these modules are cold reset the XCM does not interfere with the reboot.

Block Diagram

Figure 2-24 XCM Functional Block Diagram

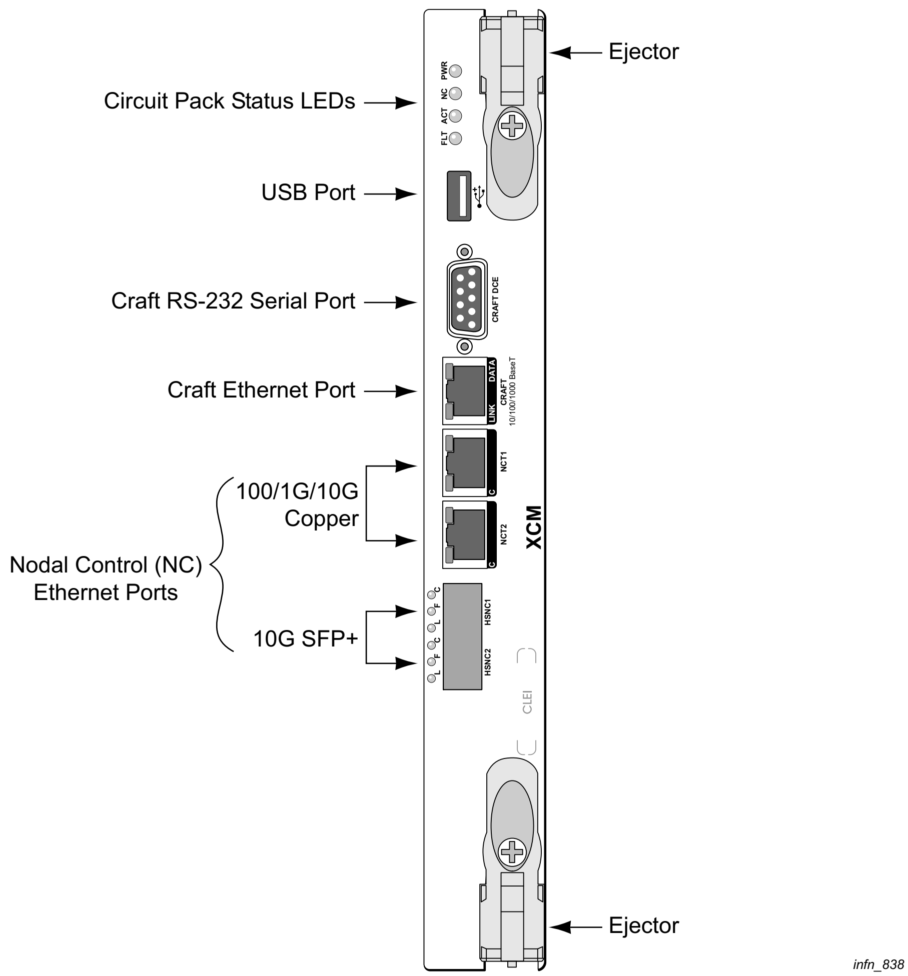


Note: NC ports are used for multi-chassis interconnection only. Timing functionality is not provided.

External Indicators and Connectors

The XCM provides circuit pack status LED indicators, craft Ethernet/serial port, NC, and Universal Serial Bus (USB) port connectors as shown in Figure 2-25.

Figure 2-25 XCM Faceplate



Note: NC ports are used for multi-chassis interconnection only. Timing functionality is not provided.

Circuit Pack Level LEDs

The XCM provides four LEDs to indicate the circuit pack status as described in Table 2-54.

Table 2-54 XCM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the XCM
NC (Node Controller)	Green	Indicates the circuit pack function: Active (Green) or Standby (off). Flashing Green indicates circuit pack is up but the management planes are not up
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

The craft Ethernet port on the front panel of the XCM has the craft Ethernet status LEDs: LINK and ACT. The LED illumination is as shown in Table 2-55.

Table 2-55 Port Visual Alarm Indicators on the XCM

LED	Color	Description
LINK	Green / Amber	Indicates the Ethernet link function: port link established at 10G (Green) or port link established at 100/1000Base-Tx (Amber). When off, indicates any of the following: • Main power is disabled • PHY circuit is in reset mode • No port link established Flashing Green/Amber indicates that a lamp test has been initiated (i.e. Lamp Test button on the IOTAP has been pressed)
ACT (Active)	Green	Indicates the Ethernet port status: port link established, no activity (Green). When off, indicates any of the following: • Main power is disabled • PHY circuit is in reset mode • No port link established Flashing Green indicates any of the following: • Indicates that a lamp test has been initiated (i.e. Lamp Test button on the IOTAP has been pressed) • Receive or transmit activity present on the port

Connectors

The XCM provides craft Ethernet, craft serial, NC, and USB ports for management purposes as described in Table 2-56.

Table 2-56 XCM Connectors

Connector	Type	Purpose
CRAFT10/100/1000 Base-T	10/100/1000Base-Tx Auto-MDIX RJ-45	Used by maintenance personnel for managing the network element
CRAFT DCE	9600 RS-232 DCE DB-9 Female	Used by maintenance personnel for initial commissioning of a network element during turn-up and test. Also used for field-debugging
NC1	100/1000/10G Base-Tx Auto-MDIX RJ-45	Used to connect to a node control shelf in a multi-chassis configuration for Inter-chassis communication
NC2		
HSNC1	10G Small Form Factor Pluggable (SFP+) module	
HSNC2		
USB	USB2.0 compliant	Used by maintenance personnel to copy and/or update system images and configuration information. This port only supports Infinera-approved removable storage media

Note: NC ports are used for multi-chassis interconnection only. Timing functionality is not provided.

Technical Specifications

Table 2-57 provides the mechanical and electrical specifications for the XCM.

Table 2-57 XCM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	12.93 inches / 328.42mm
	Width	1.47 inches / 37.34mm
	Depth	17.05 inches / 433.07mm
	Weight	8.0lb / 3.6kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Timing Synchronization Module (TSM-X10)

Table 2-58 TSM-X10 Product Details

Product Ordering Name (PON)	Description
TSM-X10	Timing Synchronization Module used on XTC-10

Functional Description

The Timing Synchronization Module, referred to as TSM-X10, is a module that resides in the upper universal card cage occupying TSM slot A-6A and/or the lower universal card cage occupying TSM slot B-6A of the XTC-10. The XTC-10 requires at least one TSM-X10.

The TSM-X10 provides a switch fabric synchronization signal (Stratum 3 level) which is used as a common timing reference by the XTC-10 switch fabric, referred to as switch fabric. The switch fabric synchronization signal is distributed to each card slot located on the switch fabric card cage and each universal card cage. The operation of the entire switch fabric depends on the correct generation, selection, and reception of a single switch fabric synchronization source. For more information on the switch fabric, refer to “XTC Data Plane” on page 2-74.

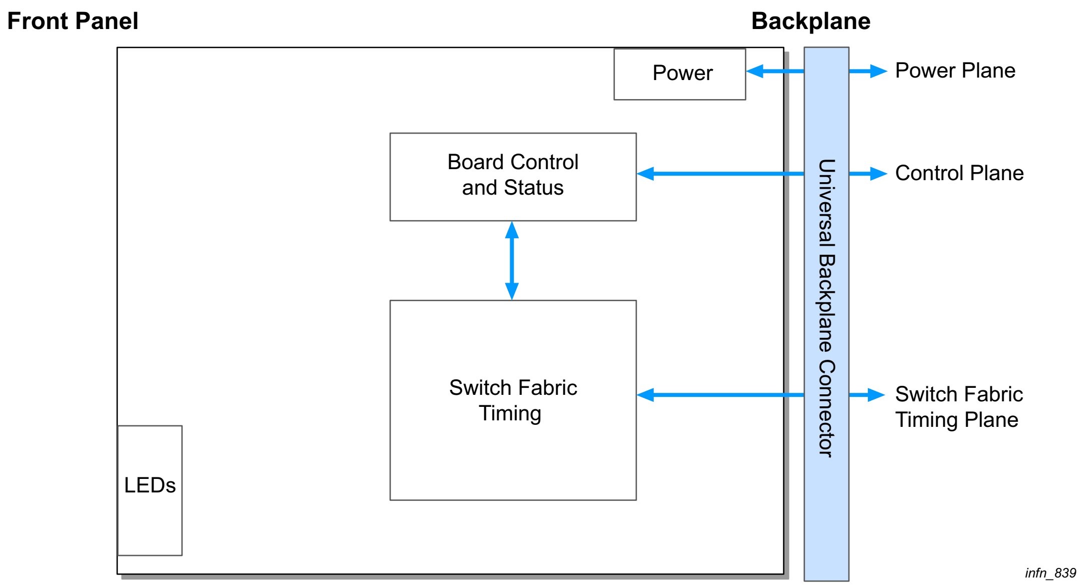
The switch fabric synchronization signal can function as Master, deriving the switch fabric synchronization signal from a local oscillator, or it can generate the signaling by synchronizing to an external switch fabric synchronization source. The external source can be another switch fabric synchronization source within the XTC or supplied from the external timing shelf in a multi-bay configuration.

Note: The XCM also provides a switch fabric synchronization signal which can be used as a timing reference by the switch fabric (in the case where both TSM-X10s are not available to provide system timing).

Note: Warm reset is not supported for TSM-X10s. Cold reset is supported only if another valid timing source (TSM-X10 or XCM) is available on the XTC-10.

Block Diagram

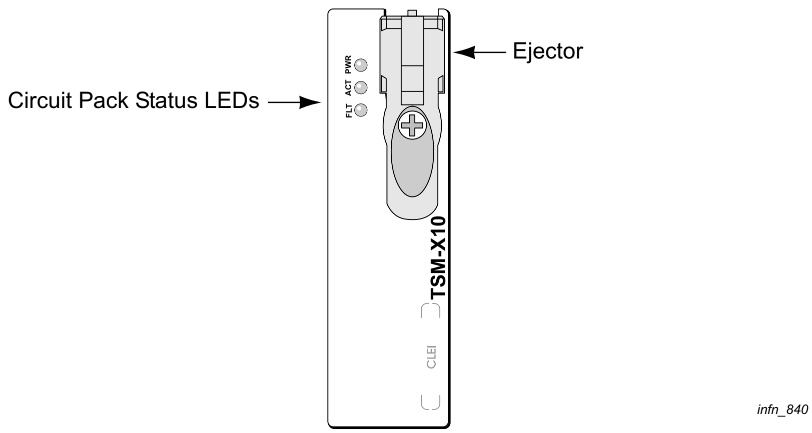
Figure 2-26 TSM-X10 Functional Block Diagram



External Indicators and Connectors

The TSM-X10 provides circuit pack status LED indicators as shown in Figure 2-27.

Figure 2-27 TSM-X10 Faceplate



Circuit Pack Level LEDs

The TSM-X10 provides three LEDs to indicate the circuit pack status as described in Table 2-59.

Table 2-59 TSM-X10 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TSM-X10
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack LED functions.

Connectors

The TSM-X10 has no external connectors.

Technical Specifications

Table 2-60 provides the mechanical and electrical specifications for the TSM-X10.

Table 2-60 TSM-X10 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	4.42 inches / 112.27mm
	Width	1.47 inches / 37.34mm
	Depth	17.25 inches / 438.15mm
	Weight	3.0lb / 1.4kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Timing Synchronization Module (TSM-X4)

Table 2-61 TSM-X4 Product Details

Product Ordering Name (PON)	Description
TSM-X4	Timing Synchronization Module used on XTC-4

Functional Description

The Timing Synchronization Module, referred to as TSM-X4, is a module that resides in the universal card cage occupying TSM slot A-6 of the XTC-4. The XTC-4 requires a TSM-X4.

The TSM-X4 provides a switch fabric synchronization signal (Stratum 3 level) which is used as a common timing reference by the XTC-4 switch fabric, referred to as switch fabric. The switch fabric synchronization signal is distributed to each card slot located on the switch fabric card cage and the universal card cage. The operation of the entire switch fabric depends on the correct generation, selection, and reception of a single switch fabric synchronization source. For more information on the switch fabric, refer to "XTC Data Plane" on page 2-74.

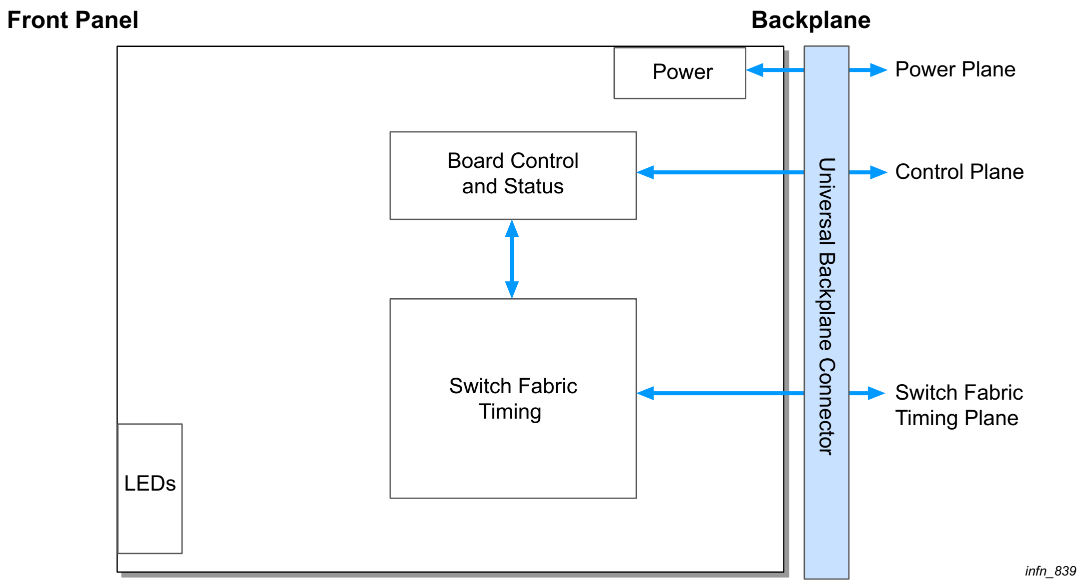
The switch fabric synchronization signal can function as Master, deriving the switch fabric synchronization signal from a local oscillator, or it can generate the signaling by synchronizing to an external switch fabric synchronization source. The external source can be another switch fabric synchronization source within the XTC or supplied from the external timing shelf in a multi-bay configuration.

Note: The XCM also provides a switch fabric synchronization signal which can be used as a timing reference by the switch fabric (in the case where a TSM-X4 is not available to provide system timing).

Note: Warm reset is not supported for TSM-X4s. Cold reset is supported only if another valid timing source (TSM-X4 or XCM) is available on the XTC-4.

Block Diagram

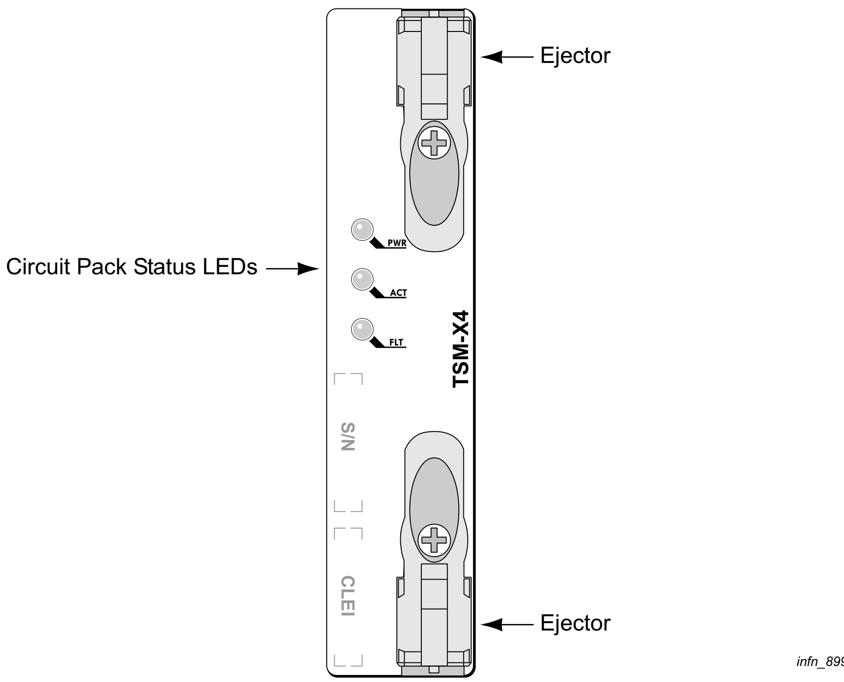
Figure 2-28 TSM-X4 Functional Block Diagram



External Indicators and Connectors

The TSM-X4 provides circuit pack status LED indicators as shown in Figure 2-29.

Figure 2-29 TSM-X4 Faceplate



Circuit Pack Level LEDs

The TSM-X4 provides three LEDs to indicate the circuit pack status as described in Table 2-62.

Table 2-62 TSM-X4 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TSM-X4
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack LED functions.

Connectors

The TSM-X4 has no external connectors.

Technical Specifications

Table 2-63 provides the mechanical and electrical specifications for the TSM-X4.

Table 2-63 TSM-X4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	5.86 inches / 148.84mm
	Width	1.47 inches / 37.34mm
	Depth	17.25 inches / 438.15mm
	Weight	3.4lb / 1.5kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

OTN Switch Module (OXM-X10)

Table 2-64 OXM-X10 Product Details

Product Ordering Name (PON)	Description
OXM-X10	OTN Switch Module used on XTC-10

Functional Description

The Optical Transport Network (OTN) Switch Module, referred to as OXM-X10, is a module that resides in the switch fabric card cage occupying OXM slots S-1 through S-10 of the XTC-10.

The XTC-10 switch fabric, referred to as switch fabric, houses a total of ten OXM-X10s (eight active OXM-X10s plus two standby OXM-X10s providing 8+2 redundancy). For more information on the switch fabric, refer to “XTC Data Plane” on page 2-74.

The OXM-X10 is an integral component of the switch fabric and performs the following:

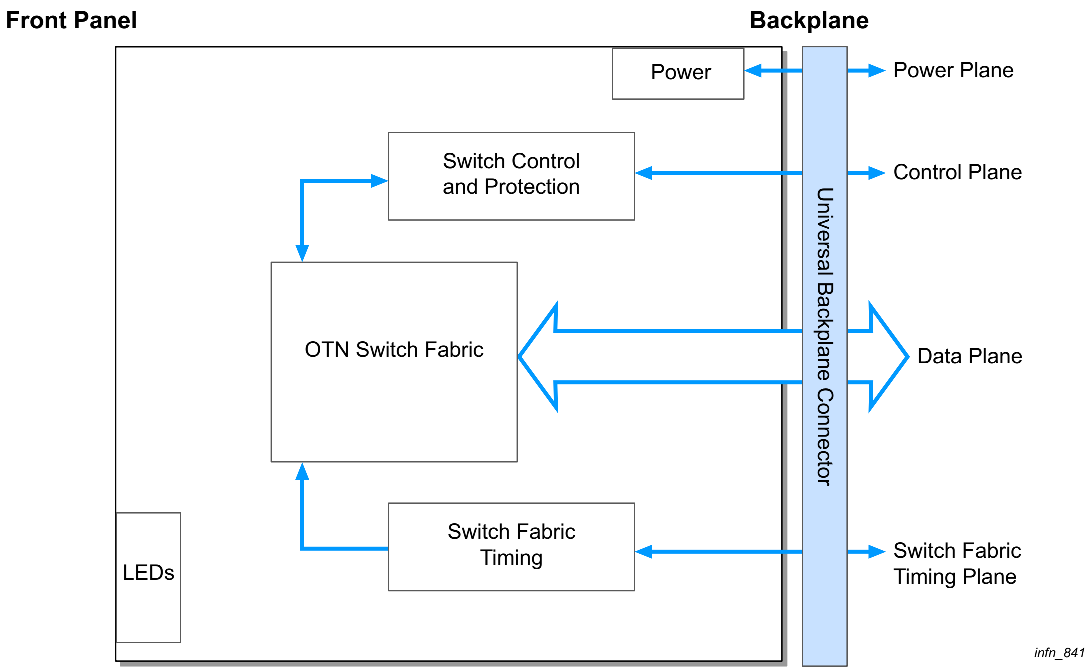
- Provides a distributed, fault-tolerant, non-blocking switch fabric architecture for switching traffic between any two universal card slots, or between links in a single tributary module
- Contains OTN switch fabric devices each containing high speed switch links that provide interleaved time-slot units from tributary streams. The devices can switch traffic from each ingress to each egress link independently in a non-blocking manner
- Receives up to four switch fabric synchronization clock signals, one from each TSM-X10 and XCM to ensure the following:
    - Each OXM-X10 is locked to the known good clock reference
    - A 3:1 protection scheme is established to ensure that any failure due to non-availability of the reference clock is minimal
    - To minimize any disruption to traffic and maintain a hitless operation

In addition, the OXM-X10 contains no external interfaces; all communication with other system modules is through the backplane.

Note: Warm reset is not supported for OXM-X10s. Cold reset is supported only for standby OXM-X10s.

Block Diagram

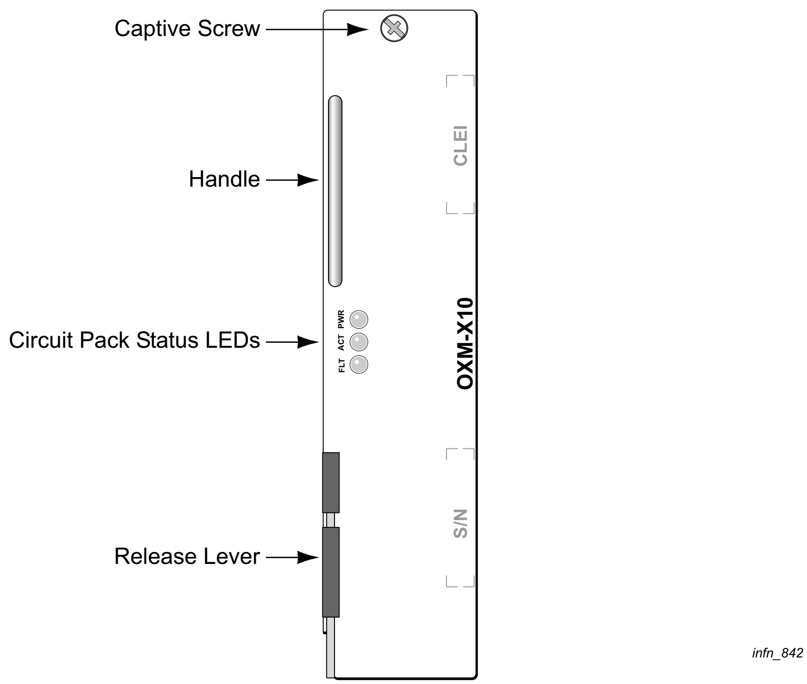
Figure 2-30 OXM-X10 Functional Block Diagram



External Indicators and Connectors

The OXM-X10 provides circuit pack status LED indicators as shown in Figure 2-31.

Figure 2-31 OXM-X10 Faceplate



Circuit Pack Level LEDs

The OXM-X10 provides three LEDs to indicate the circuit pack status as described in Table 2-65.

Table 2-65 OXM-X10 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the OXM-X10
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack LED functions.

Connectors

The OXM-X10 has no external connectors.

Technical Specifications

Table 2-66 provides the mechanical and electrical specifications for the OXM-X10.

Table 2-66 OXM-X10 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	7.28 inches / 184.91mm
	Width	1.86 inches / 47.24mm
	Depth	17.00 inches / 431.80mm
	Weight	5.6lb / 2.5kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

OTN Switch Module (OXM-X4)

Table 2-67 OXM-X4 Product Details

Product Ordering Name (PON)	Description
OXM-X4	OTN Switch Module used on XTC-4

Functional Description

The Optical Transport Network (OTN) Switch Module, referred to as OXM-X4, is a module that resides in the switch fabric card cage occupying OXM slots S-1 through S-5 of the XTC-4.

The XTC-4 switch fabric, referred to as switch fabric, houses a total of five OXM-X4s (four active OXM-X4s plus one standby OXM-X4 providing 4+1 redundancy). For more information on the switch fabric, refer to “XTC Data Plane” on page 2-74.

The OXM-X4 is an integral component of the switch fabric and performs the following:

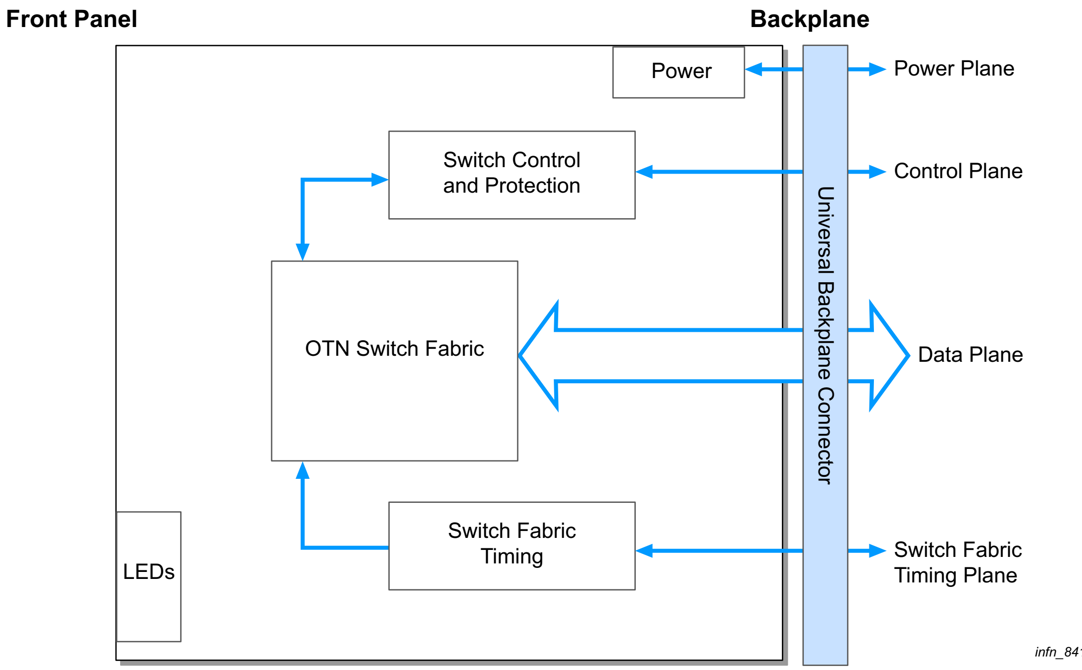
- Provides a distributed, fault-tolerant, non-blocking switch fabric architecture for switching traffic between any two universal card slots, or between links in a single tributary module
- Contains OTN switch fabric devices each containing high speed switch links that provide interleaved time-slot units from tributary streams. The devices can switch traffic from each ingress to each egress link independently in a non-blocking manner
- Receives up to three switch fabric synchronization clock signals, one from each TSM-X4 and XCM to ensure the following:
    - Each OXM-X4 is locked to the known good clock reference
    - A 2:1 protection scheme is established to ensure that any failure due to non-availability of the reference clock is minimal
    - To minimize any disruption to traffic and maintain a hitless operation

In addition, the OXM-X4 contains no external interfaces; all communication with other system modules is through the backplane.

Note: Warm reset is not supported for OXM-X4s. Cold reset is supported only for standby OXM-X4s.

Block Diagram

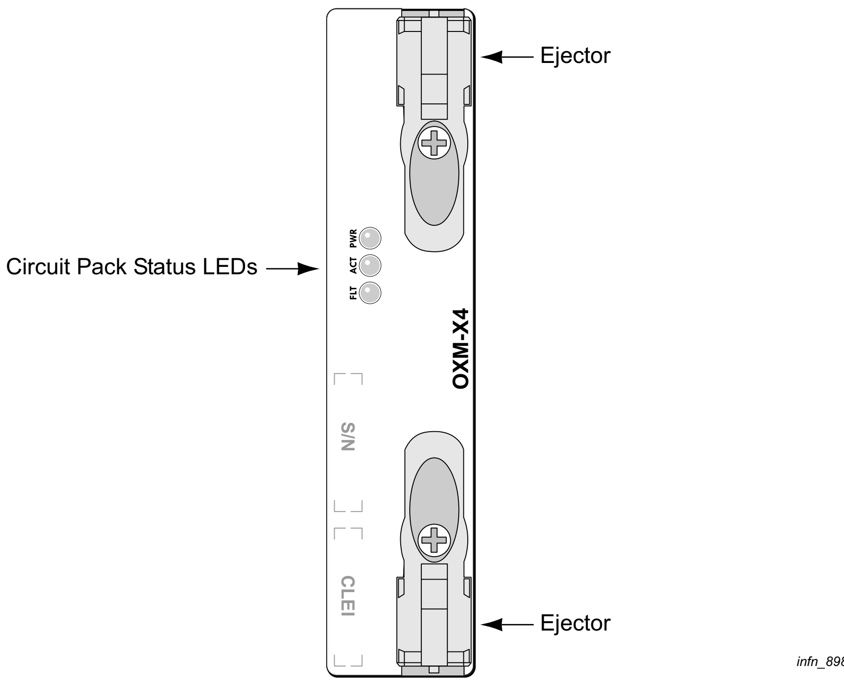
Figure 2-32 OXM-X4 Functional Block Diagram



External Indicators and Connectors

The OXM-X4 provides circuit pack status LED indicators as shown in Figure 2-33.

Figure 2-33 OXM-X4 Faceplate



Circuit Pack Level LEDs

The OXM-X4 provides three LEDs to indicate the circuit pack status as described in Table 2-68.

Table 2-68 OXM-X4 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the OXM-X4
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack LED functions.

Connectors

The OXM-X4 has no external connectors.

Technical Specifications

Table 2-69 provides the mechanical and electrical specifications for the OXM-X4.

Table 2-69 OXM-X4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	6.12 inches / 155.45mm
	Width	1.47 inches / 37.34mm
	Depth	17.00 inches / 431.80mm
	Weight	5.2lb / 2.4kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Advanced OTN Line Module 500G (AOLM-500)

The AOLM-500 supports ten (10) DWDM multiplexed optical channels (with coherent detection) and per-channel software configurable modulation options providing up to 500Gbps of bandwidth (refer to “Modulation Formats” on page 2-104 for additional information). AOLM-500s are tunable line modules that can be configured for one of four OCGs. For example, the AOLM-500-T4-1-C5 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The AOLM-500s are optically connected to a DTC (BMM2/BMM2P) to provide bandwidth for up to 8Tbps (8000Gbps) of traffic signals (160 channels x 50Gbps). Refer to the *Infinera DTN and DTN-X System Description Guide* for more information. AOLM-500s can be installed in upper universal card slots A-1 through A-5 and/or lower universal card slots B-1 through B-5 of the XTC-10, and/or universal card slots 1 through 4 of the XTC-4. The supported AOLM-500 types are listed in Table 2-70.

Table 2-70 AOLM-500 Product Details

Product Ordering Name (PON)	Description
AOLM-500-T4-1-C5	AOLM-500, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
AOLM-500-T4-1-C6	
AOLM-500-T4-3-C5	AOLM-500, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
AOLM-500-T4-3-C6	
AOLM-500-T4-5-C5	AOLM-500, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
AOLM-500-T4-5-C6	
AOLM-500-T4-7-C5	AOLM-500, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16
AOLM-500-T4-7-C6	

The Advanced Optical Transport Network (OTN) Switching Line Module 500G, referred to as AOLM-500, performs the following functions:

- Provides a bidirectional backplane interface to another AOLM-500 utilizing fixed slot pairing
- Optimized for 1-way and 2-way add/drop connections for the following types of deployments:
  - Point-to-point links
  - Linear add/drop links
  - Rings
  - Express routes on large networks
  - Regenerations
- Contains client and switch fabric interfaces which are integrated OTN digital wrapper devices each providing bidirectional bandwidth

- Generates and receives one of sixteen (16) wavelength multiplexed Optical Carrier Groups (OCGs)
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx super channel optical devices
- Improves per-fiber transmission capacity within the Infinera DTN-X C-Band while retaining a minimum channel spacing of 25 GHz
- Allows for dispersion compensation of up to +50,000ps/nm

Modulation Formats

The AOLM-500 can be provisioned via the management interfaces for one of the following modulation formats:

- Dual carrier-polarization multiplexed-quadrature phase shift keying (DC-PM-QPSK); default format
- Dual carrier-polarization multiplexed-binary phase shift keying (DC-PM-BPSK)
- Dual carrier-polarization multiplexed-enhanced binary phase shift keying (DC-PM-eBPSK)

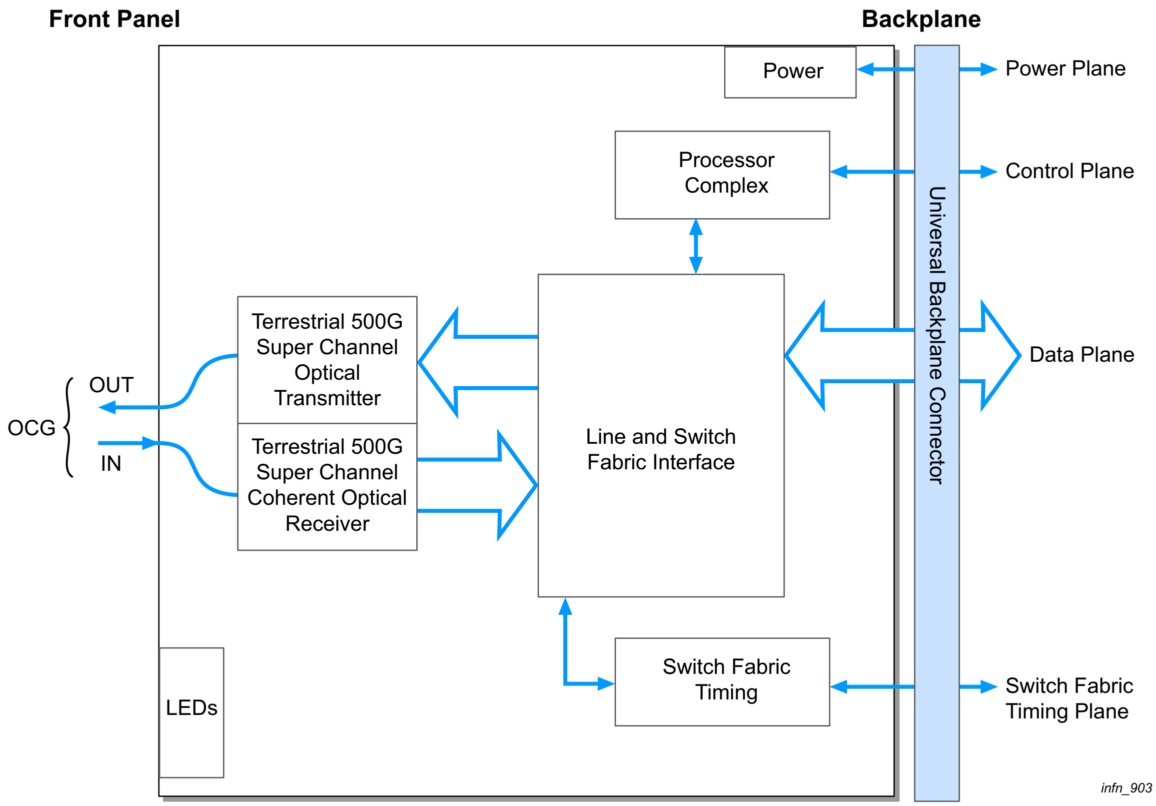
Table 2-71 provides details of the OTN and OCG facilities supported on the AOLM-500 including the supported client and line rates.

Table 2-71 AOLM-500 Maximum Bandwidth for the Supported Modulation Formats

Modulation Format	Infinera OTN Facility Type	Available Bandwidth per OTUki (Number of ODU0s)	Maximum Bandwidth per AOLM-500 (OCG Bandwidth)
DC-PM-QPSK (default format)	OTU4i	100Gbps (80 ODU0s)	500Gbps (5 x OTU4i)
DC-PM-BPSK DC-PM-eBPSK	OTU3i+	50Gbps (40 ODU0s)	250Gbps (5 x OTU3i+)

Block Diagram

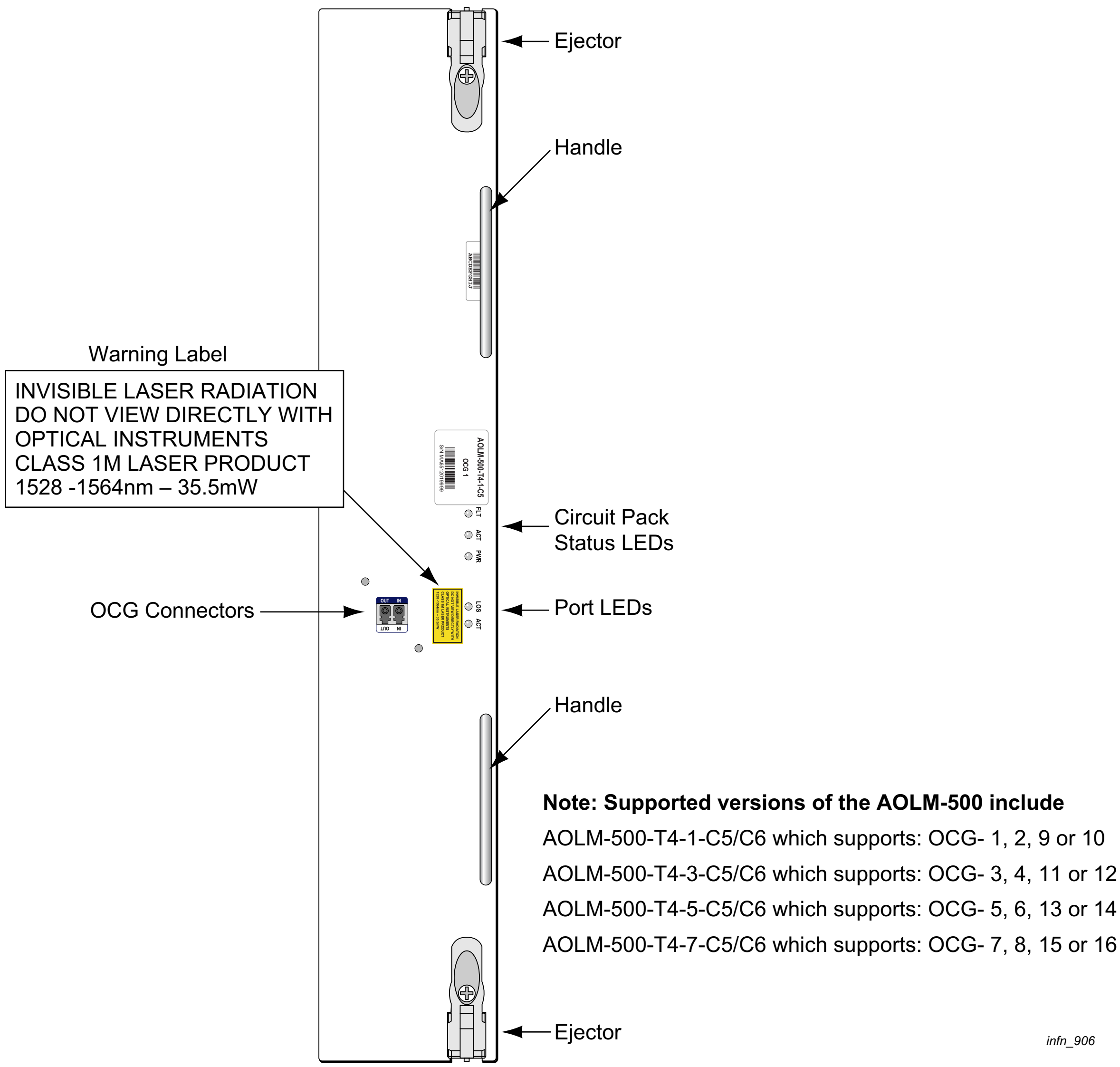
Figure 2-34 AOLM-500 Functional Block Diagram



External Indicators and Connectors

The AOLM-500 (Figure 2-35) provides circuit pack status/port LED indicators and line connectors.

Figure 2-35 AOLM-500 Faceplate



Circuit Pack Level LEDs

The AOLM-500 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-72.

Table 2-72 AOLM-500 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the AOLM-500
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the AOLM-500 OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 2-73.

Table 2-73 Port Visual Alarm Indicators on the AOLM-500

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of AOLM-500 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The AOLM-500 provides IN and OUT interfaces between the XTC and a DTC as shown in Table 2-74.

Table 2-74 AOLM-500 Connectors

Connector	Type	Purpose
IN	LC	Connects from the corresponding OCG port on the DTC (BMM2/ BMM2P)
OUT	LC	Connects to the corresponding OCG port on the DTC (BMM2/BMM2P)

Technical Specifications

Table 2-75 provides the mechanical and electrical specifications for the AOLM-500.

Table 2-75 AOLM-500 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	19.76 inches / 501.90mm
	Width	3.46 inches / 87.88mm
	Depth	17.05 inches / 433.07mm
	Weight	29.0lb / 13.2kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Optical Specifications

Table 2-76 provides the OCG optical power specifications (per OCG port) for the AOLM-500.

Table 2-76 AOLM-500 OCG Optical Power Range

Type	Parameter	Specification
AOLM-500-T4-n-C5/C6 (n=1,3,5,7)	Input power level	-9.3 to 8.0dBm
	Output power level	
	AOLM-500 to BMM2	-1.0 to 0.5dBm
	AOLM-500 to BMM2P	4.0 to 5.5dBm

Table 2-77 provides the wavelength operating range for the AOLM-500 per the Infinera DTN-X C-Band optical channel plan.

Table 2-77 AOLM-500 Wavelength Operating Range

Type	Parameter	Specification
AOLM-500-T4-1-C5/C6	Wavelength range OCG 1	1548.915nm to 1563.455nm
AOLM-500-T4-1-C5/C6 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
AOLM-500-T4-3-C5/C6	Wavelength range OCG 3	1548.115nm to 1562.640nm
AOLM-500-T4-3-C5/C6 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
AOLM-500-T4-5-C5/C6	Wavelength range OCG 5	1531.507nm to 1545.720nm
AOLM-500-T4-5-C5/C6 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
AOLM-500-T4-7-C5/C6	Wavelength range OCG 7	1530.725nm to 1544.924nm
AOLM-500-T4-7-C5/C6 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
AOLM-500-T4-1-C5/C6 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
AOLM-500-T4-1-C5/C6 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
AOLM-500-T4-3-C5/C6 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
AOLM-500-T4-3-C5/C6 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
AOLM-500-T4-5-C5/C6 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
AOLM-500-T4-5-C5/C6 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
AOLM-500-T4-7-C5/C6 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
AOLM-500-T4-7-C5/C6 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Advanced OTN Switching Line Module 500G (AOLX-500)

The AOLX-500 supports ten (10) DWDM multiplexed optical channels (with coherent detection) and per-channel software configurable modulation options providing up to 500Gbps of bandwidth (refer to "Modulation Formats" on page 2-111 for additional information). AOLX-500s are tunable line modules that can be configured for one of four OCGs. For example, the AOLX-500-T4-1-C5 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The AOLX-500s are optically connected to a DTC (BMM2/BMM2P) to provide bandwidth for up to 8Tbps (8000Gbps) of traffic signals (160 channels x 50Gbps). Refer to the *Infinera DTN and DTN-X System Description Guide* for more information. AOLX-500s can be installed in upper universal card slots A-1 through A-5 and/or lower universal card slots B-1 through B-5 of the XTC-10, and/or universal card slots 1 through 4 of the XTC-4. The supported AOLX-500 types are listed in Table 2-78.

Table 2-78 AOLX-500 Product Details

Product Ordering Name (PON)	Description
AOLX-500-T4-1-C5	AOLX-500, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
AOLX-500-T4-1-C6	
AOLX-500-T4-3-C5	AOLX-500, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
AOLX-500-T4-3-C6	
AOLX-500-T4-5-C5	AOLX-500, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
AOLX-500-T4-5-C6	
AOLX-500-T4-7-C5	AOLX-500, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16
AOLX-500-T4-7-C6	

The Advanced Optical Transport Network (OTN) Switching Line Module 500G, referred to as AOLX-500, performs the following functions:

- Provides a bidirectional backplane interface to the switch fabric to enable all switched data to be directed to any of the line card slots within the XTC
- Optimized for multi-way junctions and full switching applications for the following types of deployments:
  - Multi-degree junction nodes
  - Large mesh networks
- Contains client and switch fabric interfaces which are integrated OTN digital wrapper devices each providing bidirectional bandwidth
- Generates and receives one of sixteen (16) wavelength multiplexed Optical Carrier Groups (OCGs)

- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx super channel optical devices
- Improves per-fiber transmission capacity within the Infinera DTN-X C-Band while retaining a minimum channel spacing of 25 GHz
- Allows for dispersion compensation of up to +50,000ps/nm

Modulation Formats

The AOLX-500 can be provisioned via the management interfaces for one of the following modulation formats:

- Dual carrier-polarization multiplexed-quadrature phase shift keying (DC-PM-QPSK); default format
- Dual carrier-polarization multiplexed-binary phase shift keying (DC-PM-BPSK)
- Dual carrier-polarization multiplexed-enhanced binary phase shift keying (DC-PM-eBPSK)

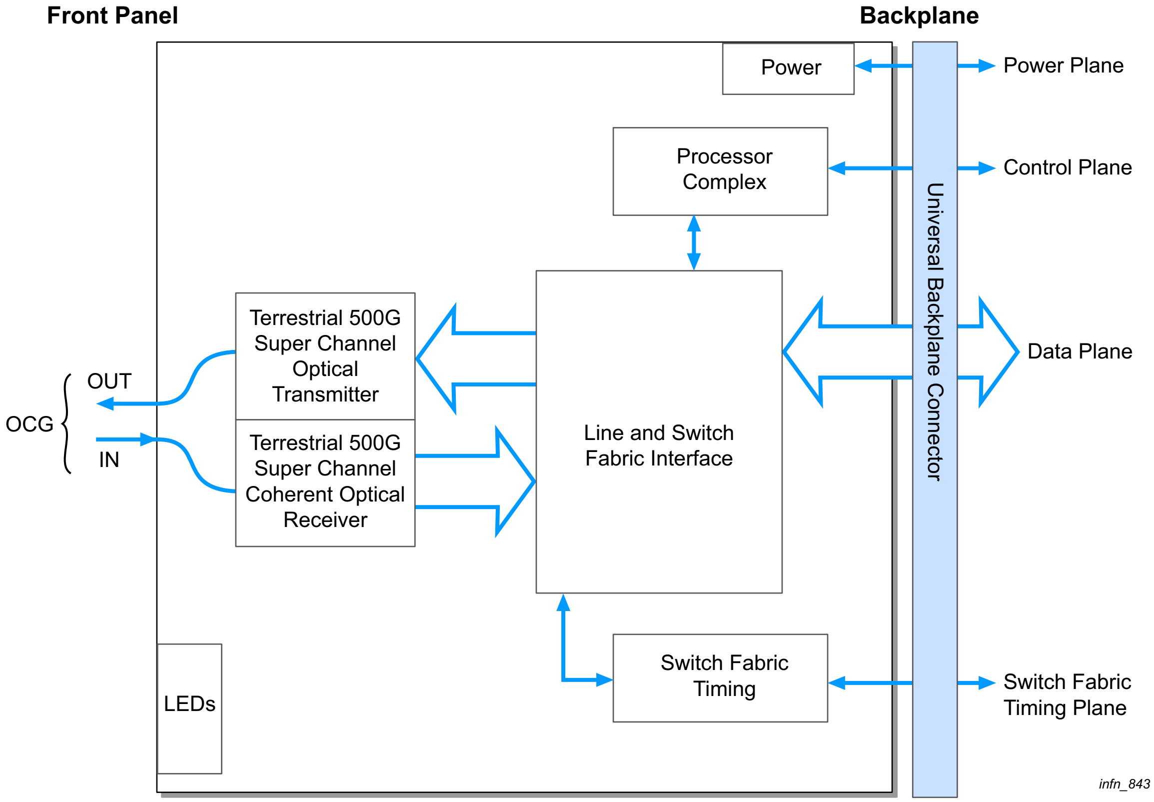
Table 2-79 provides details of the OTN and OCG facilities supported on the AOLX-500 including the supported client and line rates.

Table 2-79 AOLX-500 Maximum Bandwidth for the Supported Modulation Formats

Modulation Format	Infinera OTN Facility Type	Available Bandwidth per OTUki (Number of ODU0s)	Maximum Bandwidth per AOLX-500 (OCG Bandwidth)
DC-PM-QPSK (default format)	OTU4i	100Gbps (80 ODU0s)	500Gbps (5 x OTU4i)
DC-PM-BPSK DC-PM-eBPSK	OTU3i+	50Gbps (40 ODU0s)	250Gbps (5 x OTU3i+)

Block Diagram

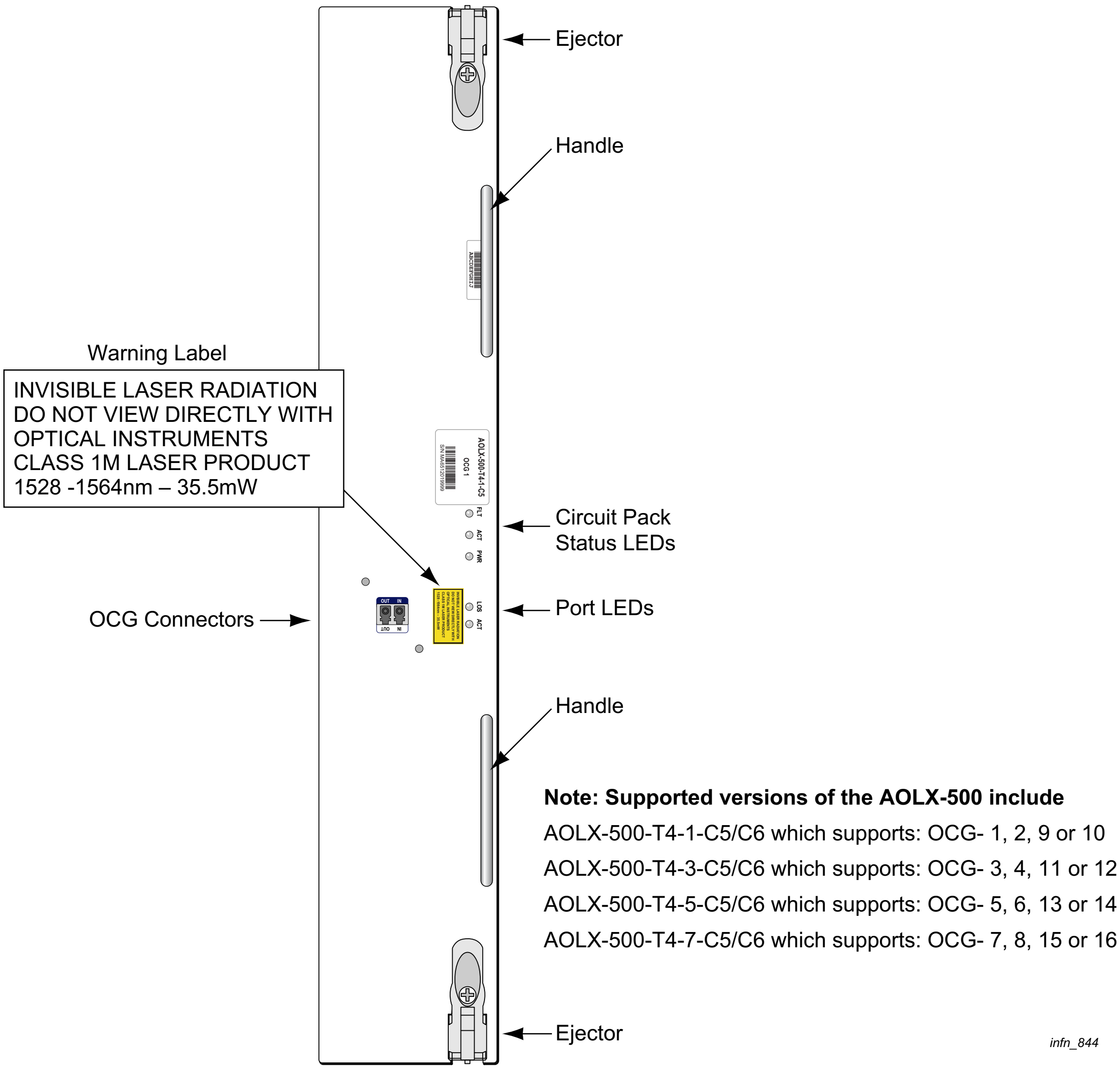
Figure 2-36 AOLX-500 Functional Block Diagram



External Indicators and Connectors

The AOLX-500 (Figure 2-37) provides circuit pack status/port LED indicators and line connectors.

Figure 2-37 AOLX-500 Faceplate



Circuit Pack Level LEDs

The AOLX-500 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-80.

Table 2-80 AOLX-500 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the AOLX-500
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the AOLX-500 OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 2-81.

Table 2-81 Port Visual Alarm Indicators on the AOLX-500

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of AOLX-500 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The AOLX-500 provides IN and OUT interfaces between the XTC and a DTC as shown in Table 2-82.

Table 2-82 AOLX-500 Connectors

Connector	Type	Purpose
IN	LC	Connects from the corresponding OCG port on the DTC (BMM2/BMM2P)
OUT	LC	Connects to the corresponding OCG port on the DTC (BMM2/BMM2P)

Technical Specifications

Table 2-83 provides the mechanical and electrical specifications for the AOLX-500.

Table 2-83 AOLX-500 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	19.76 inches / 501.90mm
	Width	3.46 inches / 87.88mm
	Depth	17.05 inches / 433.07mm
	Weight	29.0lb / 13.2kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Optical Specifications

Table 2-84 provides the OCG optical power specifications (per OCG port) for the AOLX-500.

Table 2-84 AOLX-500 OCG Optical Power Range

Type	Parameter	Specification
AOLX-500-T4-n-C5/C6 (n=1,3,5,7)	Input power level	-9.3 to 8.0dBm
	Output power level	
	AOLX-500 to BMM2	-1.0 to 0.5dBm
	AOLX-500 to BMM2P	4.0 to 5.5dBm

Table 2-85 provides the wavelength operating range for the AOLX-500 per the Infinera DTN-X C-Band optical channel plan.

Table 2-85 AOLX-500 Wavelength Operating Range

Type	Parameter	Specification
AOLX-500-T4-1-C5/C6	Wavelength range OCG 1	1548.915nm to 1563.455nm
AOLX-500-T4-1-C5/C6 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
AOLX-500-T4-3-C5/C6	Wavelength range OCG 3	1548.115nm to 1562.640nm
AOLX-500-T4-3-C5/C6 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
AOLX-500-T4-5-C5/C6	Wavelength range OCG 5	1531.507nm to 1545.720nm
AOLX-500-T4-5-C5/C6 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
AOLX-500-T4-7-C5/C6	Wavelength range OCG 7	1530.725nm to 1544.924nm
AOLX-500-T4-7-C5/C6 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
AOLX-500-T4-1-C5/C6 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
AOLX-500-T4-1-C5/C6 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
AOLX-500-T4-3-C5/C6 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
AOLX-500-T4-3-C5/C6 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
AOLX-500-T4-5-C5/C6 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
AOLX-500-T4-5-C5/C6 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
AOLX-500-T4-7-C5/C6 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
AOLX-500-T4-7-C5/C6 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Submarine OTN Line Module 500G (SOLM-500)

The SOLM-500 supports ten (10) DWDM multiplexed optical channels (with coherent detection) and per-channel software configurable modulation options providing up to 500Gbps of bandwidth (refer to “Modulation Formats” on page 2-118 for additional information). SOLM-500s are tunable line modules that can be configured for one of four OCGs. For example, the SOLM-500-T4-1-C5 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The SOLM-500s are optically connected to a DTC (BMM2/BMM2P) to provide bandwidth for up to 8Tbps (8000Gbps) of traffic signals (160 channels x 50Gbps). Refer to the *Infinera DTN and DTN-X System Description Guide* for more information. SOLM-500s can be installed in upper universal card slots A-1 through A-5 and/or lower universal card slots B-1 through B-5 of the XTC-10, and/or universal card slots 1 through 4 of the XTC-4. The supported SOLM-500 types are listed in Table 2-86.

Table 2-86 SOLM-500 Product Details

Product Ordering Name (PON)	Description
SOLM-500-T4-1-C11	SOLM-500, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
SOLM-500-T4-3-C11	SOLM-500, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
SOLM-500-T4-5-C11	SOLM-500, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
SOLM-500-T4-7-C11	SOLM-500, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16

The Advanced Optical Transport Network (OTN) Switching Line Module 500G, referred to as SOLM-500, performs the following functions:

- Used exclusively for DTN-X links operating in submarine line terminating equipment (SLTE) mode 1
- Provides a bidirectional backplane interface to another SOLM-500 utilizing fixed slot pairing
- Contains client and switch fabric interfaces which are integrated OTN digital wrapper devices each providing bidirectional bandwidth
- Generates and receives one of sixteen (16) wavelength multiplexed Optical Carrier Groups (OCGs)
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx super channel optical devices
- Improves per-fiber transmission capacity within the Infinera DTN-X C-Band while retaining a minimum channel spacing of 25 GHz
- Allows for dispersion compensation of up to +50,000ps/nm

- Support for manually configuring the receive EDFA gain. The receive EDFA gain is an absolute value, not an offset value

Note: Do not configure the receive EDFA gain unless consulted to do so by an Infinera TAC resource.

Modulation Formats

The SOLM-500 can be provisioned via the management interfaces for one of the following modulation formats:

- Dual carrier-polarization multiplexed-quadrature phase shift keying (DC-PM-QPSK); default format
- Dual carrier-polarization multiplexed-binary phase shift keying (DC-PM-BPSK)
- Dual carrier-polarization multiplexed-enhanced binary phase shift keying (DC-PM-eBPSK)

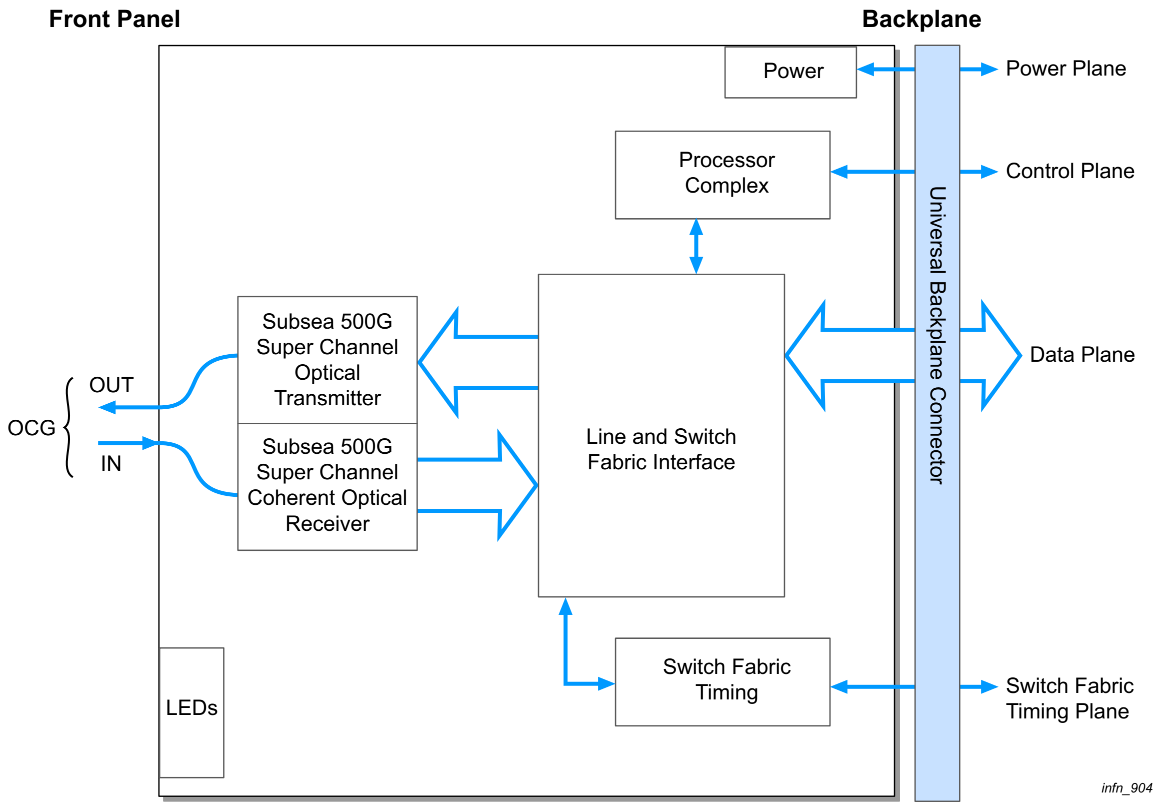
Table 2-87 provides details of the OTN and OCG facilities supported on the SOLM-500 including the supported client and line rates.

Table 2-87 SOLM-500 Maximum Bandwidth for the Supported Modulation Formats

Modulation Format	Infinera OTN Facility Type	Available Bandwidth per OTUki (Number of ODU0s)	Maximum Bandwidth per SOLM-500 (OCG Bandwidth)
DC-PM-QPSK (default format)	OTU4i	100Gbps (80 ODU0s)	500Gbps (5 x OTU4i)
DC-PM-BPSK DC-PM-eBPSK	OTU3i+	50Gbps (40 ODU0s)	250Gbps (5 x OTU3i+)

Block Diagram

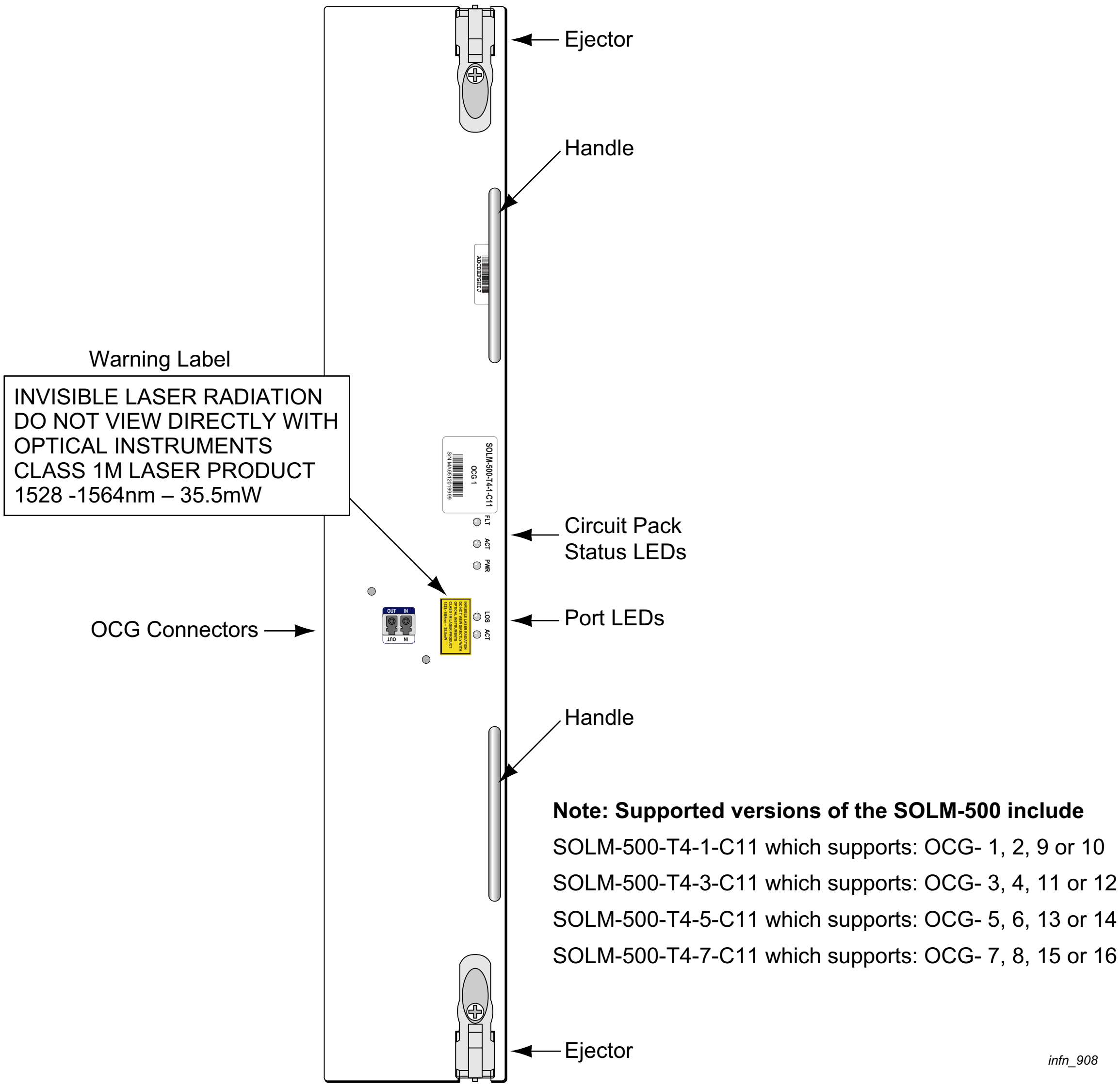
Figure 2-38 SOLM-500 Functional Block Diagram



External Indicators and Connectors

The SOLM-500 (Figure 2-39) provides circuit pack status/port LED indicators and line connectors.

Figure 2-39 SOLM-500 Faceplate



Circuit Pack Level LEDs

The SOLM-500 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-88.

Table 2-88 SOLM-500 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the SOLM-500
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the SOLM-500 OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 2-89.

Table 2-89 Port Visual Alarm Indicators on the SOLM-500

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of SOLM-500 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The SOLM-500 provides IN and OUT interfaces between the XTC and a DTC as shown in Table 2-90.

Table 2-90 SOLM-500 Connectors

Connector	Type	Purpose
IN	LC	Connects from the corresponding OCG port on the DTC (BMM2/ BMM2P)
OUT	LC	Connects to the corresponding OCG port on the DTC (BMM2/BMM2P)

Technical Specifications

Table 2-91 provides the mechanical and electrical specifications for the SOLM-500.

Table 2-91 SOLM-500 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	19.76 inches / 501.90mm
	Width	3.46 inches / 87.88mm
	Depth	17.05 inches / 433.07mm
	Weight	29.0lb / 13.2kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Optical Specifications

Table 2-92 provides the OCG optical power specifications (per OCG port) for the SOLM-500.

Table 2-92 SOLM-500 OCG Optical Power Range

Type	Parameter	Specification
SOLM-500-T4-n-C5/C6 (n=1,3,5,7)	Input power level	-9.3 to 8.0dBm
	Output power level	
	SOLM-500 to BMM2	-1.0 to 0.5dBm
	SOLM-500 to BMM2P	4.0 to 5.5dBm

Table 2-93 provides the wavelength operating range for the SOLM-500 per the Infinera DTN-X C-Band optical channel plan.

Table 2-93 SOLM-500 Wavelength Operating Range

Type	Parameter	Specification
SOLM-500-T4-1-C11	Wavelength range OCG 1	1548.915nm to 1563.455nm
SOLM-500-T4-1-C11 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
SOLM-500-T4-3-C11	Wavelength range OCG 3	1548.115nm to 1562.640nm
SOLM-500-T4-3-C11 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
SOLM-500-T4-5-C11	Wavelength range OCG 5	1531.507nm to 1545.720nm
SOLM-500-T4-5-C11 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
SOLM-500-T4-7-C11	Wavelength range OCG 7	1530.725nm to 1544.924nm
SOLM-500-T4-7-C11 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
SOLM-500-T4-1-C11 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
SOLM-500-T4-1-C11 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
SOLM-500-T4-3-C11 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
SOLM-500-T4-3-C11 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
SOLM-500-T4-5-C11 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
SOLM-500-T4-5-C11 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
SOLM-500-T4-7-C11 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
SOLM-500-T4-7-C11 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Submarine OTN Switching Line Module 500G (SOLX-500)

The SOLX-500 supports ten (10) DWDM multiplexed optical channels (with coherent detection) and per-channel software configurable modulation options providing up to 500Gbps of bandwidth (refer to “Modulation Formats” on page 2-125 for additional information). SOLX-500s are tunable line modules that can be configured for one of four OCGs. For example, the SOLX-500-T4-1-C5 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The SOLX-500s are optically connected to a DTC (BMM2/BMM2P) to provide bandwidth for up to 8Tbps (8000Gbps) of traffic signals (160 channels x 50Gbps). Refer to the *Infinera DTN and DTN-X System Description Guide* for more information. SOLX-500s can be installed in upper universal card slots A-1 through A-5 and/or lower universal card slots B-1 through B-5 of the XTC-10, and/or universal card slots 1 through 4 of the XTC-4. The supported SOLX-500 types are listed in Table 2-94.

Table 2-94 SOLX-500 Product Details

Product Ordering Name (PON)	Description
SOLX-500-T4-1-C11	SOLX-500, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
SOLX-500-T4-3-C11	SOLX-500, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
SOLX-500-T4-5-C11	SOLX-500, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
SOLX-500-T4-7-C11	SOLX-500, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16

The Advanced Optical Transport Network (OTN) Switching Line Module 500G, referred to as SOLX-500, performs the following functions:

- Used exclusively for DTN-X links operating in submarine line terminating equipment (SLTE) mode 1
- Provides a bidirectional backplane interface to the switch fabric to enable all switched data to be directed to any of the line card slots within the XTC
- Contains client and switch fabric interfaces which are integrated OTN digital wrapper devices each providing bidirectional bandwidth
- Generates and receives one of sixteen (16) wavelength multiplexed Optical Carrier Groups (OCGs)
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx super channel optical devices
- Improves per-fiber transmission capacity within the Infinera DTN-X C-Band while retaining a minimum channel spacing of 25 GHz
- Allows for dispersion compensation of up to +50,000ps/nm

- Support for manually configuring the receive EDFA gain. The receive EDFA gain is an absolute value, not an offset value

Note: Do not configure the receive EDFA gain unless consulted to do so by an Infinera TAC resource.

Modulation Formats

The SOLX-500 can be provisioned via the management interfaces for one of the following modulation formats:

- Dual carrier-polarization multiplexed-quadrature phase shift keying (DC-PM-QPSK); default format
- Dual carrier-polarization multiplexed-binary phase shift keying (DC-PM-BPSK)
- Dual carrier-polarization multiplexed-enhanced binary phase shift keying (DC-PM-eBPSK)

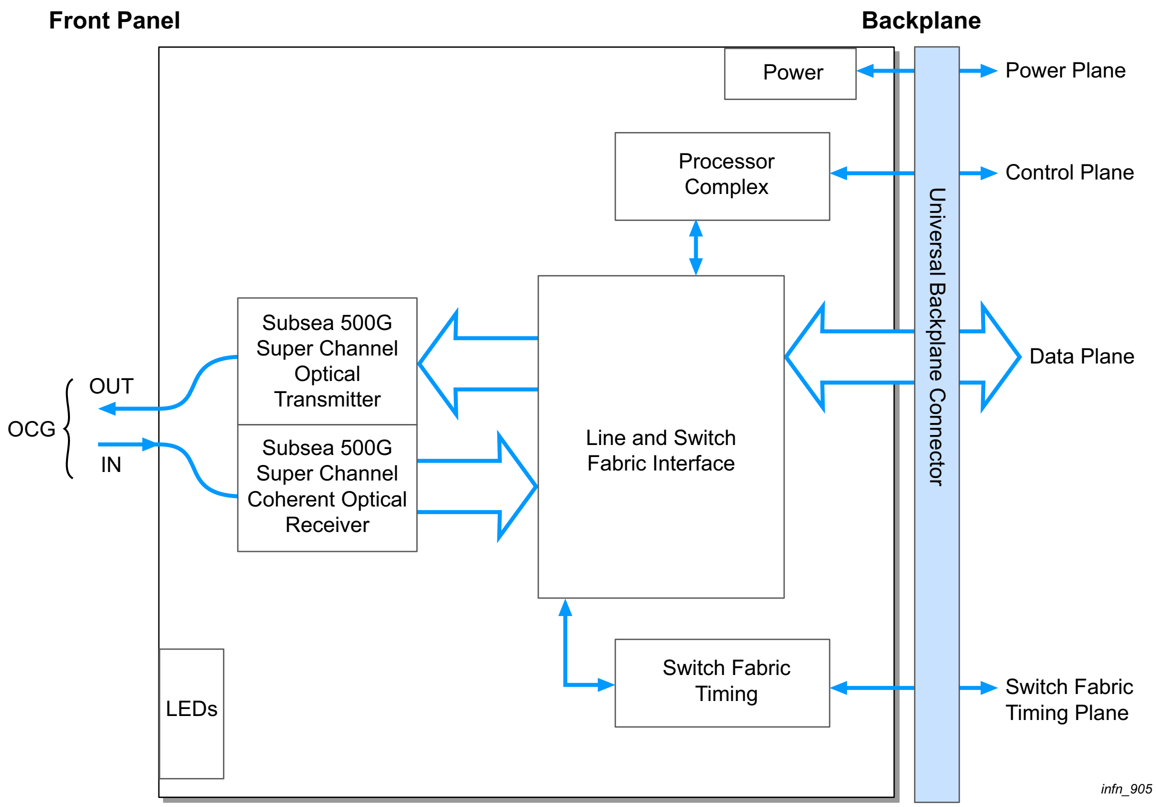
Table 2-95 provides details of the OTN and OCG facilities supported on the SOLX-500 including the supported client and line rates.

Table 2-95 SOLX-500 Maximum Bandwidth for the Supported Modulation Formats

Modulation Format	Infinera OTN Facility Type	Available Bandwidth per OTUki (Number of ODU0s)	Maximum Bandwidth per SOLX-500 (OCG Bandwidth)
DC-PM-QPSK (default format)	OTU4i	100Gbps (80 ODU0s)	500Gbps (5 x OTU4i)
DC-PM-BPSK DC-PM-eBPSK	OTU3i+	50Gbps (40 ODU0s)	250Gbps (5 x OTU3i+)

Block Diagram

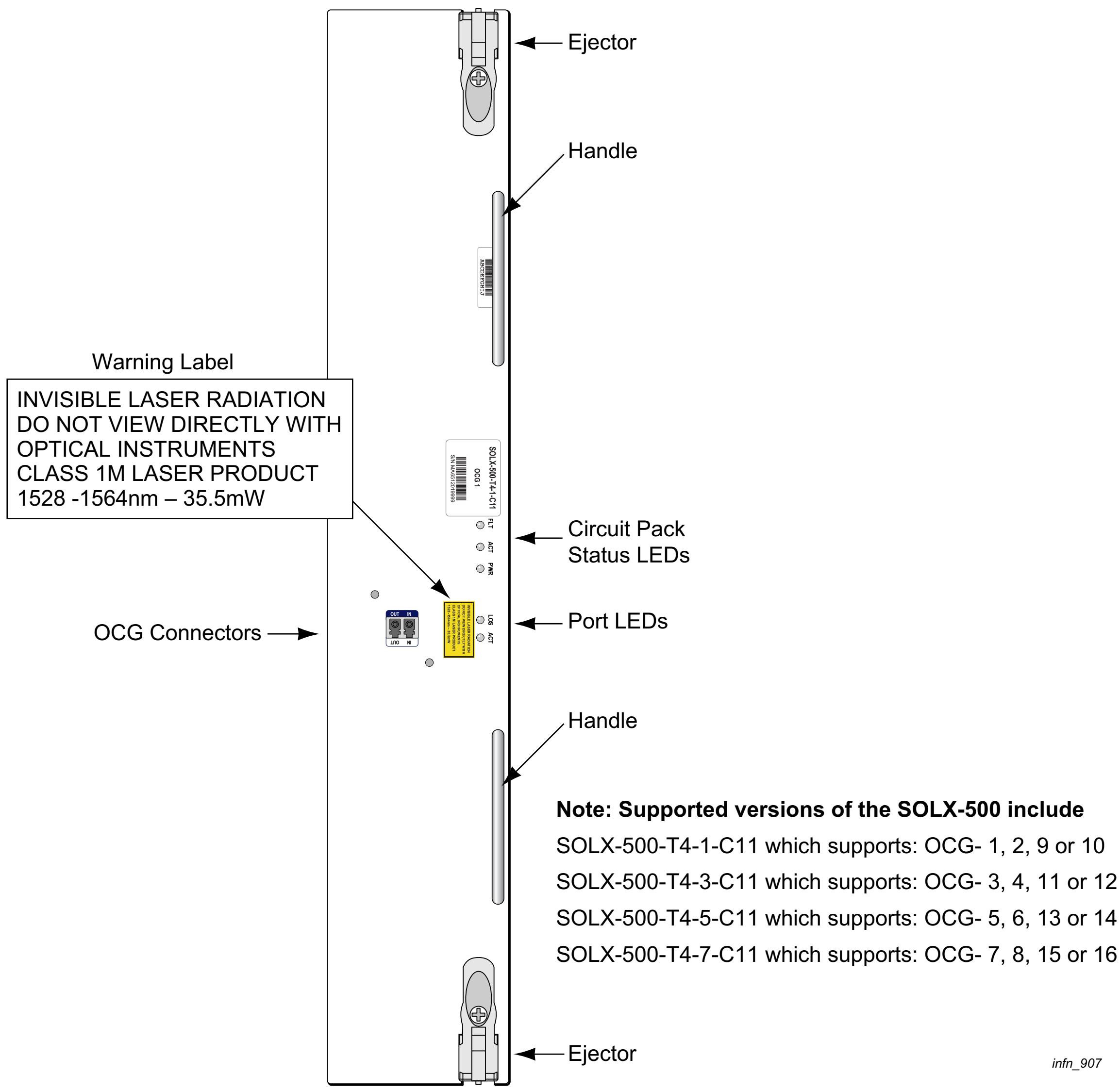
Figure 2-40 SOLX-500 Functional Block Diagram



External Indicators and Connectors

The SOLX-500 (Figure 2-41) provides circuit pack status/port LED indicators and line connectors.

Figure 2-41 SOLX-500 Faceplate



Circuit Pack Level LEDs

The SOLX-500 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-96.

Table 2-96 SOLX-500 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the SOLX-500
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the SOLX-500 OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 2-97.

Table 2-97 Port Visual Alarm Indicators on the SOLX-500

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of SOLX-500 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The SOLX-500 provides IN and OUT interfaces between the XTC and a DTC as shown in Table 2-98.

Table 2-98 SOLX-500 Connectors

Connector	Type	Purpose
IN	LC	Connects from the corresponding OCG port on the DTC (BMM2/BMM2P)
OUT	LC	Connects to the corresponding OCG port on the DTC (BMM2/BMM2P)

Technical Specifications

Table 2-99 provides the mechanical and electrical specifications for the SOLX-500.

Table 2-99 SOLX-500 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	19.76 inches / 501.90mm
	Width	3.46 inches / 87.88mm
	Depth	17.05 inches / 433.07mm
	Weight	29.0lb / 13.2kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Optical Specifications

Table 2-100 provides the OCG optical power specifications (per OCG port) for the SOLX-500.

Table 2-100 SOLX-500 OCG Optical Power Range

Type	Parameter	Specification
SOLX-500-T4-n-C5/C6 (n=1,3,5,7)	Input power level	-9.3 to 8.0dBm
	Output power level	
	SOLX-500 to BMM2	-1.0 to 0.5dBm
	SOLX-500 to BMM2P	4.0 to 5.5dBm

Table 2-101 provides the wavelength operating range for the SOLX-500 per the Infinera DTN-X C-Band optical channel plan.

Table 2-101 SOLX-500 Wavelength Operating Range

Type	Parameter	Specification
SOLX-500-T4-1-C11	Wavelength range OCG 1	1548.915nm to 1563.455nm
SOLX-500-T4-1-C11 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
SOLX-500-T4-3-C11	Wavelength range OCG 3	1548.115nm to 1562.640nm
SOLX-500-T4-3-C11 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
SOLX-500-T4-5-C11	Wavelength range OCG 5	1531.507nm to 1545.720nm
SOLX-500-T4-5-C11 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
SOLX-500-T4-7-C11	Wavelength range OCG 7	1530.725nm to 1544.924nm
SOLX-500-T4-7-C11 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
SOLX-500-T4-1-C11 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
SOLX-500-T4-1-C11 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
SOLX-500-T4-3-C11 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
SOLX-500-T4-3-C11 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
SOLX-500-T4-5-C11 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
SOLX-500-T4-5-C11 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
SOLX-500-T4-7-C11 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
SOLX-500-T4-7-C11 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

OTN Tributary Module 500G (OTM-500)

Table 2-102 OTM-500 Product Details

Product Ordering Name (PON)	Description
OTM-500	OTN Tributary Module, 500G

Functional Description

The Optical Transport Network (OTN) Tributary Module 500G, referred to as OTM-500, provides up to 500Gbps bidirectional bandwidth to the XTC backplane using pluggable TIMs. The OTM-500 contains ten TIM sub-slots each of which provide support for various tributary interfaces such as SONET, SDH, ODU, OTU, and/or Ethernet.

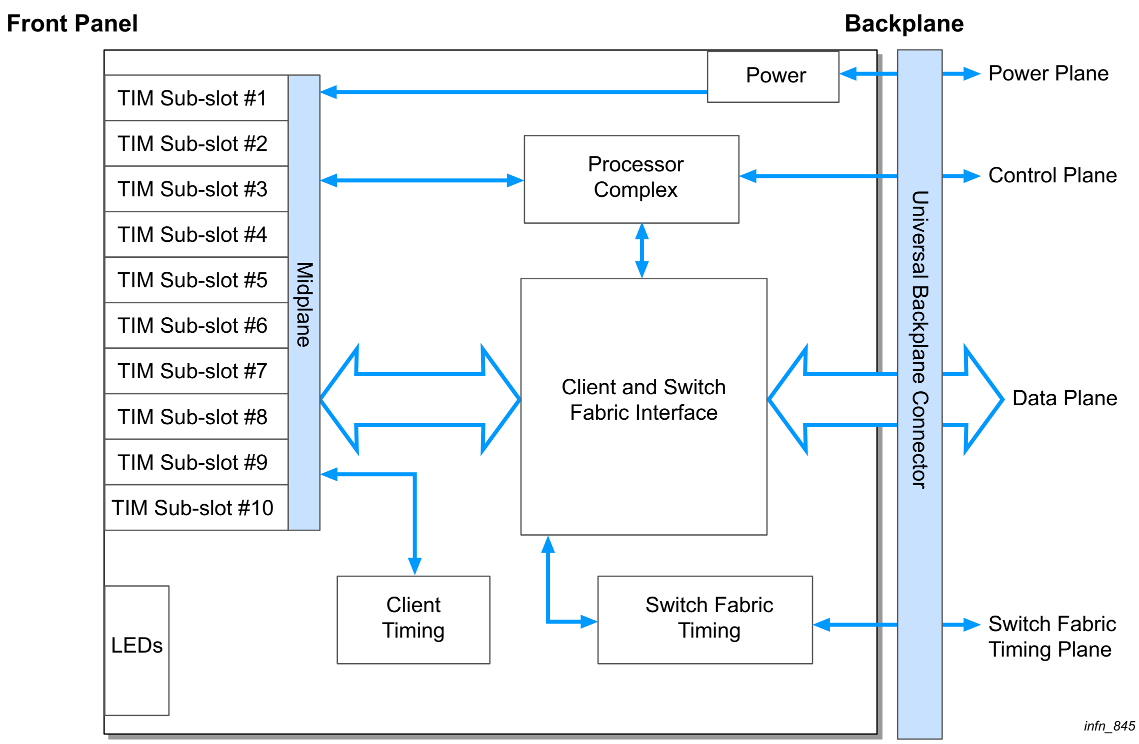
The OTM-500 contains a 500G client and switch fabric interface and a processor complex device. The client and switch fabric interface is an integrated OTN digital wrapper device providing bidirectional bandwidth. The processor complex device is responsible for extracting, processing, and inserting overhead information in the data streams transiting the client and switch fabric interface.

The OTM-500s can be installed in upper universal card slots A-1 through A-5 and/or lower universal card slots B-1 through B-5 of the XTC-10, and/or universal card slots 1 through 4 of the XTC-4 and support the following TIM types:

- TIM-1-100GE
- TIM-5-10GM

Block Diagram

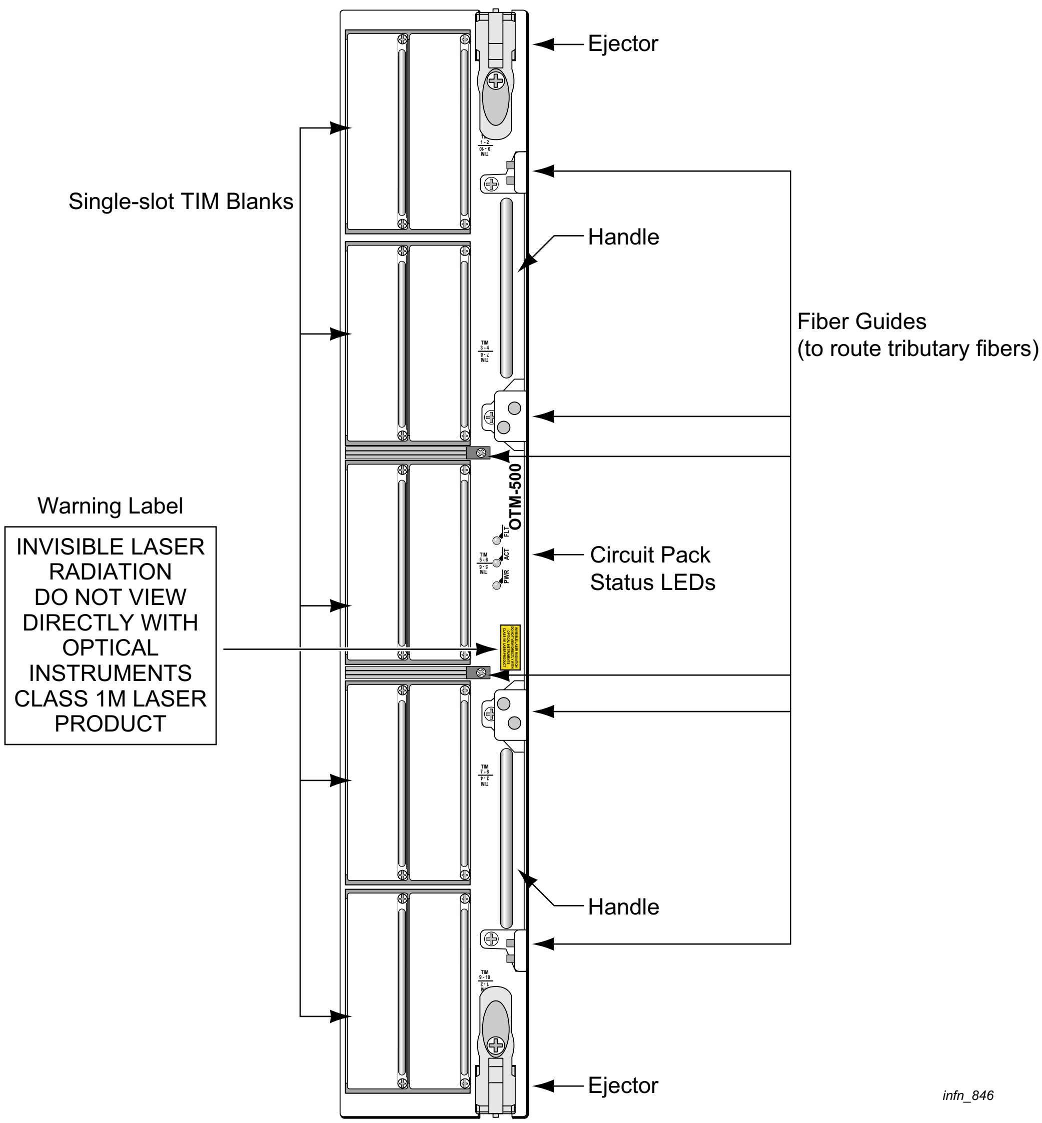
Figure 2-42 OTM-500 Functional Block Diagram



External Indicators and Connectors

The OTM-500 (Figure 2-43) provides circuit pack status LED indicators.

Figure 2-43 OTM-500 Faceplate



Circuit Pack Level LEDs

The OTM-500 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-103.

Table 2-103 OTM-500 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the OTM-500
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack functions.

Port Indicators

The OTM-500 has no port indicators.

Connectors

The OTM-500 has no external connectors.

Technical Specifications

Table 2-104 provides the mechanical and electrical specifications for the OTM-500.

Table 2-104 OTM-500 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	19.76 inches / 501.90mm
	Width	3.46 inches / 87.88mm
	Depth	17.05 inches / 433.07mm
	Weight	22.0lb / 10.0kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Tributary Interface Module (TIM)

In the receive direction, a TIM is used to convert the customer client optical signal into an electrical signal. This electrical version of the client data is then mapped into a frame structure unique to the DTN-X. The DTN-X structured frames are wrapped into a transport frame format and then sent from the TIM to the OTM-500 to be switched and/or transported through the DTN-X line side.

In the transmit direction, a TIM is used to first demap the DTN-X frames received from the OTM-500. The client data is then demapped from the received frames. The timing of the client traffic is also extracted in the transmit direction. Once the client data and timing is completely demapped, the client data is then converted to an optical signal via the TOM.

A TIM is pluggable into any available sub-slot(s) on the OTM-500. The OTM-500 contains ten TIM sub-slots with each sub-slot supporting up to 50Gbps of client traffic.

Table 2-105 lists the name and a brief description of each of the supported TIMs.

Table 2-105 TIM Product Details

Product Ordering Name (PON)	Description
TIM-1-100GE	Supports a single IEEE802.3ab 100GbE Ethernet port. The supported TOM types utilize the CFP form factor
TIM-5-10GM	Supports five 10G ports. The supported TOM type utilizes the SFP+ form factor. Each port is a multi-service port supporting SONET, SDH, OTN, GbE, and/or Fibre Channel client interfaces

Note: Warm reset is not supported for TIMs. Cold reset is supported for TIMs.

Tributary Interface Module 100GE (TIM-1-100GE)

Functional Description

The Tributary Interface Module 100GE, referred to as TIM-1-100GE, transports a 100GbE Ethernet interface as a single circuit across the DTN-X network. The TIM-1-100GE is compliant with the IEEE802.3ab 100GbE standard and the optical transceiver supported utilizes the industry standard CFP form factor.

The TIM-1-100GE is a double-slot TIM type (requiring two sub-slots) and can be arbitrarily equipped in any two adjacent TIM sub-slots located on the OTM-500.

The TIM-1-100GE provides a single sub-slot to enable the insertion of the following TOM types:

- "Tributary Optical Module 100G (TOM-100G-SR10)" on page 2-148
- "Tributary Optical Module 100G (TOM-100G-S10X)" on page 2-151
- "Tributary Optical Module 100G (TOM-100G-LR4)" on page 2-154
- "Tributary Optical Module 100G (TOM-100G-L10X)" on page 2-157

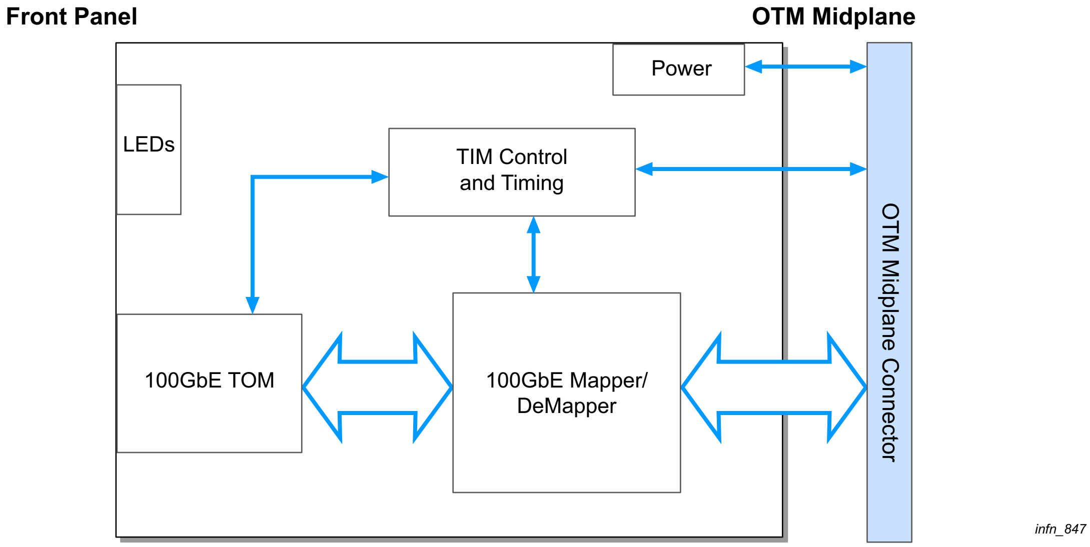
The TIM-1-100GE supports the following client interface:

- 100GbE

Note: Warm reset is not supported for TIM-1-100GE. Cold reset is supported for TIM-1-100GE.

Block Diagram

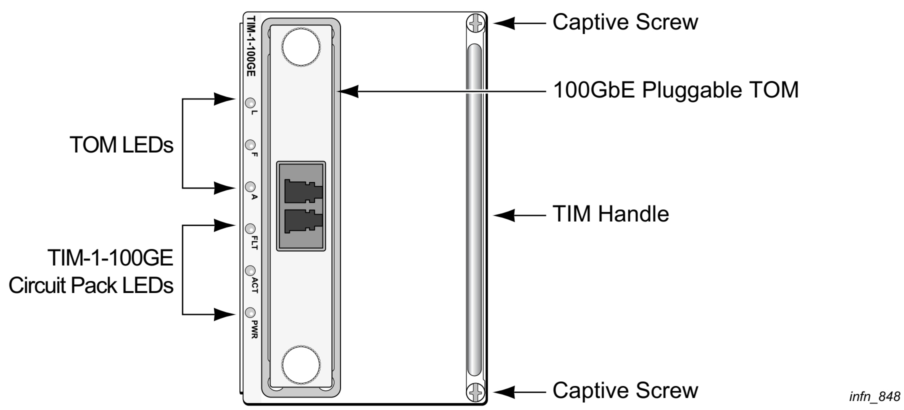
Figure 2-44 TIM-1-100GE Functional Block Diagram



External Indicators and Connectors

The TIM-1-100GE provides front panel LEDs for indicating module level status and port level status. A single sub-slot is available for a pluggable TOM-100G as shown in Figure 2-45.

Figure 2-45 TIM-1-100GE Faceplate



Circuit Pack Level LEDs

The TIM-1-100GE provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-106.

Table 2-106 TIM-1-100GE Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TIM-1-100GE. When the LED is on, the TIM is fully powered up and all the on-board voltages are within spec
ACT (Active)	Green / Yellow	Indicates the TIM-1-100GE status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TIM-1-100GE: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TIM status indicators, the TIM-1-100GE houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 2-107.

Table 2-107 TOM Status Indicators

LED	Color	Description
A (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
F (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
L (LOS)	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 2-108 provides the mechanical and electrical specifications for the TIM-1-100GE.

Table 2-108 TIM-1-100GE Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.66 inches / 92.96mm
	Width	2.24 inches / 56.90mm
	Depth	15.90 inches / 403.86mm
	Weight	5.0lb / 2.3kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Tributary Interface Specifications

Table 2-109 provides the tributary interface details for the TIM-1-100GE.

Table 2-109 TIM-1-100GE Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent
Capacity	Maximum capacity	100Gbps, max 1 TOM-100G-XXX per TIM-1-100GE

Tributary Interface Module 10GM (TIM-5-10GM)

Functional Description

The Tributary Interface Module 10GM, referred to as TIM-5-10GM, transports 8Gbps through 11Gbps client interfaces (see below) across the DTN-X network. The TIM-5-10GM is compliant with multiple standards (Telcordia GR-253-CORE, ITU-T G.693, and IEEE 802.3ae) and the optical transceiver supported utilizes the industry standard SFP+ form factor.

The TIM-5-10GM is a single-slot TIM type and can be arbitrarily equipped in any of the TIM sub-slots located on the OTM-500.

The TIM-5-10GM provides five sub-slots to enable the insertion of the following TOM type:

- “Tributary Optical Module 10G (TOM-10G-SFPP-SR1)” on page 2-160
- “Tributary Optical Module 10G (TOM-10G-SFPP-IR2)” on page 2-163
- “Tributary Optical Module 10G (TOM-10G-SFPP-LR2)” on page 2-166

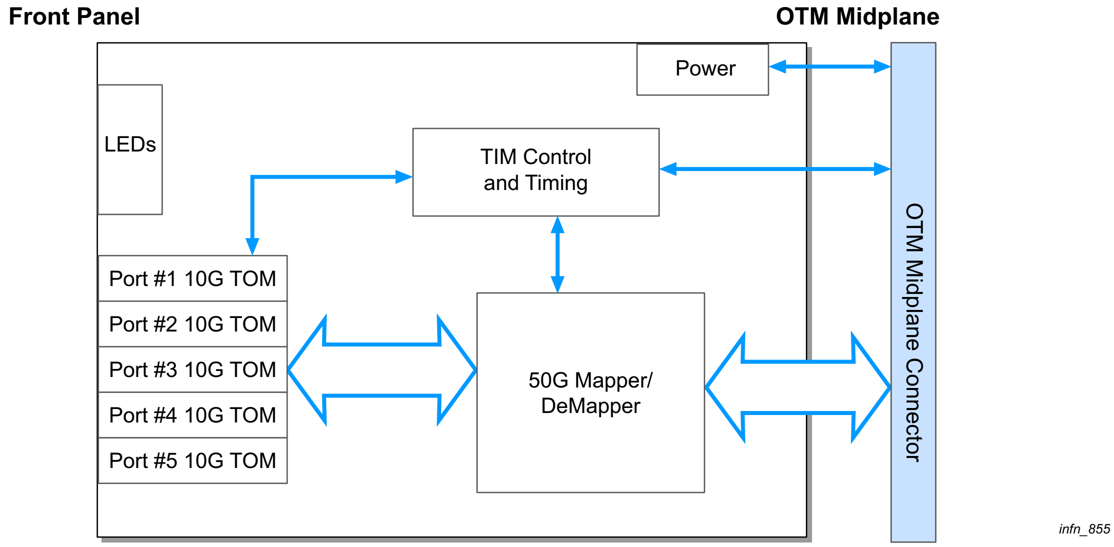
The TIM-5-10GM supports the following client interfaces:

- SONET OC-192
- SDH STM-64
- 10GbE LAN
- 10GbE WAN
- 10G Clear Channel
- 10.3G Clear Channel
- OTU2

Note: Warm reset is not supported for TIM-5-10GM. Cold reset is supported for TIM-5-10GM.

Block Diagram

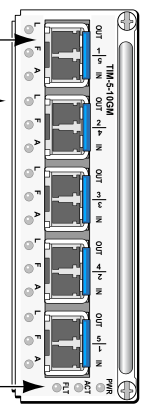
Figure 2-46 TIM-5-10GM Functional Block Diagram



External Indicators and Connectors

The TIM-5-10GM provides front panel LEDs for indicating module level status and port level status. Five sub-slots are available for pluggable TOM-10Gs as shown in Figure 2-47.

Figure 2-47 TIM-5-10GM Faceplate



Circuit Pack Level LEDs

The TIM-5-10GM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 2-110.

Table 2-110 TIM-5-10GM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TIM-5-10GM. When the LED is on, the TIM is fully powered up and all the on-board voltages are within spec
ACT (Active)	Green / Yellow	Indicates the TIM-5-10GM status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TIM-5-10GM: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TIM status indicators, the TIM-5-10GM houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 2-111.

Table 2-111 TOM Status Indicators

LED	Color	Description
A (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
F (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
L (LOS)	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 2-112 provides the mechanical and electrical specifications for the TIM-5-10GM.

Table 2-112 TIM-5-10GM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.61 inches / 91.69mm
	Width	1.12 inches / 28.45mm
	Depth	10.37 inches / 263.40mm
	Weight	2.8lb / 1.3kg (approximately)
Electrical specifications	Power consumption	See Table 2-1 on page 2-3

Tributary Interface Specifications

Table 2-113 provides the tributary interface details for the TIM-5-10GM.

Table 2-113 TIM-5-10GM Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-64	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	10GbE LAN PHY	Fully transparent; Ethernet PM and Remote Monitoring (RMON) support
	10GbE WAN PHY	Fully transparent; A1, A2, B1, and J0 monitoring, Section PM
	10G Clear Channel	Fully transparent
	10.3G Clear Channel	
	OTU2	ODU/OTU OH monitoring, OTU2 FEC terminated at ingress and regenerated at egress
Capacity	Maximum capacity	10Gbps, max 5 TOM-10G-XXX per TIM-5-10GM

Tributary Optical Module (TOM)

The TOM (shown in Figure 2-48 on page 2-146 and Figure 2-49 on page 2-147) is a field-replaceable, pluggable module that converts the client optical signals to and from a serial electrical signal. The TOM is hot-pluggable into the sub-slot in the corresponding TIM, and is powered through the pluggable interface.

Table 2-114 lists the name and a brief description of each of the supported TOMs.

Table 2-114 TOM Product Details

Product Ordering Name (PON)	Description
TOM-100G-SR10	Tributary Optical Module 100G Short Reach
TOM-100G-S10X	Tributary Optical Module 100G Short Reach
TOM-100G-LR4	Tributary Optical Module 100G Long Reach
TOM-100G-L10X	Tributary Optical Module 100G Long Reach
TOM-10G-SFPP-SR1	Tributary Optical Module 10G Short Reach
TOM-10G-SFPP-IR2	Tributary Optical Module 10G Intermediate Reach
TOM-10G-SFPP-LR2	Tributary Optical Module 10G Long Reach

Figure 2-48 100GbE Optical TOM

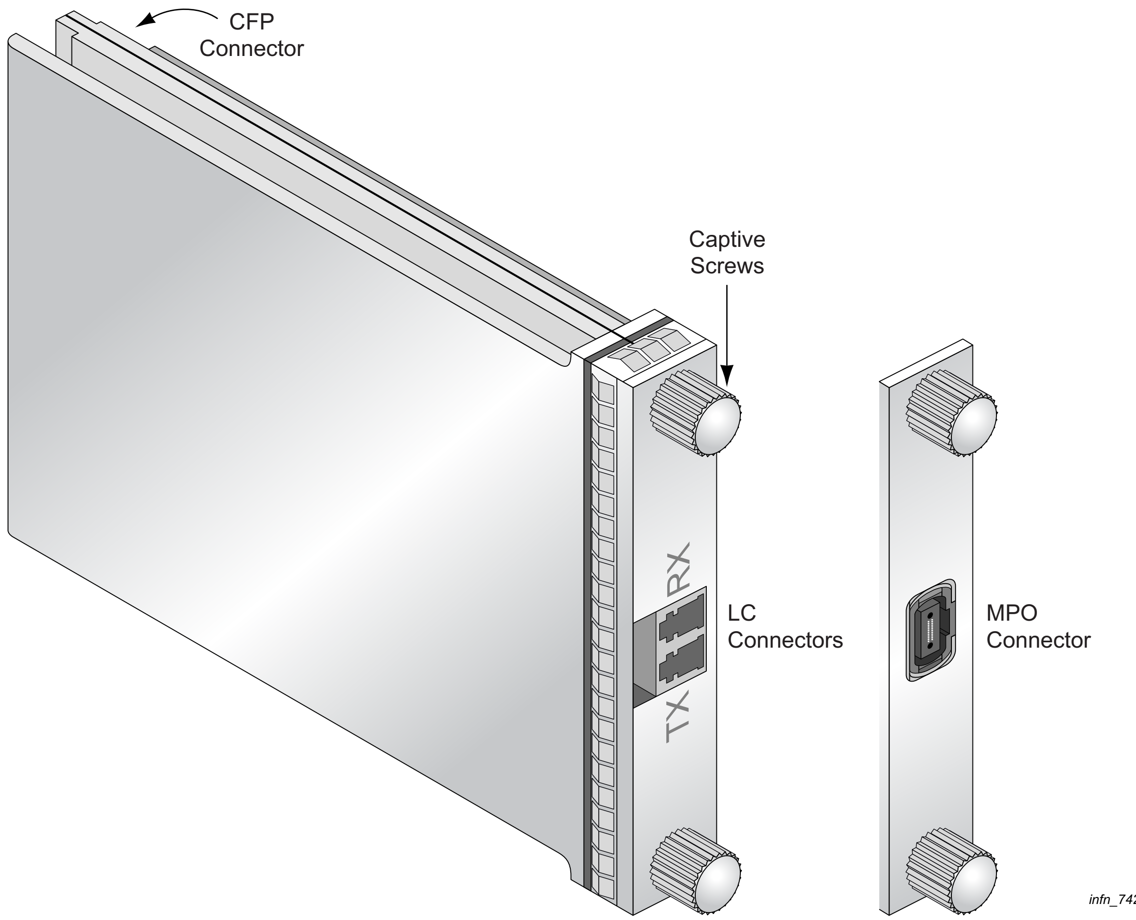
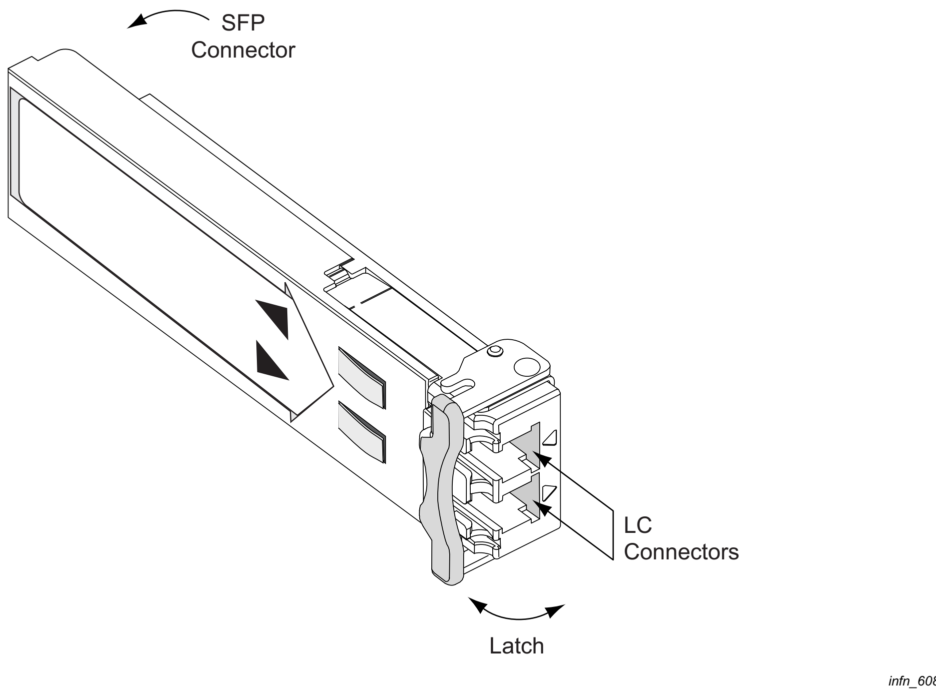


Figure 2-49 10G Optical TOM



Tributary Optical Module 100G (TOM-100G-SR10)

Table 2-115 TOM-100G-SR10 Product Features

Product Ordering Name (PON)	Features
TOM-100G-SR10	100G Tributary Optical Module Reach: • 100GbE: IEEE 802.3ba 100GBase-SR10

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-SR10, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-SR10s are hot-pluggable into the sub-slot in the TIM (TIM-1-100GE) and are powered through the pluggable interface.

The TOM-100G-SR10 supports 100GbE client signals and the optical interface complies with IEEE 802.3ba 100GBase-SR10.

TOM-100G-SR10 port status LEDs are located on the TIM as shown in Figure 2-45 on page 2-138.

Connectors

The TOM-100G-SR10 provides the optical interfaces to the client equipment through the ports as described in Table 2-116.

Table 2-116 TOM-100G-SR10 Connectors

Connector	Type	Purpose
Trib port IN	Single MTP®/MPO	Connects from the client equipment
Trib port OUT		Connects to the client equipment

Note: The TOM-100G-SR10 does not support a Y-cable protection configuration.

Technical Specifications

Table 2-117 lists the mechanical and electrical specifications for the TOM-100G-SR10.

Table 2-117 TOM-100G-SR10 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-118.

Table 2-118 TOM-100G-SR10 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Receiver sensitivity (OMA)	-5.4dBm
Receiver maximum power (per lane)	+2.4dBm
Receiver minimum power (per lane)	-9.5dBm
Receiver wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 2-119.

Table 2-119 TOM-100G-SR10 Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Transmitter output power (per lane)	-8.0dBm to +2.4dBm
Transmitter wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 2-120.

Table 2-120 TOM-100G-SR10 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-S10X)

Table 2-121 TOM-100G-S10X Product Features

Product Ordering Name (PON)	Features
TOM-100G-S10X	100G Tributary Optical Module Reach: • 100G CFP 10x10 MSA

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-S10X, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-S10Xs are hot-pluggable into the sub-slot in the TIM (TIM-1-100GE) and are powered through the pluggable interface.

The TOM-100G-S10X supports 100GbE client signals and the optical interface complies with 100G CFP 10x10 MSA.

TOM-100G-S10X port status LEDs are located on the TIM as shown in Figure 2-45 on page 2-138.

Connectors

The TOM-100G-S10X provides the optical interfaces to the client equipment through the ports as described in Table 2-122.

Table 2-122 TOM-100G-S10X Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-123 lists the mechanical and electrical specifications for the TOM-100G-S10X.

Table 2-123 TOM-100G-S10X Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-124.

Table 2-124 TOM-100G-S10X Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-6.3dBm
Receiver maximum power (per lane)	+3.0dBm
Receiver minimum power (per lane)	-9.5dBm
Receiver wavelength	1550nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 2-125.

Table 2-125 TOM-100G-S10X Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Transmitter output power (total)	+4.9dBm to +13.0dBm
Receiver lane center wavelengths (L1, L2, L3, L4, L5, L6, L7, L8, L9, and L10)	L1: 1521nm to 1525nm
	L2: 1529nm to 1533nm
	L3: 1537nm to 1541nm
	L4: 1545nm to 1549nm
	L5: 1553nm to 1557nm
	L6: 1561nm to 1565nm
	L7: 1569nm to 1573nm
	L8: 1577nm to 1581nm
	L9: 1585nm to 1589nm
	L10: 1593nm to 1597nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 2-126.

Table 2-126 TOM-100G-S10X Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-LR4)

Table 2-127 TOM-100G-LR4 Product Features

Product Ordering Name (PON)	Features
TOM-100G-LR4	100G Tributary Optical Module Reach: • 100GbE: IEEE 802.3ba 100GBase-LR4

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-LR4, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-LR4s are hot-pluggable into the sub-slot in the TIM (TIM-1-100GE) and are powered through the pluggable interface.

The TOM-100G-LR4 supports 100GbE client signals and the optical interface complies with IEEE 802.3ba 100GBase-LR4.

TOM-100G-LR4 port status LEDs are located on the TIM as shown in Figure 2-45 on page 2-138.

Connectors

The TOM-100G-LR4 provides the optical interfaces to the client equipment through the ports as described in Table 2-128.

Table 2-128 TOM-100G-LR4 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-129 lists the mechanical and electrical specifications for the TOM-100G-LR4.

Table 2-129 TOM-100G-LR4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-130.

Table 2-130 TOM-100G-LR4 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-8.6dBm
Receiver maximum power (per lane)	+4.5dBm
Receiver minimum power (per lane)	-10.6dBm
Receiver wavelength	1310nm
Data rate (per lane)	25.78125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 2-131.

Table 2-131 TOM-100G-LR4 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power (total)	+2.3dBm to +10.5dBm
Transmitter wavelength	1310nm
Transmitter lane center wavelengths (L1, L2, L3, and L4)	L1: 1294.53nm to 1296.59nm
	L2: 1299.02nm to 1301.09nm
	L3: 1303.54nm to 1305.63nm
	L4: 1308.09nm to 1310.19nm
Data rate (per lane)	25.78125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 2-132.

Table 2-132 TOM-100G-LR4 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-L10X)

Table 2-133 TOM-100G-L10X Product Features

Product Ordering Name (PON)	Features
TOM-100G-L10X	100G Tributary Optical Module Reach: • 100G CFP 10x10 MSA

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-L10X, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-L10Xs are hot-pluggable into the sub-slot in the TIM (TIM-1-100GE) and are powered through the pluggable interface.

The TOM-100G-L10X supports 100GbE client signals and the optical interface complies with 100G CFP 10x10 MSA.

TOM-100G-L10X port status LEDs are located on the TIM as shown in Figure 2-45 on page 2-138.

Connectors

The TOM-100G-L10X provides the optical interfaces to the client equipment through the ports as described in Table 2-134.

Table 2-134 TOM-100G-L10X Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-135 lists the mechanical and electrical specifications for the TOM-100G-L10X.

Table 2-135 TOM-100G-L10X Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-136.

Table 2-136 TOM-100G-L10X Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-6.9dBm
Receiver maximum power (per lane)	+3.0dBm
Receiver minimum power (per lane)	-10.8dBm
Receiver wavelength	1550nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 2-137.

Table 2-137 TOM-100G-L10X Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Transmitter output power (total)	+5.8dBm to +13.0dBm
Transmitter lane center wavelengths (L1, L2, L3, L4, L5, L6, L7, L8, L9, and L10)	L1: 1520nm to 1526nm
	L2: 1528nm to 1534nm
	L3: 1536nm to 1542nm
	L4: 1544nm to 1550nm
	L5: 1552nm to 1558nm
	L6: 1560nm to 1566nm
	L7: 1568nm to 1574nm
	L8: 1576nm to 1582nm
	L9: 1584nm to 1590nm
	L10: 1592nm to 1598nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 2-138.

Table 2-138 TOM-100G-L10X Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 10G (TOM-10G-SFPP-SR1)

Table 2-139 TOM-10G-SFPP-SR1 Product Features

Product Ordering Name (PON)	Features
TOM-10G-SFPP-SR1	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 SR-1 • ITU-T G.693 VSR2000-2R1 • 10GbE LAN: IEEE 802.3ae 10GBase-LR • 10GbE WAN: IEEE 802.3ae 10GBase-LW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-SFPP-SR1, is a field-replaceable 10G Small Form Factor Pluggable (SFP+) module. It converts client optical signals to and from serial electrical signals. TOM-10G-SFPP-SR1s are hot-pluggable into any of the five sub-slots in the TIM (TIM-5-10GM) and are powered through the pluggable interface.

TOM-10G-SFPP-SR1 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, and/or OTU2 client signals.

The optical interface complies with Telcordia GR-253-CORE OC-192 SR-1 for the OC-192 client signal, ITU-T G.693 VSR2000-2R1 for the STM-64 client signal, IEEE 802.3ae 10GBase-LR for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-LW for the 10GbE WAN client signal.

TOM-10G-SFPP-SR1 port status LEDs are located on the TIM as shown in Figure 2-47 on page 2-142.

Connectors

The TOM-10G-SFPP-SR1 provides the optical interfaces to the client equipment through the ports as shown in Table 2-140.

Table 2-140 TOM-10G-SFPP-SR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-141 lists the mechanical and electrical specifications for the TOM-10G-SFPP-SR1.

Table 2-141 TOM-10G-SFPP-SR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.55 inches / 13.97mm
	Width	0.34 inches / 8.64mm
	Depth	2.22 inches / 56.39mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-142.

Table 2-142 TOM-10G-SFPP-SR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-11.0dBm
Receiver overload	-1.0dBm
Receiver wavelength	1260nm to 1600nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 2-143.

Table 2-143 TOM-10G-SFPP-SR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-6.0dBm to -1.0dBm
Transmitter wavelength	1290nm to 1330nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 2-144.

Table 2-144 TOM-10G-SFPP-SR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	OTU2	

Tributary Optical Module 10G (TOM-10G-SFPP-IR2)

Table 2-145 TOM-10G-SFPP-IR2 Product Features

Product Ordering Name (PON)	Features
TOM-10G-SFPP-IR2	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 IR-2 • ITU-T G.959.1 P1S1-2D2b • 10GbE LAN: IEEE 802.3ae 10GBase-ER • 10GbE WAN: IEEE 802.3ae 10GBase-EW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-SFPP-IR2, is a field-replaceable 10G Small Form Factor Pluggable (SFP+) module. It converts client optical signals to and from serial electrical signals. TOM-10G-SFPP-IR2s are hot-pluggable into any of the five sub-slots in the TIM (TIM-5-10GM) and are powered through the pluggable interface.

TOM-10G-SFPP-IR2 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, and/or OTU2 client signals.

The optical interface complies with Telcordia GR-253-CORE OC-192 IR-2 for the OC-192 client signal, ITU-T G.959 P1S1-2D2b for the STM-64 client signal, IEEE 802.3ae 10GBase-ER for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-EW for the 10GbE WAN client signal.

TOM-10G-SFPP-IR2 port status LEDs are located on the TIM as shown in Figure 2-47 on page 2-142.

Connectors

The TOM-10G-SFPP-IR2 provides the optical interfaces to the client equipment through the ports as shown in Table 2-146.

Table 2-146 TOM-10G-SFPP-IR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-147 lists the mechanical and electrical specifications for the TOM-10G-SFPP-IR2.

Table 2-147 TOM-10G-SFPP-IR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.55 inches / 13.97mm
	Width	0.34 inches / 8.64mm
	Depth	2.22 inches / 56.39mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-148.

Table 2-148 TOM-10G-SFPP-IR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-14.0dBm
Receiver overload	-1.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 2-149.

Table 2-149 TOM-10G-SFPP-IR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-1.0dBm to +2.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 2-150.

Table 2-150 TOM-10G-SFPP-IR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	OTU2	

Tributary Optical Module 10G (TOM-10G-SFPP-LR2)

Table 2-151 TOM-10G-SFPP-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-10G-SFPP-LR2	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 LR-2 • ITU-T G.959.1 P1L1-2D2 • 10GbE LAN: IEEE 802.3ae 10GBase-ER • 10GbE WAN: IEEE 802.3ae 10GBase-EW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-SFPP-LR2, is a field-replaceable 10G Small Form Factor Pluggable (SFP+) module. It converts client optical signals to and from serial electrical signals. TOM-10G-SFPP-LR2s are hot-pluggable into any of the five sub-slots in the TIM (TIM-5-10GM) and are powered through the pluggable interface.

TOM-10G-SFPP-LR2 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, and/or OTU2 client signals.

The optical interface complies with Telcordia GR-253-CORE OC-192 LR-2 for the OC-192 client signal, ITU-T G.959 P1L1-2D2 for the STM-64 client signal, IEEE 802.3ae 10GBase-ER for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-EW for the 10GbE WAN client signal.

TOM-10G-SFPP-LR2 port status LEDs are located on the TIM as shown in Figure 2-47 on page 2-142.

Connectors

The TOM-10G-SFPP-LR2 provides the optical interfaces to the client equipment through the ports as shown in Table 2-152.

Table 2-152 TOM-10G-SFPP-LR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 2-153 lists the mechanical and electrical specifications for the TOM-10G-SFPP-LR2.

Table 2-153 TOM-10G-SFPP-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.55 inches / 13.97mm
	Width	0.34 inches / 8.64mm
	Depth	2.22 inches / 56.39mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TIM; see Table 2-1 on page 2-3

Optical Specifications

The optical specifications for tributary port IN are listed in Table 2-154.

Table 2-154 TOM-10G-SFPP-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-24.0dBm
Receiver overload	-7.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 2-155.

Table 2-155 TOM-10G-SFPP-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	0.0dBm to +4.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 2-156.

Table 2-156 TOM-10G-SFPP-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	OTU2	

Blank Circuit Packs

Whenever a circuit pack is removed, the blank space must be occupied by the corresponding blank circuit pack. Blank circuit packs serve three important functions:

- Prevents exposure to hazardous voltage and currents inside the chassis
- Contains any electromagnetic interference (EMI) that might affect other equipment
- Directs the flow of cooling air through the chassis

Table 2-157 lists the corresponding blank circuit packs.

Table 2-157 XTC Blank Circuit Packs

Product Ordering Name (PON)	Description
X-XCM-BLANK	DTN-X Control Module (XCM) slot blank used on XTC-10 and/or XTC-4
X-TSM-BLANK-X10	Timing Synchronization Module (TSM) slot blank used on XTC-10
X-TSM-BLANK-X4	TSM slot blank used on XTC-4
X-OXM-BLANK-X10	OTN Switch Module (OXM) slot blank used on XTC-10
X-OXM-BLANK-X4	OXM slot blank used on XTC-4
X-UNIV-BLANK	Universal (UNIV) card cage slot blank used on XTC-10 and/or XTC-4
X-TIMA-BLANK	Tributary Interface Module (TIM) single-slot blank used on OTM-500

CHAPTER 3

Infinera DTN

The Infinera DTN, referred to as the DTN, is a network element deployed in a Digital Optical Network. The DTN provides digital bandwidth management and client access to the Dense Wavelength Division Multiplexing (DWDM) transport bandwidth.

The DTN consists of one or more Digital Transport Chassis (DTC), MTC, Optical Transport Chassis (OTC), and optionally one or more Dispersion Management Chassis (DMC) for dispersion compensation. Refer to “Infinera Optical Line Amplifier” on page 4-1 for more details on the OTC and refer to “Infinera Dispersion Management Chassis” on page 5-1 for more details on DMC.

This chapter provides a hardware description for the DTN including a functional description of the hardware, block diagram of the internal signal flow (where applicable), and technical specifications. This chapter includes the following sections:

For DTN installation procedures, refer to the *Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide.* For DTN turn-up and test procedures, refer to the *Infinera DTN and DTN-X Turn-up and Test Guide.*

For a description of module Light Emitting Diode (LED) status indicators, refer to the *Infinera GNM Fault Management and Diagnostics Guide*.

DTC/MTC System Specifications

This section contains system specifications for the DTC and MTC and includes the following:

- "DTC/MTC Power Consumption and Configuration Rules" on page 3-4
- "DTC/MTC Compliancy" on page 3-8
- "DTC/MTC Technical Specifications" on page 3-9

DTC/MTC Power Consumption and Configuration Rules

Power consumption numbers for the DTC and MTC are presented as two values:

- Typical Power Draw—characterizes average power usage under normal operating system conditions and can be used for estimating average power consumption over time (ongoing operational cost for power consumption)
- Maximum Power Draw—is worst-case power draw under severe equipment, environmental, and network conditions

Table 3-1 provides typical and maximum power draw numbers for supported DTC/MTC system components.

Table 3-1 DTC/MTC Power Consumption Numbers

Configuration	Typical Power Draw (Watts)	Maximum Power Draw at 40º C (Watts)	Maximum Power Draw at 55º C (Watts)
Base DTC (1 MCM, 2 PEM-70s, IOP, TAP, and 2 fan trays)	160	440	767
Base MTC (1 MCM, 2 PEM-70s, IOP, TAP, and 2 fan trays)	290	500	745
Base DTC (1 MCM, 2 PEM-35s, IOP, TAP, and 2 fan trays)	160	440	767
Base MTC (1 MCM, 2 PEM-35s, IOP, TAP, and 2 fan trays)	290	500	745
MCM (both MCMs in chassis)	22	26	28
BMM-4/BMM-8 (all types)	28	44	44
BMM1H	32	51	51
BMM2	65	85	85
BMM2P	45	65	85
BMM2E (expansion BMM2)	52	68	68
BMM2PE (expansion BMM2P)	45	65	85
BMM2H	57	74	74
BMM2HE (expansion BMM2H)	42	55	55
CMM	26	30	48
DLM (C1 and C2 types)	150	227	246

Table 3-1 DTC/MTC Power Consumption Numbers

Configuration	Typical Power Draw (Watts)	Maximum Power Draw at 40º C (Watts)	Maximum Power Draw at 55º C (Watts)
XLM and/or DLM (C3 type)	160	232	258
ADLM, AXLM, and/or SLM	160	232	258
ADLM-80, AXLM-80, and/or SLM-80	260	260	260
TEM	35	50	50
GAM-1	7	11	11
GAM-2	4	6	8
TAM-1-100GE/TAM-1-100GR with LR4 TOM type	112	121	124
TAM-1-100GE/TAM-1-100GR with L10X, SR10, or S10X TOM types	108	117	122
TAM-1-40GE/TAM-1-40GR with SR4 TOM type	48	52	54
TAM-1-40GE/TAM-1-40GR with LR4 TOM type	50	54	58
TAM-1-40G with integrated TOM-40G-VSR TOM type	79	90	90
TAM-2-10G with SR0 or SR1 TOM types	26	29	29
TAM-2-10G with IR2, LR2, or DWDM TOM types	28	31	31
TAM-2-10GR with SR0 or SR1 TOM types	28	35	35
TAM-2-10GR with IR2, LR2 or DWDM TOM types	29	37	37
TAM-2-10GT with SR0 or SR1 TOM types	28	40	40
TAM-2-10GT with IR2, LR2, or DWDM TOM types	28	42	42
TAM-2-10GM with any supported TOM type	39	41	42
TAM-4-2.5G with any supported TOM type	38	42	42
TAM-8-2.5GM with any supported TOM type	56	61	65
TAM-8-1G with any supported TOM type	38	41	41

Note: Unless specifically noted otherwise, all references to the PEM will refer to either the PEM-70 and/or PEM-35 interchangeably.

Note: Unless specifically noted otherwise, all references to the MCM will refer to either the MCM-B and/or MCM-C interchangeably.

Maximum Power Draw

The DTC/MTC requires two 70A or two 35A feeds and these feeds provide power to the system through the PEMs (using either 70A or 35A PEM types). In some instances, it may be possible to configure the system in such a way that the maximum amperage draw could exceed 70A or 35A for the DTC/MTC.

The user can configure the system software to calculate per-chassis worst-case power draw based on shelf configuration, and escalate a standing condition for a DTC/MTC when this configuration is exceeded. The power draw limit is compared against the total estimated power draw for all of the equipment provisioned (and pre-provisioned) in the chassis.

The chassis raises an alarm if the sum of the power values for the provisioned/pre-provisioned equipment in the chassis exceeds the user configured maximum power draw value. This raised alarm does not indicate actual power draw, but indicates that the system is configured in such a way that should all environmental, network and system conditions be worst-case—that this is the potential total maximum power draw of the system under those conditions.

Inrush Current

Inrush current refers to the maximum, instantaneous current drawn by the DTC/MTC at initial system power up (or by a module inserted into a DTC/MTC already powered up). The inrush current for the DTC/MTC will not exceed the worst-case power consumption current for the particular shelf configuration (or module) within the appropriate ambient selected (normal or short-term operation). For example:

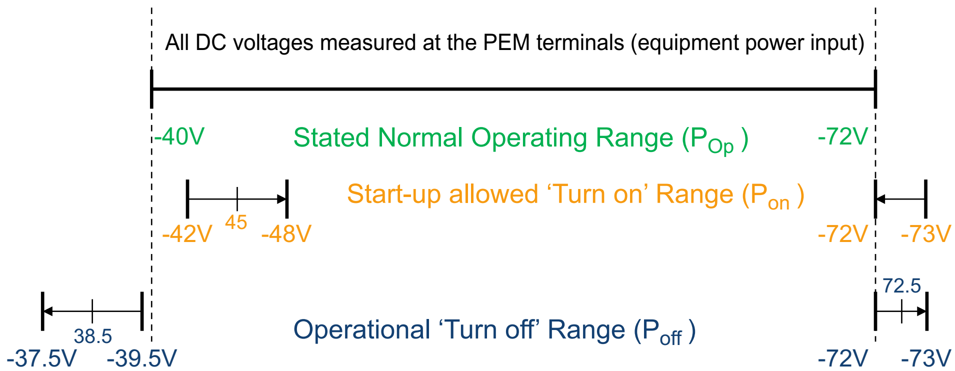
- For environments under 40º C (normal operation), the inrush current will not exceed that for the 40º C worst-case power consumption
- For environments under 55º C (short-term operation), the inrush current will not exceed that for the 55º C worst-case power consumption

Input Voltage Operating Range and Thresholds

The DTC/MTC DC input voltage operating range and thresholds are shown in Figure 3-1 on page 3-7. Each module (except for TAMs and GAMs) implements the voltage thresholds independently and may turn on/off at different voltages within the specified range. The thresholds comply with the ATT-TP-76200 standard.

The thresholds shown in Figure 3-1 on page 3-7 do not apply to fan trays which operate over a wider voltage range.

Figure 3-1 Input Voltage Operating Range and Thresholds



- P_{Op} — Normal operating range. Installed modules remain operational across this complete range (and must operate down to -39.5V per P_{off}).
- P_{on} — Start-up condition. Indicates the lowest/highest voltage where the module will turn on: at < -42V or > -73V the module does *not* turn on. Between -48V and -72V the module must turn on.
- P_{off} — From operational state. Indicates the lowest/highest voltage where the module must turn off: at < -37.5V or > -73V the module must turn off (AT&T test condition assumes >10 seconds at low-end).

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DTC/MTC Compliancy

The DTC/MTC complies with many industry standard specifications as described in Table 3-2.

Table 3-2 DTC/MTC Hardware Compliancy

Category	Approval Agency / Requirement
Safety Certifications	• IEC/EN/UL 60950: Safety of Information Technology Equipment • CAN/CSA C22.2 No. 60950: Safety of Information Technology Equipment • AS/NZS 60950: Approval & Test specification - Safety of Information Technology Equipment • UL Class II: Fire Safety (air filters)

NEBS/ETSI Compliancy	• NEBS Level 1/3
	  • GR-63-CORE: Network Equipment Building Systems - Physical Protection
	  • GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety - Generic requirement for Network Telecommunications Equipment
	• ETS 300 386
	• ETS 300 019-2-1, 2, 3, and 4 A1 (earthquake test methods)
	• ETS 300 753

EMC Emissions	• CISPR 22/EN55022 Class A, FCC-A, VCCI-A
EMC Immunity	• CISPR 24/EN55024

Laser Safety	• IEC/EN 60825 Series: Safety of Laser Products
	  • IEC/EN 60825-1: 2007
	  • IEC/EN 60825-2: 2004+A1
	• FDA 21 CFR 1040: Performance Standard of Light Emitting Products

General Compliancy	• ETSI ETS 300 119-2 • ETSI ETS 300 119-4 • GR-78-CORE • GR-253-CORE • GR-1209-CORE • GR-1221-CORE • ANSI T1.315 • ANSI T1.304 • ATT-TP-76200

DTC/MTC Technical Specifications

Table 3-3 provides electrical and environmental specifications for the DTC/MTC, common components, and all supported circuit packs.

Table 3-3 DTC/MTC Technical Specifications

Type	Parameter	Specification
Electrical specifications	Power consumption	• Typical (DTC with PEM-70): 1618W (approximately) • Typical (MTC with PEM-70): 1770W (approximately) • Maximum (DTC/MTC with PEM-70): 2800W
		• Typical (DTC with PEM-35): 500W (approximately) • Typical (MTC with PEM-35): 600W (approximately) • Maximum (DTC/MTC with PEM-35): 1400W **Note**: A typical DTC/MTC configuration with PEM-35s assumes that 2 BMMs and 4 CMMs are installed in the chassis
		Refer to Table 3-1 on page 3-4 for module level power consumption numbers
	Input voltage range	-40V DC to -72V DC (Worldwide except for Australia/New Zealand) IEC/EN/UL/CSA 60950 See Figure 3-1 on page 3-7 for detailed information regarding the input voltage operating range and thresholds
		-40V DC to -60V DC (Australia/New Zealand only) ANZ60950-1
Environmental specifications	Operating temperature range	Normal operation (including system power up): 5º C to 40º C Short term operation: -5º C to 55º C
	Storage temperature range	-40º C to 70º C
	High relative humidity	90% non-condensing

DTC Overview

Note: Full-height BMM/BMM2/BMM2Ps are the only BMM types supported on the DTC.

Note: Unless specifically noted otherwise, all references to the "line module" will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the "LM-80" will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The Digital Transport Chassis (DTC) is a 23-inch chassis option for the DTN. The DTC can be deployed as a Main Chassis, or as an Expansion Chassis in a multi-chassis configuration.

Table 3-4 provides a list of the common components that make up a DTC (some components are field-replaceable).

Table 3-5 on page 3-11 provides a list of the supported circuit packs on a DTC (circuit packs are field-replaceable).

Chassis Type Identification

The DTC is available as an ANSI or ETSI chassis type and can be identified as follows:

- A product label located on the right side of the chassis identifies the chassis type as ANSI or ETSI
- The jumper termination value used for ITU Building Integrated Timing Supply (BITS) is set to 100 Ohms for ANSI or 120 Ohms for ETSI. This value is preset at the factory and not field-upgradeable
- An internal serial EEPROM setting identifies the chassis type as ANSI or ETSI

Table 3-4 DTC Common Components

Name	Description
Air Plenums	See page 3-18
Rack Mounting Ears	See page 3-19
Power Entry Module (PEM)	See page 3-21
Input/Output (I/O) Panel	See page 3-25
Timing and Alarm Panel (TAP)	See page 3-29
Fan Tray	See page 3-37
Air Filter	See page 3-38
Card Cage	See page 3-39

Table 3-5 DTC Supported Circuit Packs

Name	Description
Management Control Module (MCM)	See page 3-80
Band Multiplexing Module (BMM)	See page 3-86
Channel Multiplexing Module (CMM)	See page 3-141
Digital Line Module (DLM)	See page 3-150
Switching Line Module (XLM)	See page 3-158
TAM Extender Module (TEM)	See page 3-165
Gain Adapter Module (GAM)	See page 3-170
Amplified Digital Line Module (ADLM)	See page 3-178
Amplified Switching Line Module (AXLM)	See page 3-186
Submarine Line Module (SLM)	See page 3-195
Amplified Digital Line Module (ADLM-80)	See page 3-202
Amplified Switching Line Module (AXLM-80)	See page 3-209
Submarine Line Module (SLM-80)	See page 3-216
Tributary Adapter Module 100GE (TAM-1-100GE)	See page 3-225
Tributary Adapter Module 100GR (TAM-1-100GR)	See page 3-230
Tributary Adapter Module 40GE (TAM-1-40GE)	See page 3-235
Tributary Adapter Module 40GR (TAM-1-40GR)	See page 3-240
Tributary Adapter Module 40G (TAM-1-40G-VSR)	See page 3-245
Tributary Adapter Module 10G (TAM-2-10G)	See page 3-250
Tributary Adapter Module 10GR (TAM-2-10GR)	See page 3-255
Tributary Adapter Module 10GT (TAM-2-10GT)	See page 3-260
Tributary Adapter Module 10GM (TAM-2-10GM)	See page 3-264
Tributary Adapter Module 2.5G (TAM-4-2.5G)	See page 3-269
Tributary Adapter Module 2.5GM (TAM-8-2.5G)	See page 3-274
Tributary Adapter Module 1G (TAM-8-1G)	See page 3-280
Tributary Optical Module 100G (TOM-100G-SR10)	See page 3-289
Tributary Optical Module 100G (TOM-100G-S10X)	See page 3-292
Tributary Optical Module 100G (TOM-100G-LR4)	See page 3-295
Tributary Optical Module 100G (TOM-100G-L10X)	See page 3-298
Tributary Optical Module 40G (TOM-40G-SR4)	See page 3-301
Tributary Optical Module 40G (TOM-40G-LR4)	See page 3-304
Tributary Optical Module 40G (TOM-40G-VSR)	See page 3-307
Tributary Optical Module 10G (TOM-10G-SR0)	See page 3-309

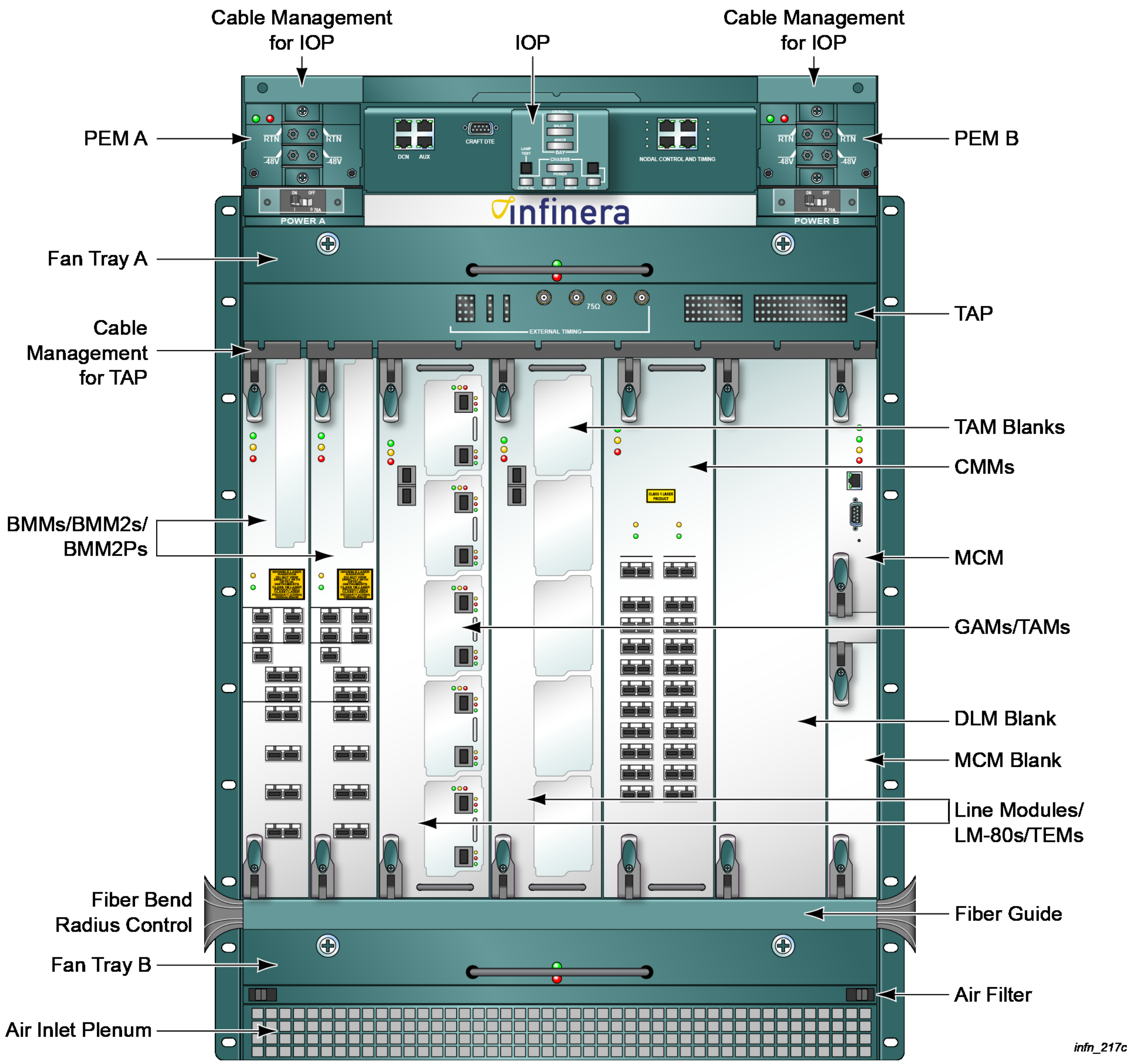
Table 3-5 DTC Supported Circuit Packs

Name	Description
Tributary Optical Module 10G (TOM-10G-SR1)	See page 3-312
Tributary Optical Module 10G (TOM-10G-IR2)	See page 3-315
Tributary Optical Module 10G (TOM-10G-LR2)	See page 3-318
Tributary Optical Module 10G (TOM-10G-Dn-LR2)	See page 3-321
Tributary Optical Module 8G (TOM-8G-SM-LC-L)	See page 3-326
Tributary Optical Module 2.5G (TOM-2.5G-SR1)	See page 3-329
Tributary Optical Module 2.5G (TOM-2.5G-IR1)	See page 3-332
Tributary Optical Module 2.5G (TOM-2.5G-IR2)	See page 3-335
Tributary Optical Module 2.5G (TOM-2.5G-LR2)	See page 3-339
Tributary Optical Module 2.5G (TOM-2.5GCn-LR2)	See page 3-343
Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)	See page 3-347
Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)	See page 3-351
Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)	See page 3-355
Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)	See page 3-359
Tributary Optical Module 1G (TOM-1G-SX)	See page 3-359
Tributary Optical Module 1G (TOM-1G-LX)	See page 3-366
Tributary Optical Module 1G (TOM-1G-ZX)	See page 3-369
Tributary Optical Module HD-SDI (TOM-1.485HD-RX)	See page 3-372
Tributary Optical Module HD-SDI (TOM-1.485HD-TX)	See page 3-375
Tributary Optical Module HD-SDI (TOM-1.4835HD-RX)	See page 3-378
Tributary Optical Module HD-SDI (TOM-1.4835HD-TX)	See page 3-381
Blank Circuit Packs	See page 3-384

Front View

A front view of the DTC, with components and circuit packs, is shown in Figure 3-2.

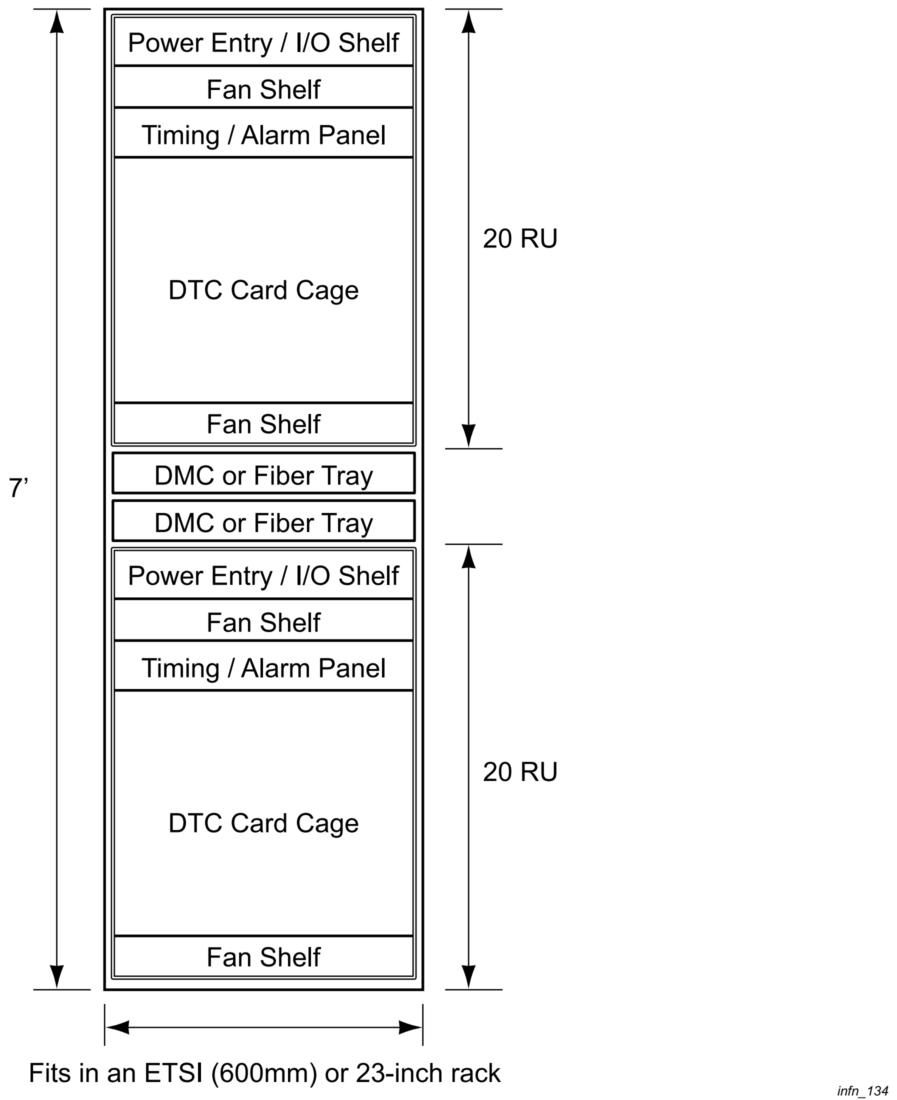
Figure 3-2 DTC Front View



Note: The DTC-A and the DTC-B chassis look very similar. The two chassis can be differentiated by looking on the fiber tray: the DTC-B has a label to identify the chassis as a DTC-B, whereas there is no label on the DTC-A. In addition, there is a product label on the right side of the chassis that includes the Product Ordering Name (PON) of the chassis.

A single bay can accommodate two DTCs, and if needed, fiber management tray or DMC. Up to two DTNs, each with a single DTC, can be accommodated in a bay as shown in Figure 3-3.

Figure 3-3 Two DTCs on a Rack



DTC Thermal Loading

Table 3-6 provides typical heat release information for the DTC housed in a 23-inch frame.

Table 3-6 DTC Typical Heat Release

DTC Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	1618								
Frame Depth (feet)	1.50								
Frame Width (feet)	2.17								
Equipment Height (feet)	2.92								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	102.3	93.0	85.2	78.7	73.1	68.2	63.9	60.2	56.8
1.5	93.0	85.2	78.7	73.1	68.2	63.9	60.2	56.8	53.8
2.0	85.2	78.7	73.1	68.2	63.9	60.2	56.8	53.8	51.1
2.5	78.7	73.1	68.2	63.9	60.2	56.8	53.8	51.1	48.7
3.0	73.1	68.2	63.9	60.2	56.8	53.8	51.1	48.7	46.5
3.5	68.2	63.9	60.2	56.8	53.8	51.1	48.7	46.5	44.5
4.0	63.9	60.2	56.8	53.8	51.1	48.7	46.5	44.5	42.6
4.5	60.2	56.8	53.8	51.1	48.7	46.5	44.5	42.6	40.9
5.0	56.8	53.8	51.1	48.7	46.5	44.5	42.6	40.9	39.3

In lieu of increasing the typical aisle width, an additional vertical empty space (either above or below the EUT) may be implemented as follows:

Equipment Type	**Equipment Vertical Space (feet)**	**Reference**
Forced-air Fans Frame Depth =18 inches	2.432	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-3)
Forced-air Fans Frame Depth = 24 inches	2.4324	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-6)

Table 3-7 provides maximum heat release information for the DTC housed in a 23-inch frame.

Table 3-7 DTC Maximum Heat Release

DTC Maximum Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	2800								
Frame Depth (feet)	1.50								
Frame Width (feet)	2.17								
Equipment Height (feet)	2.91								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	181.0	164.6	150.9	139.3	129.3	120.7	113.1	106.5	100.6
1.5	164.6	150.9	139.3	129.3	120.7	113.1	106.5	100.6	95.3
2.0	150.9	139.3	129.3	120.7	113.1	106.5	100.6	95.3	90.5
2.5	139.3	129.3	120.7	113.1	106.5	100.6	95.3	90.5	86.2
3.0	129.3	120.7	113.1	106.5	100.6	95.3	90.5	86.2	82.3
3.5	120.7	113.1	106.5	100.6	95.3	90.5	86.2	82.3	78.7
4.0	113.1	106.5	100.6	95.3	90.5	86.2	82.3	78.7	75.4
4.5	106.5	100.6	95.3	90.5	86.2	82.3	78.7	75.4	72.4
5.0	100.6	95.3	90.5	86.2	82.3	78.7	75.4	72.4	69.6

In lieu of increasing the typical aisle width, an additional vertical empty space (either above or below the EUT) may be implemented as follows:

Equipment Type	**Equipment Vertical Space (feet)**	**Reference**
Forced-air Fans Frame Depth =18 inches	2.432	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-3)
Forced-air Fans Frame Depth = 24 inches	2.4324	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-6)

DTC Product Details

Table 3-8 lists the name and a brief description of each of the supported DTCs.

Table 3-8 DTC Product Details

Product Ordering Name (PON)	Description
DTC-ANSI-A[a]	Digital Transport Chassis ANSI
DTC-ETSI-A[a]	Digital Transport Chassis ETSI
DTC-ANSI-B	Digital Transport Chassis Mesh Backplane ANSI
DTC-ETSI-B	Digital Transport Chassis Mesh Backplane ETSI

a. DTC-A is generally no longer available but is still supported.

Functional Description

The DTC supports the following functions:

- The DTC can be deployed as a Main Chassis or an Expansion Chassis within a DTN
  - A DTN can support up to 40 interconnected chassis (28 DTC/MTCs and 12 OTCs) if the Main Chassis includes an MCM-C as the node controller. The Main Chassis must be a DTC or an MTC. The DTN can be configured with up to 8 BMMs, up to 96 line module/TEMs (with optional control module redundancy on any chassis). Each OTC Expansion Chassis can house up to 2 Raman modules or 2 DSEs (with optional control module redundancy on any chassis). Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis)
  - A DTN can support up to 17 interconnected chassis (DTC/MTC/OTCs) if the Main Chassis includes an MCM-B as the node controller. The Main Chassis must be a DTC or an MTC; the 16 Expansion Chassis can be any combination of DTC/MTC/OTCs. The DTN can be configured with up to 8 BMMs, up to 32 line module/TEMs (with optional control module redundancy on any chassis). Each OTC Expansion Chassis can house up to 2 Raman modules or 2 DSEs (with optional control module redundancy on any chassis). Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis)
- The DTC is used in Digital Terminal, Digital Add/Drop, and Digital Repeater configurations
- The DTC can be installed in an ETSI (600mm) or 23-inch rack

The DTC is composed of the following components (see Figure 3-2 on page 3-13 for an illustration):

- "Air Plenums" on page 3-18
- "Rack Mounting Ears" on page 3-19
- "Power Entry Module (PEM)" on page 3-21

- "Input/Output (I/O) Panel" on page 3-25
- "Timing and Alarm Panel (TAP)" on page 3-29
- "Fan Tray" on page 3-37
- "Air Filter" on page 3-38
- "Card Cage" on page 3-39

Mechanical Specifications

Table 3-9 provides the mechanical specifications for the DTC.

Table 3-9 DTC Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	34.95 inches / 887.73mm (20 RU)
	Width	19.50 inches / 495.30mm (Main Chassis width)
	Depth	15.44 inches / 392.18mm (Overall Chassis depth)
	Weight - with PEMs, air filter, rack mounting ears, and door	88.5lb / 40.1kg
	Weight - fully loaded chassis	240.0lb / 108.8kg

The DTC contains four electrical grounding points. Two sets of two 1/4-20 press-nuts are located on the chassis at the rear bottom and two 1/4-20 press-nuts are located on each side toward the bottom front of the chassis.

Air Plenums

Optional air plenums can be installed on each side of the DTC to divert exhaust air away from the sides of the chassis. The DTC Air Plenum Kit (PON D-PLENUM-ANSI) contains all necessary hardware to install the air plenums on the DTC.

Note: Air plenums are supported on the DTC ANSI chassis type only. In addition, the chassis must be installed on a 23-inch rack with the external rack mounting ears configured using the 5-inch forward mount option. Contact your Infinera account team for additional information.

Rack Mounting Ears

Each DTC includes integrated rack mounting ears used to flush mount the chassis on an ETSI (600mm) or 23-inch rack. Additionally, external rack mounting ears are pre-installed at the factory (per customer specification) for mid-mounting the chassis on a 23-inch rack in the positions of 1-inch, 2-inch, 5-inch, or 6-inch forward from the rack rails.

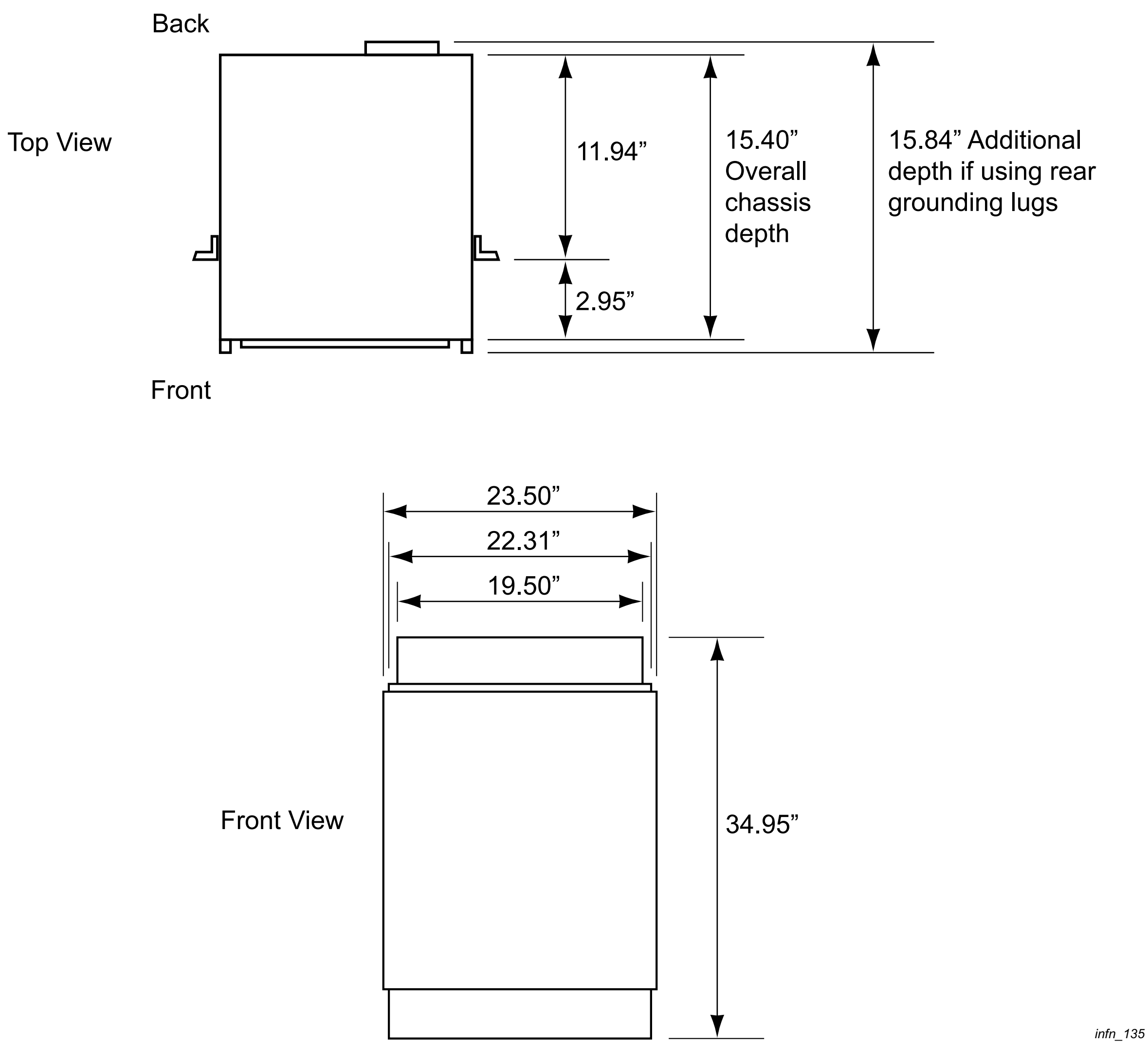
When the rack mounting ears are in the 5-inch back and 6-inch back positions for a forward mount configuration, the DTC uses slack management ears to route the fiber-optic cables. There are three slack management ears on each side of the DTC (six total) which maximize valuable rack space and help to eliminate the pinching of cables in addition to providing correct cable bend radius. This ensures the system's continual integrity and protection against signal loss or degradation.

Vertical Hole Spacing

- For ANSI rack mounting ears, the spacing between each hole (in a repeating pattern) is: 1.5 inches (38.1mm), 2.0 inches (50.8mm), and 1.5 inches (38.1mm)
- For ETSI rack mounting ears, the spacing between each hole is: 75.0mm

The DTC top and front dimensions of the chassis are provided in Figure 3-4.

Figure 3-4 DTC Dimensions



Note: When the front door is installed and in the closed position, the distance between the front of the chassis and the front door is approximately 2.8 inches (71.1mm).

Power Entry Module (PEM)

Note: Unless specifically noted otherwise, all references to the PEM will refer to either the PEM-70 and/or PEM-35 interchangeably.

Table 3-10 PEM Product Details

Product Ordering Name (PON)	Description
D-PEM-A	Power Entry Module, 70A
D-PEM-35	Power Entry Module, 35A

The top position of the DTC accommodates two PEMs (PEM A and PEM B) for redundant power feeds. Each PEM has either a 70A or 35A circuit breaker for over-current protection on the power feed as shown in Figure 3-5 on page 3-22 (PEM-70) and Figure 3-6 on page 3-22 (PEM-35).

The 35A PEM type, referred to as PEM-35, is available for specific configurations that do not require 70A. The PEM-35 contains a 35A circuit breaker and is distinguished by a white breaker handle while the 70A PEM type, referred to as PEM-70, contains a 70A circuit breaker and is distinguished by a black breaker handle. Other than the different load requirements and PEM outer case markings, the PEM-70 and PEM-35 function identically.

CAUTION

A DTC/MTC configured with PEM-35s will only support a combination of MCMs, BMMs and/or CMMs. Line modules, LM-80s, and/or TEMs must ***not*** be physically installed in slots 3 through 6 of the chassis. In addition, a combination of a PEM-70 and a PEM-35 is supported only during a temporary migration between PEM types; a DTC/MTC configured with a PEM-70 and a PEM-35 is otherwise ***not*** recommended. Contact Infinera TAC for additional information.

Note: When a DTC/MTC is configured with both a PEM-70 and a PEM-35, an Equipment Type Mismatch alarm for the PEMs will be reported by the management interfaces.

External Indicators

Figure 3-5 DTC PEM-70 Faceplate

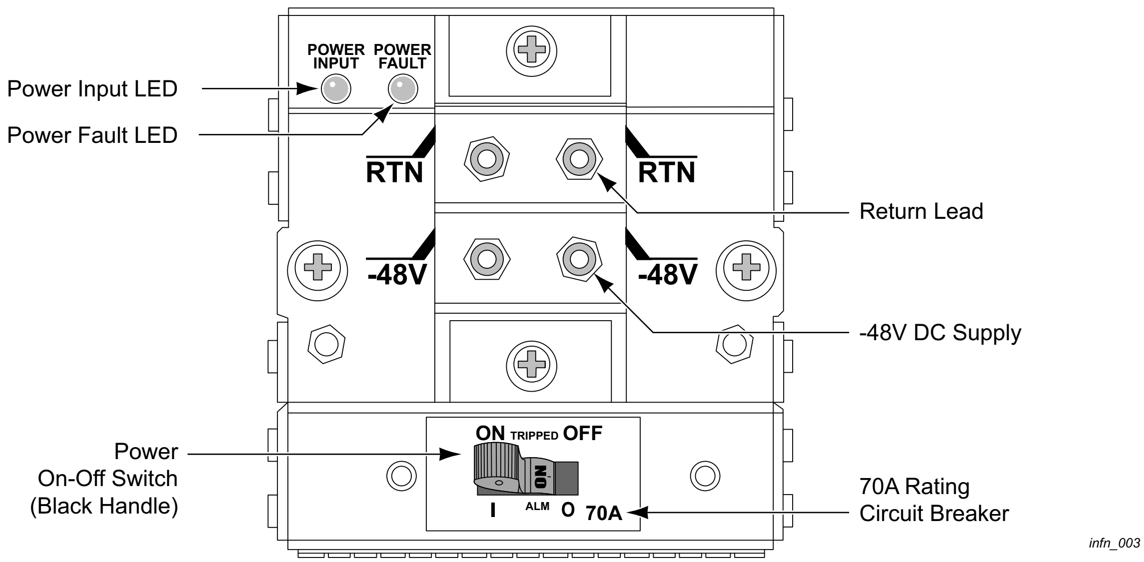
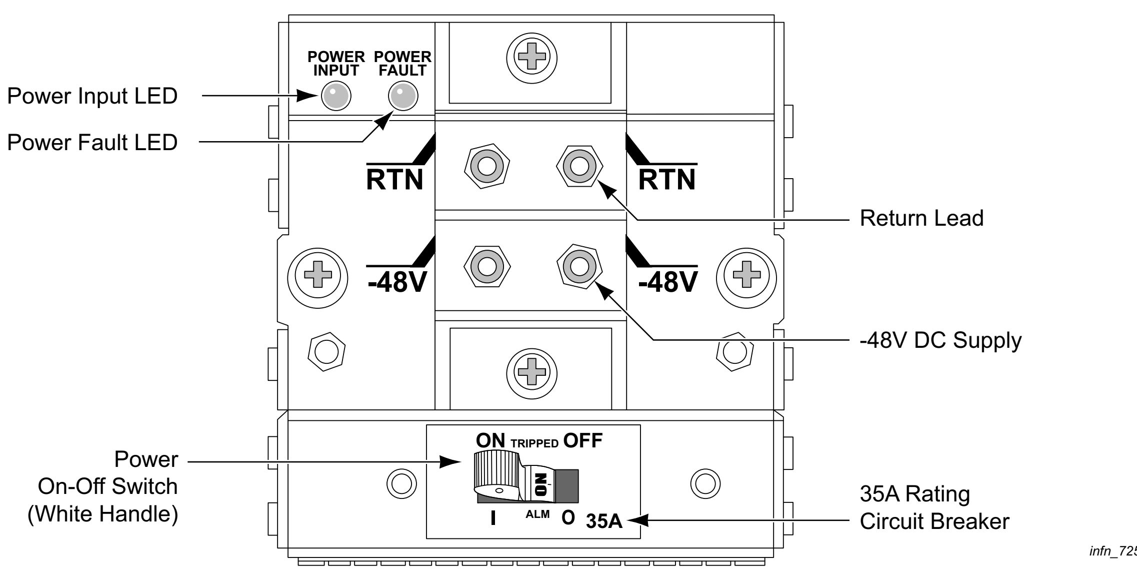


Figure 3-6 DTC PEM-35 Faceplate



Power LEDs

The PEMs located on top of the chassis provide two status LEDs: Power Input and Power Fault. The LEDs indicate whether the power levels are within specified limits. The significance of an illuminated LED is described in Table 3-11.

Table 3-11 DTC PEM Visual Alarm Indicators

POWER INPUT (Green)	POWER FAULT (Red)	Description
ON	OFF	• Input lead is receiving power • Power output from the PEM as per specifications
ON	ON	• Input lead is receiving power • Power output from the PEM not to specifications
OFF	ON	• Input lead is not receiving power • No power output from the PEM as per specifications
OFF	OFF	• Input lead is not receiving power • No power output from the PEM as per specifications

Connectors

Each PEM is provided with two sets of dual 1/4-20 studs on 5/8” centers. One set is for connection to -48V DC Power and the second set to its Return. The studs are capable of accommodating industry standard two-hole compression lugs on 5/8” centers. A plastic safety cover is provided to prevent inadvertent contact with the terminals once installed.

CAUTION

To prevent damage to the PEM, the compression lugs used must have 1/4 inch diameter stud hole size, 5/8 inch hole spacing, and the lug width must not exceed 0.60 inch.

Technical Specifications

Table 3-12 provides the mechanical and electrical specifications for the DTC PEM.

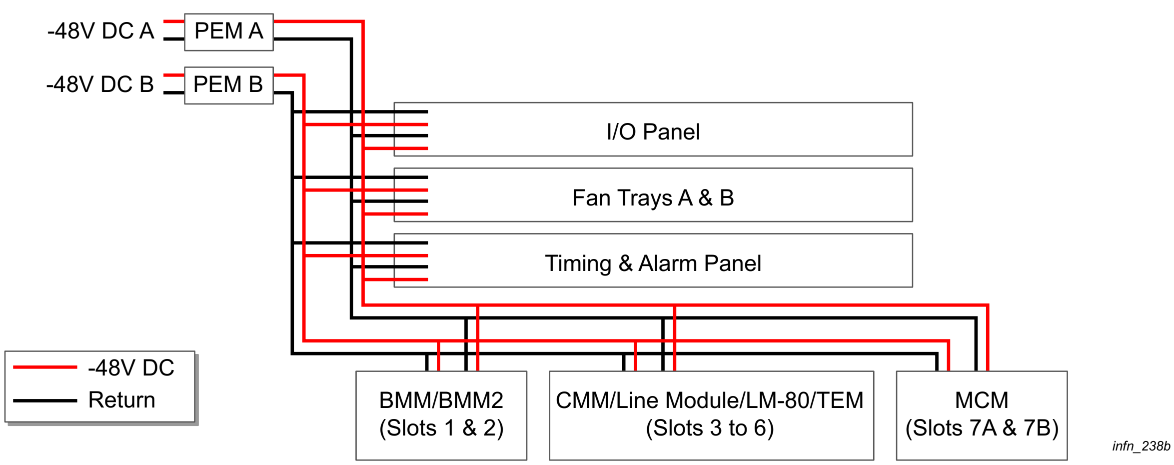
Table 3-12 DTC PEM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.70 inches / 93.98mm
	Width	3.30 inches / 83.82mm
	Depth	10.80 inches / 274.32mm
	Weight	3.0lb / 1.3kg
Electrical specifications	Power consumption	Included as part of base DTC system; see Table 3-1 on page 3-4

Power Distribution Architecture

PEM A and PEM B distribute the power supply to the power connectors on top of the backplane. The backplane feeds the power supply from each PEM to the circuit packs as shown in Figure 3-7.

Figure 3-7 DTC Power Distribution Diagram



The DTC hardware modules combine the power feed by diode-ORing. The -48V DC inputs are individually fused on the circuit packs, I/O panel, TAP, and fan trays to protect it from overcurrent conditions. The fuse is not field-replaceable. The status of each fuse is monitored before the ORing diodes. A diode and a transient voltage suppression (TVS) diode are provided to protect against reverse polarity and transient overvoltage conditions.

Input/Output (I/O) Panel

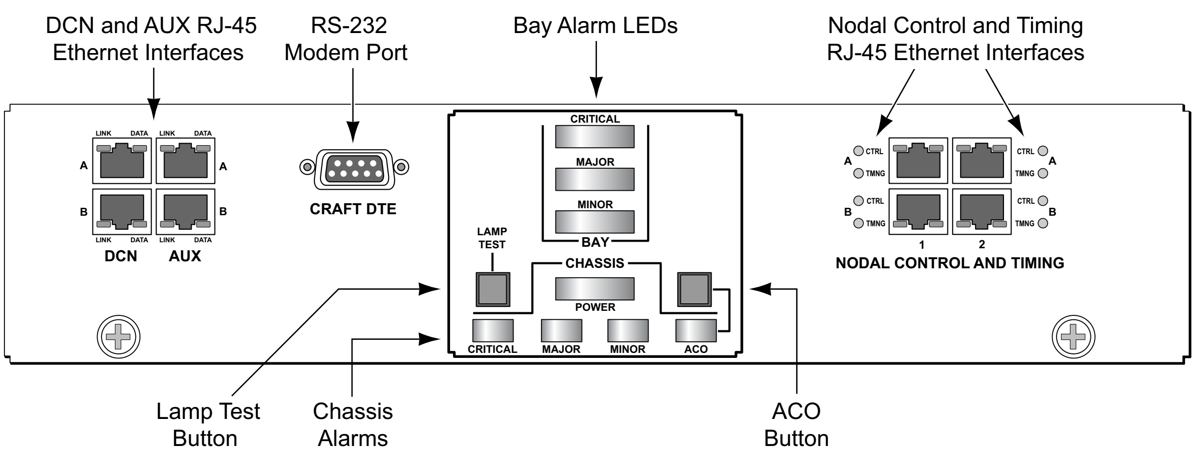
Note: In a multi-chassis configuration the DCN and AUX ports on the Main Chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

The I/O panel is part of the DTC. The I/O panel houses the management and operations interfaces as described below. The front view of the I/O panel is shown in Figure 3-8.

- Two 10/100Mbps auto-negotiating Data Communication Network (DCN) RJ-45 Ethernet interfaces, labeled as DCN. This interface provides ports for Ethernet network connectivity
- Two 10/100Mbps auto-negotiating Administrative Inter-LAN RJ-45 Ethernet interfaces, labeled as AUX. This interface provides ports for Datawire services
- Four 10/100Mbps auto-negotiating inter-chassis interconnect RJ-45 Ethernet interfaces, labeled as Nodal Control and Timing (NCT). This interface provides ports for a multi-chassis configuration
- Craft RS-232 Modem port labeled as Craft DTE
- Bay level alarm LEDs (Critical, Major, and Minor)
- Chassis level alarm LEDs (Power, Critical, Major, and Minor)
- One Lamp Test button
- One Alarm Cutoff (ACO) button
- One ACO LED

External Indicators

Figure 3-8 DTC I/O Panel Front View



Bay Level Alarm LEDs

The bay level indicators reflect the alarm status of all chassis in a bay as described in Table 3-13.

Table 3-13 DTC Visual Alarm Indicators - Bay Level

LED	Color	Description
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in any of the chassis in the bay
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in any of the chassis in the bay
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in any of the chassis in the bay

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding bay level and chassis level LED functions.

Chassis Level Alarm LEDs

The I/O panel provides chassis level alarms, POWER, CRITICAL, MAJOR, and MINOR LEDs. These indicate the severities of the current outstanding alarms within that chassis. The POWER LED indicates the power-on status. Each chassis has an Alarm Cutoff (ACO) button on the alarm panel which controls the reporting of audible alarms. The significance of an illuminated LED is described in Table 3-14.

Table 3-14 DTC Visual Alarm Indicators - Chassis Level

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply within the specified operating range to the chassis
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in the chassis
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in the chassis
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in the chassis
ACO	Yellow	Indicates the presence (lit) or absence (dimmed) of the Alarm Cutoff function

Lamp Test

The I/O panel contains a lamp test button for testing the LEDs. When the lamp test button is pressed, all LEDs on the I/O panel and the circuit packs on the chassis are lit (power LEDs illuminate Green and fault LEDs illuminate Red) and bi-color LEDs will toggle between two colors (Green and Yellow) until the lamp test button is released. Once the lamp test button is released, all LEDs will return to the previous condition.

Alarm Cutoff (ACO) Indicators

The I/O panel contains one ACO button and an ACO LED. The ACO feature allows muting of the external audible alarms. When the ACO button is pressed, all current critical, major, and minor audio alarms are muted and the ACO LED is lit. Table 3-15 provides a description of the alarm state and the ACO LED state.

Table 3-15 DTC Audio Alarm Indicators - Chassis Level

Condition	ACO LED State	Audio Alarm
There are no external alarms on the chassis	OFF	Not present
An external alarm is raised on the chassis	OFF	Present
ACO button is pressed	ON	Muted
An external alarm is cleared	OFF	Not present

I/O Connectors

The I/O panel has a total of eight RJ-45 ports and one RS-232 port as described in Table 3-16.

Table 3-16 DTC I/O Panel Connectors

Connector	Type	Purpose
DCN A, DCN B	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors with redundancy for remote management through DCN
AUX A, AUX B	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors for datawire service to carry customer management traffic
CRAFT DTE	9600 baud RS-232 DTE DB-9 Male	Allows remote management through a modem
NODAL CONTROL AND TIMING (NCT)	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Four connectors for Inter-chassis communication for uplink and downlink with A and B connectors for redundancy

Note: NCT ports are used for multi-chassis interconnection.

Note: In a multi-chassis configuration the DCN and AUX ports on the Main chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

DCN and AUX Port LEDs

The I/O panel provides DCN and AUX port visual indicators: a DATA and a LINK LED. The significance of an illuminated LED is described in Table 3-17.

Table 3-17 DTC Visual Alarm Indicators on the DCN and AUX Ports

DATA (Green)	LINK (Green)	Description
ON	ON	• Link established • The port is active
OFF	OFF	• Link not established
OFF	ON	• Link established • The port is not active

NCT Port LEDs

The I/O panel provides NCT port visual indicators: a Control (CTRL) and a Timing (TMNG) LED. The significance of an illuminated LED is described in Table 3-18.

Table 3-18 DTC Visual Alarm Indicators on the NCT Ports

LED	Color	Description
CTRL	Tri-color	• ON (Green)—Link is established, rapid spanning tree protocol (RSTP) is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established
TMNG	Tri-color	• ON (Green)—Link is established, RSTP is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established

Timing and Alarm Panel (TAP)

The TAP provides interfaces for external timing synchronization and environmental alarm contacts. The TAP does not contain any active component. External timing synchronization is not supported. However, the TAP houses Telcordia and ITU Building Integrated Timing Supply (BITS) input and output timing interfaces. The BITS interfaces are labeled using the “A/B” convention for indicating paired interfaces. The configuration of the timing synchronization mode (T1 versus E1) determines which of the physical ports is referenced.

The TAP also houses alarm input and output contact sets. The TAP has 20 alarm input contact sets. Each input alarm contact set has two contacts. Sixteen alarm input contact sets are user customizable, while the rest are reserved for Bay LED and ACO inputs from an external chassis. Refer to “DTC Alarm Input Contact Pin Assignments” on page 3-31 for the list of the alarm contacts.

The TAP has 20 alarm output contact sets. Each output alarm contact set consists of Normally-closed, Normally-open and common contacts. Ten output contacts are user customizable, while the rest are reserved for office alarms and bay alarms. Refer to “DTC Alarm Output Contact Pin Assignments” on page 3-33 for the list of the alarm contacts.

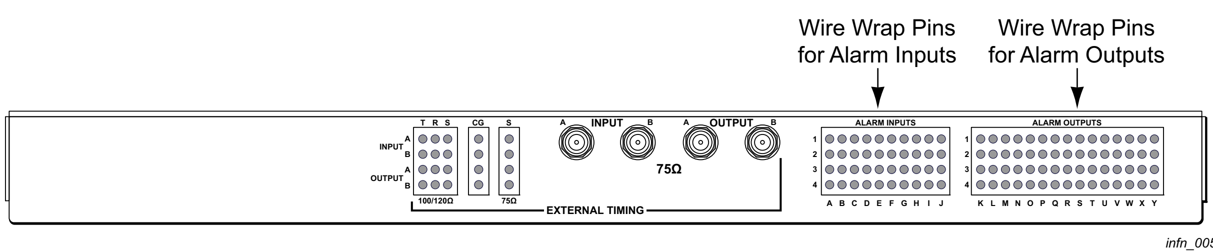
Chassis Level Audio Indicators

The TAP provides output alarm contacts for CRITICAL, MAJOR, and MINOR audible alarms. Audible alert is triggered when an alarm is raised on the chassis.

External Connectors

The input and output dry alarm contacts of 0.045sq. inch pins are accessible from the front of the TAP to facilitate easy interconnection. These contacts are used for integration with existing environmental alarm systems. The alarm pin positions are shown in Figure 3-9.

Figure 3-9 DTC TAP Front View



The input and output connector details are provided in Table 3-19.

Table 3-19 DTC TAP External Connectors

Connector	Type	Purpose
ALARM INPUTS	0.045sq. inch wire wrap pins	Environmental alarm inputs and office alarm input contacts
ALARM OUTPUTS	0.045sq. inch wire wrap pins	Environmental alarm output and office alarm output contacts

Technical Specifications

The environmental alarm contacts have the electrical ratings specified in Table 3-20.

Table 3-20 DTC Alarm Relay Contact Specifications

Parameter	Value
Maximum voltage	250V AC, 220V DC
Maximum current	2A
Rated load	0.5A @ 125V AC, 2A @ 30V DC
Wire size	24 AWG minimum
Maximum surge voltage between contact and coil	2,500V

Alarm Input Contact Pin Assignments

Table 3-21 lists the assignment of alarm input contact pins for the DTC. Four alarm contacts are pre-defined in the system and the remaining sixteen contacts can be customized by the users to monitor environmental alarms.

Table 3-21 DTC Alarm Input Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	A	Alarm Input Contact 1	User defined
1	B	Alarm Input Contact 1	User defined
1	C	Alarm Input Contact 5	User defined
1	D	Alarm Input Contact 5	User defined
1	E	Alarm Input Contact 9	User defined
1	F	Alarm Input Contact 9	User defined
1	G	Alarm Input Contact 13	User defined
1	H	Alarm Input Contact 13	User defined
1	I	Reserved for Critical Bay alarm	Predefined
1	J	Reserved for Critical Bay alarm	Predefined
2	A	Alarm Input Contact 2	User defined
2	B	Alarm Input Contact 2	User defined
2	C	Alarm Input Contact 6	User defined
2	D	Alarm Input Contact 6	User defined
2	E	Alarm Input Contact 10	User defined
2	F	Alarm Input Contact 10	User defined
2	G	Alarm Input Contact 14	User defined
2	H	Alarm Input Contact 14	User defined
2	I	Reserved for Major Bay alarm	Predefined
2	J	Reserved for Major Bay alarm	Predefined
3	A	Alarm Input Contact 3	User defined
3	B	Alarm Input Contact 3	User defined
3	C	Alarm Input Contact 7	User defined
3	D	Alarm Input Contact 7	User defined
3	E	Alarm Input Contact 11	User defined
3	F	Alarm Input Contact 11	User defined
3	G	Alarm Input Contact 15	User defined
3	H	Alarm Input Contact 15	User defined
3	I	Reserved for Minor Bay alarm	Predefined

Table 3-21 DTC Alarm Input Contact Pin Assignments

Pin		Description	Function
Row	Column		
3	J	Reserved for Minor Bay alarm	Predefined
4	A	Alarm Input Contact 4	User defined
4	B	Alarm Input Contact 4	User defined
4	C	Alarm Input Contact 8	User defined
4	D	Alarm Input Contact 8	User defined
4	E	Alarm Input Contact 12	User defined
4	F	Alarm Input Contact 12	User defined
4	G	Alarm Input Contact 16	User defined
4	H	Alarm Input Contact 16	User defined
4	I	Reserved for Alarm Cutoff (ACO)[a]	Predefined
4	J	Reserved for Alarm Cutoff (ACO)[a]	Predefined

a. ACO can be enabled using the input contact pins in addition to the ACO push button and the Infinera GNM user interface.

Alarm Output Contact Pin Assignments

Table 3-22 lists the assignment of alarm output contact pins for the DTC. Ten alarm contacts are pre-defined in the system and the remaining ten contacts can be customized by the users to monitor the environmental alarms.

Table 3-22 DTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	K	Alarm Output Contact 1, RETURN	User defined
1	L	Alarm Output Contact 1, NORMALLY OPEN	User defined
1	M	Alarm Output Contact 1, NORMALLY CLOSED	User defined
1	N	Alarm Output Contact 5, RETURN	User defined
1	O	Alarm Output Contact 5, NORMALLY OPEN	User defined
1	P	Alarm Output Contact 5, NORMALLY CLOSED	User defined
1	Q	Alarm Output Contact 9, RETURN	User defined
1	R	Alarm Output Contact 9, NORMALLY OPEN	User defined
1	S	Alarm Output Contact 9, NORMALLY CLOSED	User defined
1	T	Minor Audio Alarm, RETURN	Predefined
1	U	Minor Audio Alarm, NORMALLY OPEN	Predefined
1	V	Minor Audio Alarm, NORMALLY CLOSED	Predefined
1	W	Power Fault Alarm, RETURN	Predefined
1	X	Power Fault Alarm, NORMALLY OPEN[a]	Predefined

Table 3-22 DTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	Y	Power Fault Alarm, NORMALLY CLOSED[a]	Predefined
2	K	Alarm Output Contact 2, RETURN	User defined
2	L	Alarm Output Contact 2, NORMALLY OPEN	User defined
2	M	Alarm Output Contact 2, NORMALLY CLOSED	User defined
2	N	Alarm Output Contact 6, RETURN	User defined
2	O	Alarm Output Contact 6, NORMALLY OPEN	User defined
2	P	Alarm Output Contact 6, NORMALLY CLOSED	User defined
2	Q	Alarm Output Contact 10, RETURN	User defined
2	R	Alarm Output Contact 10, NORMALLY OPEN	User defined
2	S	Alarm Output Contact 10, NORMALLY CLOSED	User defined
2	T	Critical Visual Alarm, RETURN	Predefined
2	U	Critical Visual Alarm, NORMALLY OPEN	Predefined
2	V	Critical Visual Alarm, NORMALLY CLOSED	Predefined
2	W	Critical Bay Alarm, RETURN	Predefined
2	X	Critical Bay Alarm, NORMALLY OPEN	Predefined
2	Y	Critical Bay Alarm, NORMALLY CLOSED	Predefined
3	K	Alarm Output Contact 3, RETURN	User defined

Table 3-22 DTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
3	L	Alarm Output Contact 3, NORMALLY OPEN	User defined
3	M	Alarm Output Contact 3, NORMALLY CLOSED	User defined
3	N	Alarm Output Contact 7, RETURN	User defined
3	O	Alarm Output Contact 7, NORMALLY OPEN	User defined
3	P	Alarm Output Contact 7, NORMALLY CLOSED	User defined
3	Q	Critical Audio Alarm, RETURN	Predefined
3	R	Critical Audio Alarm, NORMALLY OPEN	Predefined
3	S	Critical Audio Alarm, NORMALLY CLOSED	Predefined
3	T	Major Visual Alarm, RETURN	Predefined
3	U	Major Visual Alarm, NORMALLY OPEN	Predefined
3	V	Major Visual Alarm, NORMALLY CLOSED	Predefined
3	W	Major Bay Alarm, RETURN	Predefined
3	X	Major Bay Alarm, NORMALLY OPEN	Predefined
3	Y	Major Bay Alarm, NORMALLY CLOSED	Predefined
4	K	Alarm Output Contact 4, RETURN	User defined
4	L	Alarm Output Contact 4, NORMALLY OPEN	User defined
4	M	Alarm Output Contact 4, NORMALLY CLOSED	User defined

Table 3-22 DTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
4	N	Alarm Output Contact 8, RETURN	User defined
4	O	Alarm Output Contact 8, NORMALLY OPEN	User defined
4	P	Alarm Output Contact 8, NORMALLY CLOSED	User defined
4	Q	Major Audio Alarm, RETURN	Predefined
4	R	Major Audio Alarm, NORMALLY OPEN	Predefined
4	S	Major Audio Alarm, NORMALLY CLOSED	Predefined
4	T	Minor Visual Alarm, RETURN	Predefined
4	U	Minor Visual Alarm, NORMALLY OPEN	Predefined
4	V	Minor Visual Alarm, NORMALLY CLOSED	Predefined
4	W	Minor Bay Alarm, RETURN	Predefined
4	X	Minor Bay Alarm, NORMALLY OPEN	Predefined
4	Y	Minor Bay Alarm, NORMALLY CLOSED	Predefined

a. When there is no power fault condition, the Normally Open contact is closed and the Normally Closed contact is open. When both PEM A and PEM B have power fault condition, the Normally Open contact is open and Normally Closed contact is closed. The power fault is defined as when the power input into PEM A or PEM B is out of working range.

Fan Tray

The DTC contains two removable fan trays. Each fan tray consists of three individually controlled fans. The top fan tray is referred to as Fan Tray A, and the bottom tray is referred to as Fan Tray B. The thermal system employs a push-pull approach to move air through the system. The airflow enters from the bottom front and sides, and exits from the top rear and sides.

Both fan trays are required for normal operation and are not redundant. However, individual fans within a fan tray, are N+1 redundant with power hot-swap controllers. If one of the six fans is failed, the DTC system can operate indefinitely in an environment up to 50ºC. An alarm will be generated that indicates one of the fans has failed. Although the system can run reliably with one fan failed, the user should change the fan tray at the earliest convenience to ensure against a second fan failure.

The faulted fan tray should be kept installed inside the DTC until a replacement fan tray is available. If a fan tray is completely removed from the DTC, the chassis should be able to run without failure in an ambient up to 45ºC as long as the air filter is clean.

The fan trays should never be partially removed from the system unless performing air filter maintenance (when performing air filter maintenance, the fan trays should not be removed from the system for more than one minute).

A POWER LED and a FAULT LED are provided on each fan tray. The significance of an illuminated LED is described in Table 3-23.

Table 3-23 DTC Fan Tray Visual Alarm Indicators

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the fan tray
FAULT	Red	Indicates the presence (lit) or absence (dimmed) of a fault condition with the fan tray. Flashing Red indicates that the fan is not under control of the active MCM (for example, the active MCM has been reset or physically removed from the system)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding fan tray LED functions.

Technical Specifications

Table 3-24 provides the mechanical and electrical specifications for the DTC fan tray.

Table 3-24 DTC Fan Tray Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	2.15 inches / 54.61mm
	Width	19.30 inches / 490.22mm
	Depth	10.53 inches / 267.46mm
	Weight	11.0lb / 4.9kg
Electrical specifications	Power consumption	Included as part of base DTC system; see Table 3-1 on page 3-4

Air Filter

A replaceable air filter is necessary to filter out dust particles at the air intake of the DTC. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the DTC the air filter must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filter once every six months.

Mechanical Specifications

Table 3-25 provides the mechanical specifications for the DTC air filter.

Table 3-25 DTC Air Filter Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	19.35 inches / 491.49mm
	Depth	9.70 inches / 246.38mm
	Weight	Less than 0.5lb / 0.2kg
	Dust arrestance	80%

Card Cage

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The DTC contains a single card cage consisting of seven chassis slots which house the circuit packs that provide the optical and digital transport functions of the system as shown in Figure 3-10.

Slots 1 and 2 are full-height slots reserved for BMM/BMM2/BMM2Ps, slots 3 through 6 are full-height slots reserved for CMMs, line modules, LM-80s, and/or TEMs, and slot 7 is divided into two half-height slots (7A and 7B) reserved for MCMs. Table 3-26 on page 3-40 outlines the DTC card slot assignments.

The DTC-B features a “Mesh” backplane switching mode when used in conjunction with XLM/AXLM/SLM/AXLM-80/SLM-80s (the DTC-A and/or DLM/ADLM/ADLM-80s do not support Mesh switching mode). Mesh switching mode supports incremental line module-slot to line module-slot connectivity. For additional information regarding Mesh switching mode, refer to the *Infinera DTN and DTN-X System Description Guide*.

Figure 3-10 DTC Card Cage

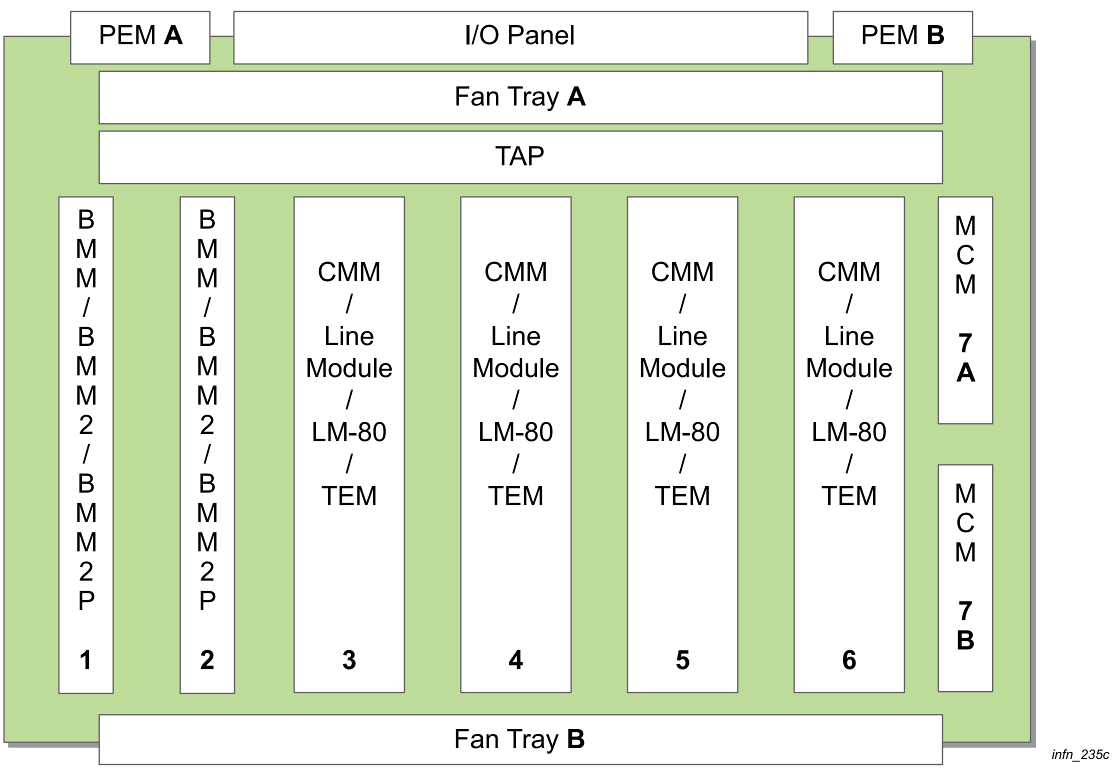


Table 3-26 DTC Card Slot Assignments

Slot Number	Module Type
1	BMM/BMM2/BMM2P
2	
3	CMM/Line Module/LM-80/TEM
4	
5	
6	
7A	MCM
7B	

DTC-A and DTC-B Data Plane

Note: The DTC-A type chassis supports Ring switching mode only. The DTC-B type chassis is set to Ring switching mode by default and can be set to Mesh switching mode only when all line modules are removed and deleted from the chassis or during initial commissioning of the chassis and before any line module is added (pre-provisioned/provisioned) to the chassis with no modules installed in slots 3, 4, 5, and 6.

Note: DLM/ADLM/ADLM-80s are not supported in a chassis that is set to Mesh switching mode. If a DLM/ADLM/ADLM-80 is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the DLM/ADLM/ADLM-80.

Note: XLM/AXLM/SLM/AXLM-80/SLM-80s are supported on the DTC-A but without meshing switching mode capability.

Note: In multi-chassis nodes, each chassis can be configured independently for Ring or Mesh switching mode.

The DTC-B is an enhanced DTC that supports incremental line module-slot to line module-slot connectivity (Mesh switching mode). The DTC-B is fully backward compatible with the DTC-A and uses all of the existing MCMs, BMM/BMM2/BMM2Ps, line modules, LM-80s, TEMs, TAMs, GAMs, and/or TOMs currently deployed in the DTC-A. In each DTC, slots 3 through 6 comprise the data plane.

Table 3-27 (DTC-A) and Table 3-28 (DTC-B) list the maximum supported switching capacity across the data plane (per slot pair), based on installed line module/TEMs.

For additional information on data plane functionality, refer to the *Infinera DTN and DTN-X System Description Guide*.

Table 3-27 DTC-A Switching Capacity between Line Module/LM-80/TEM Slots

Slot Pair[a]	Switching Capacity (Ring Mode) using Line Module/LM-80/TEMs
3 and 4	100Gbps
3 and 5	60Gbps
3 and 6	No direct connectivity
4 and 5	No direct connectivity
4 and 6	60Gbps
5 and 6	100Gbps

a. The XLM/AXLM/SLM/AXLM-80/SLM-80 is supported on the DTC-A but without Mesh switching mode capability.

Table 3-28 DTC-B Switching Capacity between Line Module/LM-80/TEM Slots

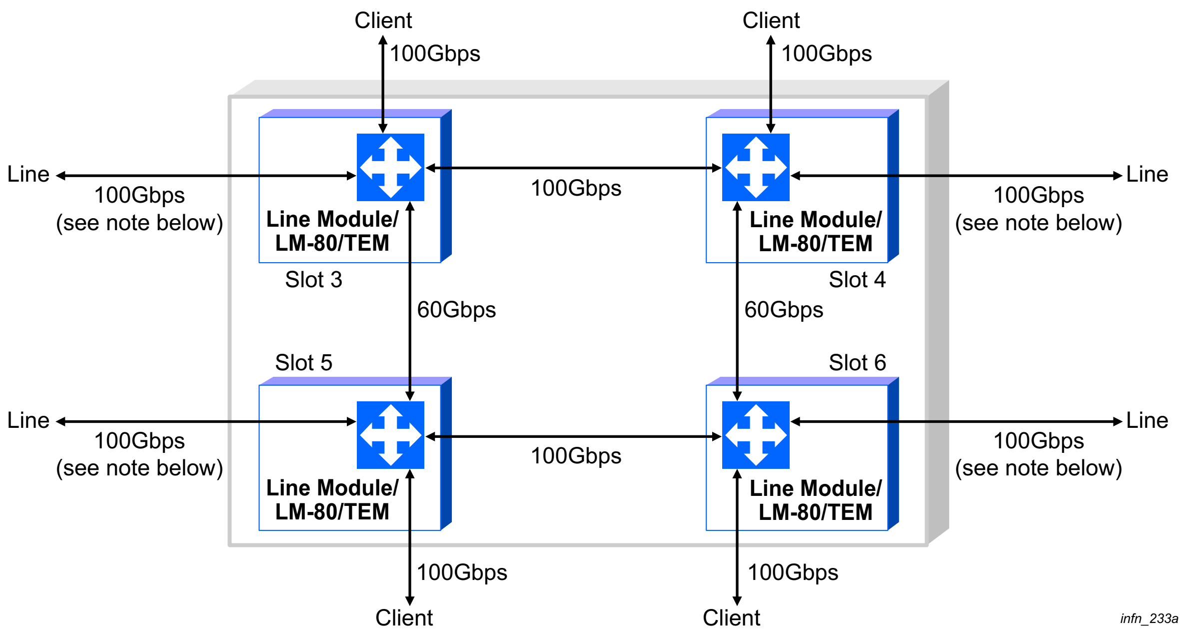
Slot Pair	Switching Capacity (Ring Mode) using Line Module/LM-80/TEMs	Switching Capacity (Mesh Mode) using XLM/AXLM/SLM/AXLM-80/ SLM-80s Only
3 and 4	100Gbps	100Gbps
3 and 5	60Gbps	100Gbps
3 and 6	No direct connectivity	100Gbps
4 and 5	No direct connectivity	100Gbps
4 and 6	60Gbps	100Gbps
5 and 6	100Gbps	100Gbps

Follow these guidelines for configuring Mesh switching mode on a DTC-B:

- DLM/ADLM/ADLM-80s are not supported in a DTC-B that is set to Mesh switching mode. If a DLM/ ADLM/ADLM-80 is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the DLM/ADLM/ADLM-80
- The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/ AXLM-80/SLM-80s in each slot. See Figure 3-12 on page 3-43
- If a TEM is used in a slot pair on a DTC-B configured for Mesh switching mode, the switching capacity for that particular slot pair is reduced to 60Gbps
    - Only one TEM can be used in slots 3 and 5, and slots 4 and 6 (the other slot must contain an XLM/AXLM/SLM/AXLM-80/SLM-80 to provide access to the virtual fabric). See Figure 3-13 on page 3-44

Figure 3-11 shows the bandwidth capabilities of a DTC configured for Ring switching mode and provisioned with line modules, LM-80s, and/or TEMs.

Figure 3-11 DTC Ring Switching Mode Bandwidth Capacity

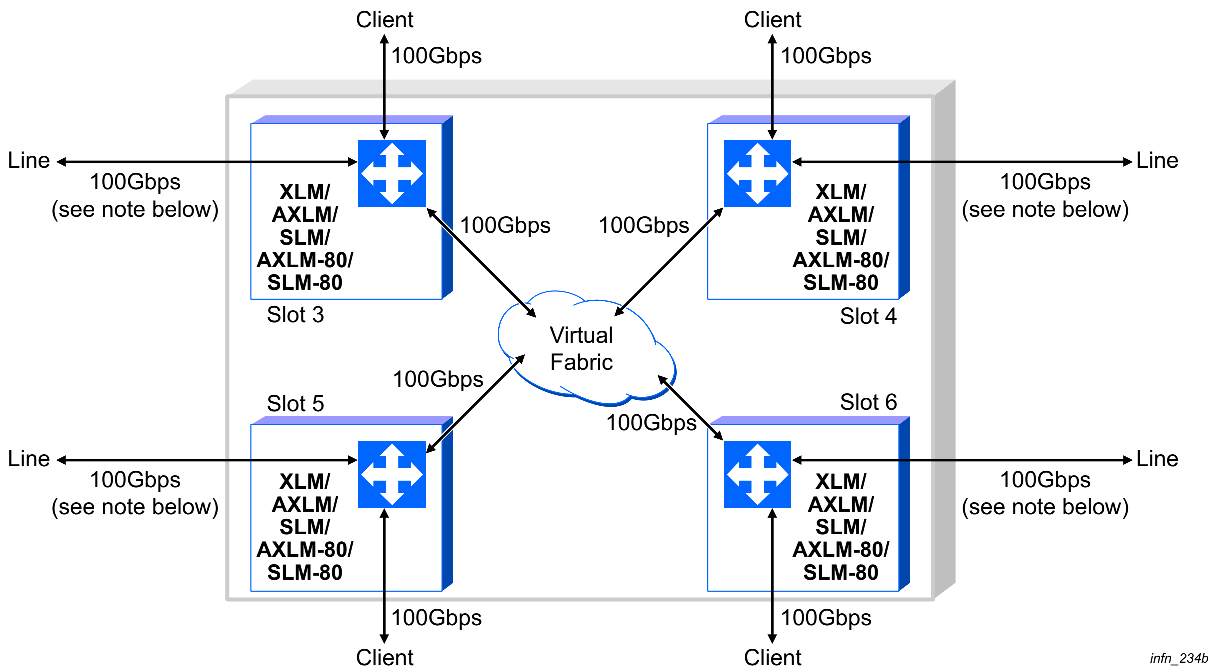


Note: The LM-80 only supports up to 80Gbps across the line side.

Note: The bandwidth capabilities for a DTC configured for Ring switching mode are the same regardless of whether the chassis is provisioned with line modules, LM-80s, and/or TEMs.

Figure 3-12 shows the bandwidth capabilities of a DTC-B configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s.

Figure 3-12 DTC-B Mesh Switching Mode Bandwidth Capacity (without TEMs)



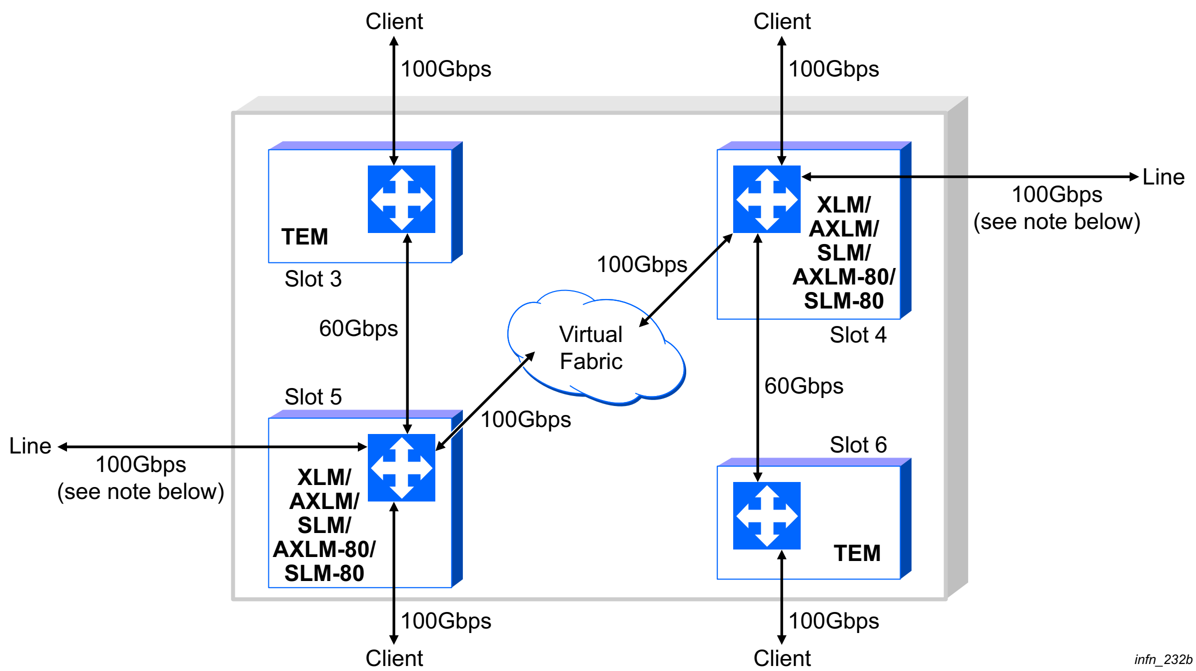
Note: The AXLM-80/SLM-80 only supports up to 80Gbps across the line side.

Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s in each slot.

Figure 3-13 shows the bandwidth capabilities of a DTC-B configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s and TEMs.

Note: When TEMs are used, the switching capacity for the particular slot pair is reduced to 60Gbps. Only one TEM can be used in slots 3 and 5, and slots 4 and 6 (the other slot must contain an XLM/AXLM/SLM/AXLM-80/SLM-80 to provide access to the virtual fabric).

Figure 3-13 DTC-B Mesh Switching Mode Bandwidth Capacity (with TEMs)



Note: The AXLM-80/SLM-80 only supports up to 80Gbps across the line side.

Note: Any attempt to provision a TEM in a chassis configured for Mesh switching mode in *both* slot 3 and slot 5 will be denied by the management interfaces, as will any attempt to provision a TEM in *both* slot 4 and slot 6.

MTC Overview

Note: Half-height BMMs (BMM1H-4-CX2, BMM2H-4-R3-MS, and BMM2H-4-B3) are the only BMM types supported on the MTC.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The MTC-A (referred to as an “MTC”) is a 19-inch chassis option for the DTN. The MTC functions as a DTC-B and uses the same field-replaceable circuit packs as the DTC-B, with a single exception: the MTC requires half-height BMMs (BMM1H-4-CX2, BMM2H-4-R3-MS, and/or BMM2H-4-B3).

The MTC can be deployed as a Main Chassis, or as an Expansion Chassis in a multi-chassis configuration.

Table 3-29 provides a list of the common components that make up an MTC (some components are field-replaceable).

Table 3-30 on page 3-46 provides a list of the supported circuit packs on an MTC (circuit packs are field-replaceable).

Chassis Type Identification

The MTC is available as an ANSI or ETSI chassis type and can be identified as follows:

- A product label located on the right side of the chassis identifies the chassis type as ANSI or ETSI
- The jumper termination value used for ITU Building Integrated Timing Supply (BITS) is set to 100 Ohms for ANSI or 120 Ohms for ETSI. This value is preset at the factory and not field-upgradeable
- An internal serial EEPROM setting identifies the chassis type as ANSI or ETSI

Table 3-29 MTC Common Components

Name	Description
Rack Mounting Ears	See page 3-53
Power Entry Module (PEM)	See page 3-56
Input/Output (I/O) Panel	See page 3-60
Timing and Alarm Panel (TAP)	See page 3-64
Fan Tray	See page 3-72
Air Filter	See page 3-73
Card Cage	See page 3-74

Table 3-30 MTC Supported Circuit Packs

Name	Description
Management Control Module (MCM)	See page 3-80
Band Multiplexing Module (BMM)	See page 3-86
Channel Multiplexing Module (CMM)	See page 3-141
Digital Line Module (DLM)	See page 3-150
Switching Line Module (XLM)	See page 3-158
TAM Extender Module (TEM)	See page 3-165
Gain Adapter Module (GAM)	See page 3-170
Amplified Digital Line Module (ADLM)	See page 3-178
Amplified Switching Line Module (AXLM)	See page 3-186
Submarine Line Module (SLM)	See page 3-195
Amplified Digital Line Module (ADLM-80)	See page 3-202
Amplified Switching Line Module (AXLM-80)	See page 3-209
Submarine Line Module (SLM-80)	See page 3-216
Tributary Adapter Module 100GE (TAM-1-100GE)	See page 3-225
Tributary Adapter Module 100GR (TAM-1-100GR)	See page 3-230
Tributary Adapter Module 40GE (TAM-1-40GE)	See page 3-235
Tributary Adapter Module 40GR (TAM-1-40GR)	See page 3-240
Tributary Adapter Module 40G (TAM-1-40G-VSR)	See page 3-245
Tributary Adapter Module 10G (TAM-2-10G)	See page 3-250
Tributary Adapter Module 10GR (TAM-2-10GR)	See page 3-255
Tributary Adapter Module 10GT (TAM-2-10GT)	See page 3-260
Tributary Adapter Module 10GM (TAM-2-10GM)	See page 3-264
Tributary Adapter Module 2.5G (TAM-4-2.5G)	See page 3-269
Tributary Adapter Module 2.5GM (TAM-8-2.5G)	See page 3-274
Tributary Adapter Module 1G (TAM-8-1G)	See page 3-280
Tributary Optical Module 100G (TOM-100G-SR10)	See page 3-289
Tributary Optical Module 100G (TOM-100G-S10X)	See page 3-292
Tributary Optical Module 100G (TOM-100G-LR4)	See page 3-295
Tributary Optical Module 100G (TOM-100G-L10X)	See page 3-298
Tributary Optical Module 40G (TOM-40G-SR4)	See page 3-301
Tributary Optical Module 40G (TOM-40G-LR4)	See page 3-304
Tributary Optical Module 40G (TOM-40G-VSR)	See page 3-307
Tributary Optical Module 10G (TOM-10G-SR0)	See page 3-309

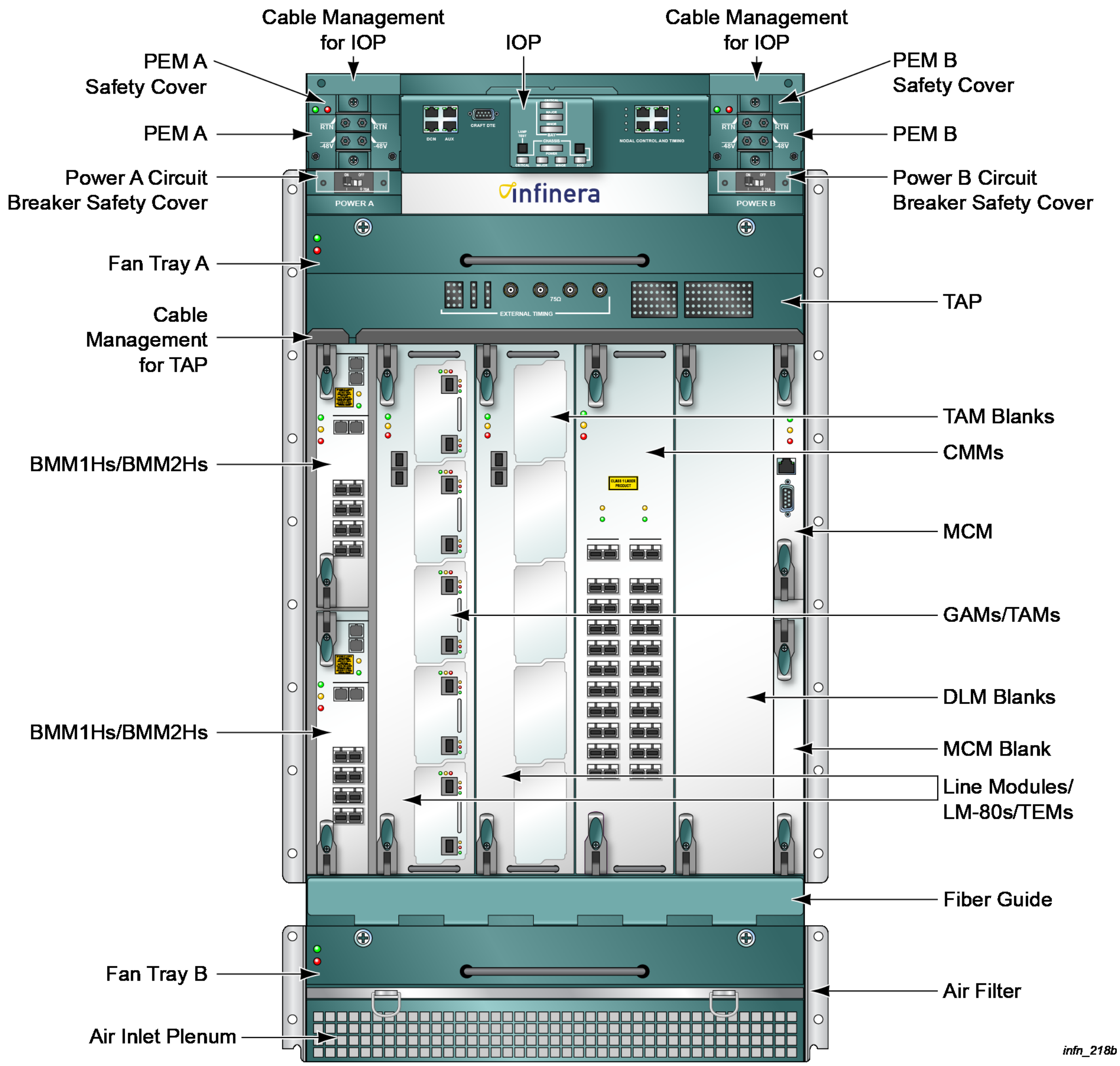
Table 3-30 MTC Supported Circuit Packs

Name	Description
Tributary Optical Module 10G (TOM-10G-SR1)	See page 3-312
Tributary Optical Module 10G (TOM-10G-IR2)	See page 3-315
Tributary Optical Module 10G (TOM-10G-LR2)	See page 3-318
Tributary Optical Module 10G (TOM-10G-Dn-LR2)	See page 3-321
Tributary Optical Module 8G (TOM-8G-SM-LC-L)	See page 3-326
Tributary Optical Module 2.5G (TOM-2.5G-SR1)	See page 3-329
Tributary Optical Module 2.5G (TOM-2.5G-IR1)	See page 3-332
Tributary Optical Module 2.5G (TOM-2.5G-IR2)	See page 3-335
Tributary Optical Module 2.5G (TOM-2.5G-LR2)	See page 3-339
Tributary Optical Module 2.5G (TOM-2.5GCn-LR2)	See page 3-343
Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)	See page 3-347
Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)	See page 3-351
Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)	See page 3-355
Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)	See page 3-359
Tributary Optical Module 1G (TOM-1G-SX)	See page 3-359
Tributary Optical Module 1G (TOM-1G-LX)	See page 3-366
Tributary Optical Module 1G (TOM-1G-ZX)	See page 3-369
Tributary Optical Module (TOM-1.485HD-RX)	See page 3-372
Tributary Optical Module (TOM-1.485HD-TX)	See page 3-375
Tributary Optical Module (TOM-1.4835HD-RX)	See page 3-378
Tributary Optical Module (TOM-1.4835HD-TX)	See page 3-381
Blank Circuit Packs	See page 3-384

Front View

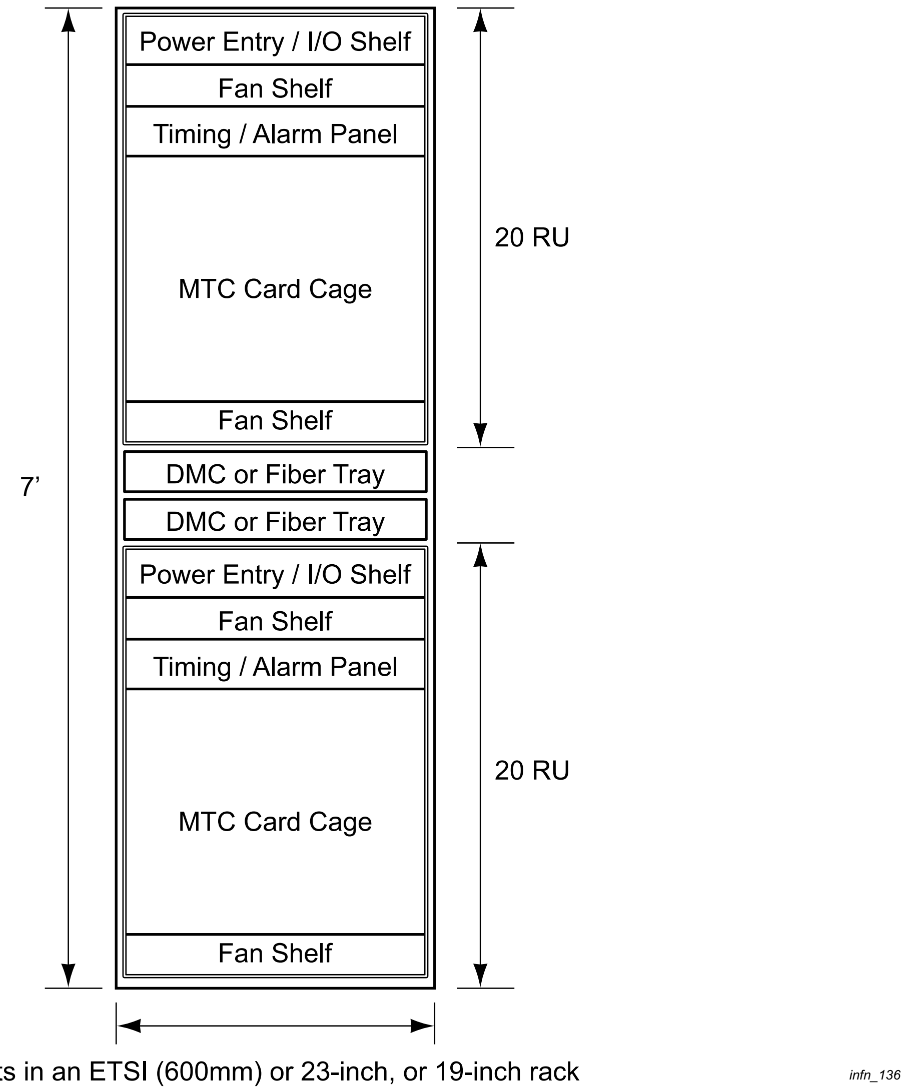
A front view of the MTC, with components and circuit packs, is shown in Figure 3-14.

Figure 3-14 MTC Front View



A single bay can accommodate two MTCs, and if needed, fiber management tray or DMC. Up to two DTNs, each with a single MTC, can be accommodated in a bay as shown in Figure 3-15.

Figure 3-15 Two MTCs on a Rack



MTC Thermal Loading

Table 3-31 provides typical heat release information for the MTC housed in a 19-inch frame.

Table 3-31 MTC Typical Heat Release

MTC Typical Heat Release Calculation for 19-inch (483mm) Frame									
Power Consumption (Watts)	1770								
Frame Depth (feet)	1.50								
Frame Width (feet)	1.84								
Equipment Height (feet)	2.92								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	132.0	120.0	110.0	101.5	94.3	88.0	82.5	77.6	73.3
1.5	120.0	110.0	101.5	94.3	88.0	82.5	77.6	73.3	69.5
2.0	110.0	101.5	94.3	88.0	82.5	77.6	73.3	69.5	66.0
2.5	101.5	94.3	88.0	82.5	77.6	73.3	69.5	66.0	62.9
3.0	94.3	88.0	82.5	77.6	73.3	69.5	66.0	62.9	60.0
3.5	88.0	82.5	77.6	73.3	69.5	66.0	62.9	60.0	57.4
4.0	82.5	77.6	73.3	69.5	66.0	62.9	60.0	57.4	55.0
4.5	77.6	73.3	69.5	66.0	62.9	60.0	57.4	55.0	52.8
5.0	73.3	69.5	66.0	62.9	60.0	57.4	55.0	52.8	50.8

In lieu of increasing the typical aisle width, an additional vertical empty space (either above or below the EUT) may be implemented as follows:		
Equipment Type	**Equipment Vertical Space (feet)**	**Reference**
Forced-air Fans Frame Depth =18 inches	2.432	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-3)
Forced-air Fans Frame Depth = 24 inches	2.4324	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-6)

Table 3-32 provides maximum heat release information for the MTC housed in a 19-inch frame.

Table 3-32 MTC Maximum Heat Release

MTC Maximum Heat Release Calculation for 19-inch (483mm) Frame									
Power Consumption (Watts)	2800								
Frame Depth (feet)	1.50								
Frame Width (feet)	1.84								
Equipment Height (feet)	2.92								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	208.6	189.6	173.8	160.4	149.0	139.0	130.4	122.7	115.9
1.5	189.6	173.8	160.4	149.0	139.0	130.4	122.7	115.9	109.8
2.0	173.8	160.4	149.0	139.0	130.4	122.7	115.9	109.8	104.3
2.5	160.4	149.0	139.0	130.4	122.7	115.9	109.8	104.3	99.3
3.0	149.0	139.0	130.4	122.7	115.9	109.8	104.3	99.3	94.8
3.5	139.0	130.4	122.7	115.9	109.8	104.3	99.3	94.8	90.7
4.0	130.4	122.7	115.9	109.8	104.3	99.3	94.8	90.7	86.9
4.5	122.7	115.9	109.8	104.3	99.3	94.8	90.7	86.9	83.4
5.0	115.9	109.8	104.3	99.3	94.8	90.7	86.9	83.4	80.2

In lieu of increasing the typical aisle width, an additional vertical empty space (either above or below the EUT) may be implemented as follows:

Equipment Type	**Equipment Vertical Space (feet)**	**Reference**
Forced-air Fans Frame Depth =18 inches	2.432	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-3)
Forced-air Fans Frame Depth = 24 inches	2.4324	Vertical empty space calculation based on Typical Aisle Widths for a Typical 20 x 20 feet Bay (GR-63-CORE, Figure 2-6)

MTC Product Details

Table 3-33 lists the name and a brief description of each of the supported MTCs.

Table 3-33 MTC Product Details

Product Ordering Name (PON)	Description
MTC-ANSI	MTC Chassis ANSI
MTC-ETSI	MTC Chassis ETSI

Functional Description

The MTC supports the following functions:

- The MTC can be deployed as a Main Chassis or an Expansion Chassis within a DTN
  - A DTN can support up to 40 interconnected chassis (28 DTC/MTCs and 12 OTCs) if the Main Chassis includes an MCM-C as the node controller. The Main Chassis must be a DTC or an MTC. The DTN can be configured with up to 8 BMMs, up to 96 line module/TEMs (with optional control module redundancy on any chassis). Each OTC Expansion Chassis can house up to 2 Raman modules or 2 DSEs (with optional control module redundancy on any chassis). Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis)
  - A DTN can support up to 17 interconnected chassis (DTC/MTC/OTCs) if the Main Chassis includes an MCM-B as the node controller. The Main Chassis must be a DTC or an MTC; the 16 Expansion Chassis can be any combination of DTC/MTC/OTCs. The DTN can be configured with up to 8 BMMs, up to 32 line module/TEMs (with optional control module redundancy on any chassis). Each OTC Expansion Chassis can house up to 2 Raman modules or 2 DSEs (with optional control module redundancy on any chassis). Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis)
- The MTC is used in Digital Terminal, Digital Add/Drop, and Digital Repeater configurations
- The MTC can be installed in an ETSI (600mm), 23-inch rack, or 19-inch rack

The MTC is composed of the following components (see Figure 3-14 on page 3-48 for an illustration):

- "Rack Mounting Ears" on page 3-53
- "Power Entry Module (PEM)" on page 3-56
- "Input/Output (I/O) Panel" on page 3-60
- "Timing and Alarm Panel (TAP)" on page 3-64
- "Fan Tray" on page 3-72
- "Air Filter" on page 3-73
- "Card Cage" on page 3-74

Mechanical Specifications

Table 3-34 provides the mechanical specifications for the MTC.

Table 3-34 MTC Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	34.95 inches / 887.73mm (20 RU)
	Width	17.68 inches / 449.07mm (Main Chassis width)
	Depth	15.44 inches / 392.18mm (Overall Chassis depth)
	Weight - with PEMs, air filter, rack mounting ears, and door	82.0lb / 37.1kg
	Weight - fully loaded chassis	233.0lb / 105.6kg

The MTC contains four electrical grounding points. Two sets of two 1/4-20 press-nuts are located on the chassis at the rear bottom and two 1/4-20 press-nuts are located on each side toward the bottom front of the chassis.

Rack Mounting Ears

Each MTC includes integrated rack mounting ears used to flush mount the chassis on a 19-inch rack. Optional rack mounting kits are available for the following configurations:

- Flush mounting on an ETSI (600mm) rack
- Flush and mid-mounting on a 23-inch rack in the positions of flush, 1-inch, 2-inch, 5-inch, or 6-inch forward from the rack rails
- Mid-mounting on a 19-inch rack in the positions of 1-inch, 2-inch, 5-inch, or 6-inch forward from the rack rails

Table 3-35 lists the rack mounting kits available for the MTC.

Table 3-35 MTC Rack Mounting Kits

Product Ordering Name (PON)	Description
M-RM-600-B1	MTC Rack Mounting Accessory Kit for ETSI (600mm) rack installations
M-RM-23-B1	MTC Rack Mounting Accessory Kit for 23-inch rack installations
M-RM-19-B1	MTC Rack Mounting Accessory Kit for 19-inch rack installations

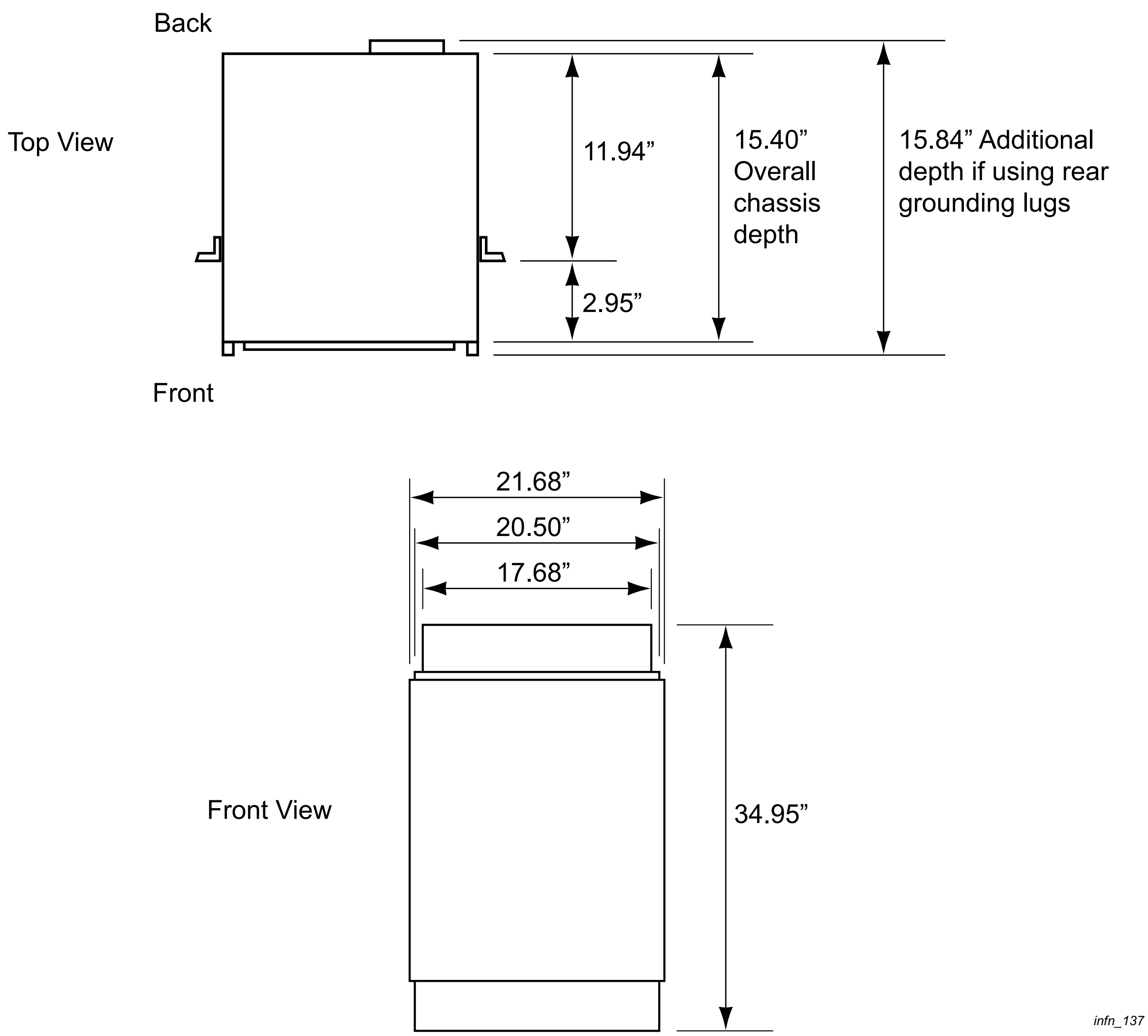
When the rack mounting ears are in the 5-inch back and 6-inch back positions for a forward mount configuration, the MTC uses slack management ears to route the fiber-optic cables. There are three slack management ears on each side of the MTC (six total) which maximize valuable rack space and help to eliminate the pinching of cables in addition to providing correct cable bend radius. This ensures the system's continual integrity and protection against signal loss or degradation.

Vertical Hole Spacing

- For ANSI rack mounting ears, the spacing between each hole is: 3.5 inches (88.9mm)
- For ETSI rack mounting ears, the spacing between each hole is: 90mm

The MTC top and front dimensions of the chassis are provided in Figure 3-16.

Figure 3-16 MTC Dimensions



Note: When the front door is installed and in the closed position, the distance between the front of the chassis and the front door is approximately 2.8 inches (71.1mm).

Power Entry Module (PEM)

Note: Unless specifically noted otherwise, all references to the PEM will refer to either the PEM-70 and/or PEM-35 interchangeably.

Table 3-36 PEM Product Details

Product Ordering Name (PON)	Description
D-PEM-A	Power Entry Module, 70A
D-PEM-35	Power Entry Module, 35A

The top position of the MTC accommodates two PEMs (PEM A and PEM B) for redundant power feeds. Each PEM has either a 70A or 35A circuit breaker for over-current protection on the power feed as shown in Figure 3-17 on page 3-57 (PEM-70) and Figure 3-18 on page 3-57 (PEM-35).

The 35A PEM type, referred to as PEM-35, is available for specific configurations that do not require 70A. The PEM-35 contains a 35A circuit breaker and is distinguished by a white breaker handle while the 70A PEM type, referred to as PEM-70, contains a 70A circuit breaker and is distinguished by a black breaker handle. Other than the different load requirements and PEM outer case markings, the PEM-70 and PEM-35 function identically.

CAUTION

A DTC/MTC configured with PEM-35s will only support a combination of MCMs, BMMs and/or CMMs. Line modules, LM-80s, and/or TEMs must ***not*** be physically installed in slots 3 through 6 of the chassis. In addition, a combination of a PEM-70 and a PEM-35 is supported only during a temporary migration between PEM types; a DTC/MTC configured with a PEM-70 and a PEM-35 is otherwise ***not*** recommended. Contact Infinera TAC for additional information.

Note: When a DTC/MTC is configured with both a PEM-70 and a PEM-35, an Equipment Type Mismatch alarm for the PEMs will be reported by the management interfaces.

External Indicators

Figure 3-17 MTC PEM-70 Faceplate

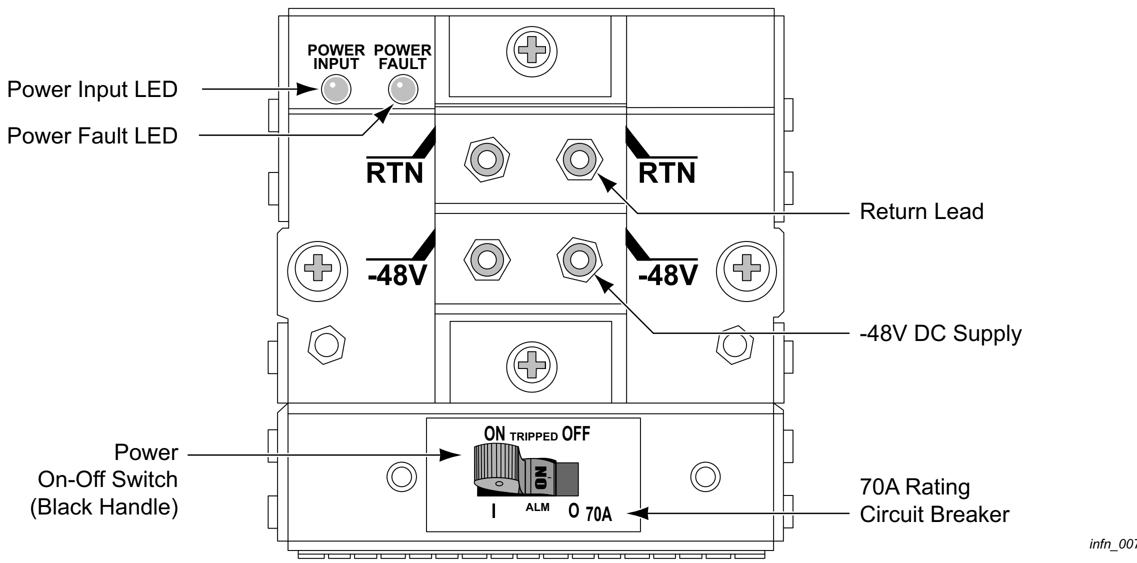
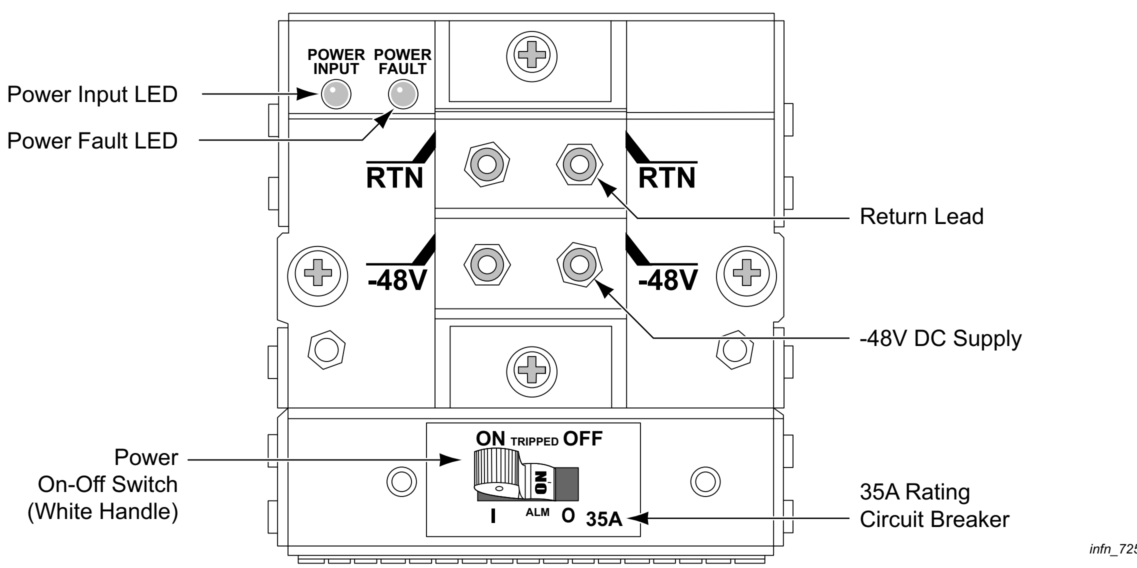


Figure 3-18 MTC PEM-35 Faceplate



Power LEDs

The PEMs located on top of the chassis provide two status LEDs: Power Input and Power Fault. The LEDs indicate whether the power levels are within specified limits. The significance of an illuminated LED is described in Table 3-37.

Table 3-37 MTC PEM Visual Alarm Indicators

POWER INPUT (Green)	POWER FAULT (Red)	Description
ON	OFF	• Input lead is receiving power • Power output from the PEM as per specifications
ON	ON	• Input lead is receiving power • Power output from the PEM not to specifications
OFF	ON	• Input lead is not receiving power • No power output from the PEM as per specifications
OFF	OFF	• Input lead is not receiving power • No power output from the PEM as per specifications

Connectors

Each MTC PEM is provided with two sets of dual 1/4-20 studs on 5/8” centers. One set is for connection to -48V DC Power and the second set to its Return. The studs are capable of accommodating industry standard two-hole compression lugs on 5/8” centers. A plastic safety cover is provided to prevent inadvertent contact with the terminals once installed.

CAUTION

To prevent damage to the PEM, the compression lugs used must have 1/4 inch diameter stud hole size, 5/8 inch hole spacing, and the lug width must not exceed 0.60 inch.

Technical Specifications

Table 3-38 provides the mechanical and electrical specifications for the MTC PEM.

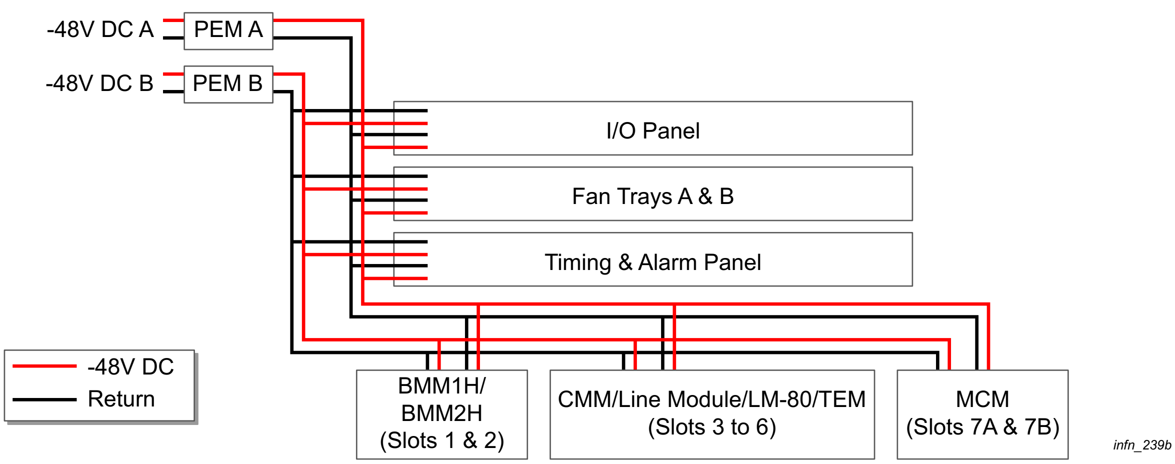
Table 3-38 MTC PEM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.70 inches / 93.98mm
	Width	3.30 inches / 83.82mm
	Depth	10.80 inches / 274.32mm
	Weight	3.0lb / 1.3kg
Electrical specifications	Power consumption	Included as part of base MTC system; see Table 3-1 on page 3-4

Power Distribution Architecture

The MTC PEM A and PEM B distribute the power supply to the power connectors on top of the backplane. The backplane feeds the power supply from each PEM to the circuit packs as shown in Figure 3-19.

Figure 3-19 MTC Power Distribution Diagram



The MTC hardware modules combine the power feed by diode-ORing. The -48V DC inputs are individually fused on the circuit packs, I/O panel, TAP, and fan trays to protect it from overcurrent conditions. The fuse is not field-replaceable. The status of each fuse is monitored before the ORing diodes. A diode and a transient voltage suppression (TVS) diode are provided to protect against reverse polarity and transient overvoltage conditions.

Input/Output (I/O) Panel

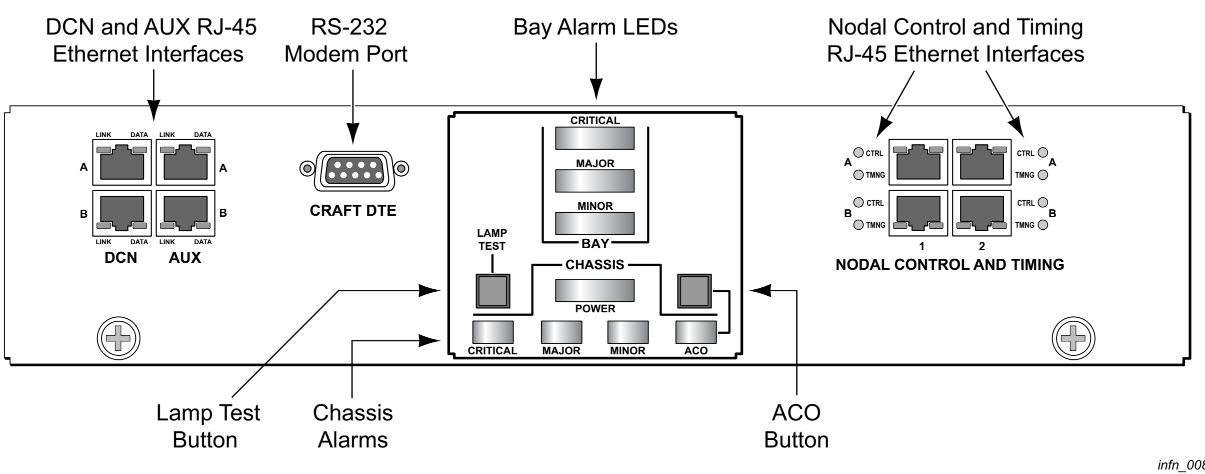
Note: In a multi-chassis configuration the DCN and AUX ports on the Main Chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

The I/O panel is part of the MTC. The I/O panel houses the management and operations interfaces as described below. The front view of the I/O panel is shown in Figure 3-20.

- Two 10/100Mbps auto-negotiating Data Communication Network (DCN) RJ-45 Ethernet interfaces, labeled as DCN. This interface provides ports for Ethernet network connectivity
- Two 10/100Mbps auto-negotiating Administrative Inter-LAN RJ-45 Ethernet interfaces, labeled as AUX. This interface provides ports for Datawire services
- Four 10/100Mbps auto-negotiating inter-chassis interconnect RJ-45 Ethernet interfaces, labeled as Nodal Control and Timing (NCT). This interface provides ports for a multi-chassis configuration
- Craft RS-232 Modem port labeled as Craft DTE
- Bay level alarm LEDs (Critical, Major, and Minor)
- Chassis level alarm LEDs (Power, Critical, Major, and Minor)
- One Lamp Test button
- One Alarm Cutoff (ACO) button
- One ACO LED

External Indicators

Figure 3-20 MTC I/O Panel Front View



Bay Level Alarm LEDs

The bay level indicators reflect the alarm status of all chassis in a bay as described in Table 3-39.

Table 3-39 MTC Visual Alarm Indicators - Bay Level

LED	Color	Description
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in any of the chassis in the bay
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in any of the chassis in the bay
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in any of the chassis in the bay

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding bay level and chassis level LED functions.

Chassis Level Alarm LEDs

The I/O panel provides chassis level alarms, POWER, CRITICAL, MAJOR, and MINOR LEDs. These indicate the severities of the current outstanding alarms within that chassis. The POWER LED indicates the power-on status. Each chassis has an Alarm Cutoff (ACO) button on the alarm panel which controls the reporting of audible alarms. The significance of an illuminated LED is described in Table 3-40.

Table 3-40 MTC Visual Alarm Indicators - Chassis Level

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply within the specified operating range to the chassis
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in the chassis
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in the chassis
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in the chassis
ACO	Yellow	Indicates the presence (lit) or absence (dimmed) of the Alarm Cutoff function

Lamp Test

The I/O panel contains a lamp test button for testing the LEDs. When the lamp test button is pressed, all LEDs on the I/O panel and the circuit packs on the chassis are lit (power LEDs illuminate Green and fault LEDs illuminate Red) and bi-color LEDs will toggle between two colors (Green and Yellow) until the lamp test button is released. Once the lamp test button is released, all LEDs will return to the previous condition.

Alarm Cutoff (ACO) Indicators

The I/O panel contains one ACO button and an ACO LED. The ACO feature allows muting of the external audible alarms. When the ACO button is pressed, all current critical, major, and minor audio alarms are muted and the ACO LED is lit. Table 3-41 provides a description of the alarm state and the ACO LED state.

Table 3-41 MTC Audio Alarm Indicators - Chassis Level

Condition	ACO LED State	Audio Alarm
There are no external alarms on the chassis	OFF	Not present
An external alarm is raised on the chassis	OFF	Present
ACO button is pressed	ON	Muted
An external alarm is cleared	OFF	Not present

I/O Connectors

The I/O panel has a total of eight RJ-45 ports and one RS-232 port as described in Table 3-42.

Table 3-42 MTC I/O Panel Connectors

Connector	Type	Purpose
DCN A, DCN B	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors with redundancy for remote management through DCN
AUX A, AUX B	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Two connectors for datawire service to carry customer management traffic
CRAFT DTE	9600 baud RS-232 DTE DB-9 Male	Allows remote management through a modem
NODAL CONTROL AND TIMING (NCT)	10/100Base-Tx Auto-MDIX RJ-45 Ethernet	Four connectors for Inter-chassis communication for uplink and downlink with A and B connectors for redundancy

Note: NCT ports are used for multi-chassis interconnection.

Note: In a multi-chassis configuration the DCN and AUX ports on the Main Chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

DCN and AUX Port LEDs

The I/O panel provides DCN and AUX port visual indicators: a DATA and a LINK LED. The significance of an illuminated LED is described in Table 3-43.

Table 3-43 MTC Visual Alarm Indicators on the DCN and AUX Ports

DATA (Green)	LINK (Green)	Description
ON	ON	• Link established • The port is active
OFF	OFF	• Link not established
OFF	ON	• Link established • The port is not active

NCT Port LEDs

The I/O panel provides NCT port visual indicators: a Control (CTRL) and a Timing (TMNG) LED. The significance of an illuminated LED is described in Table 3-44.

Table 3-44 MTC Visual Alarm Indicators on the NCT Ports

LED	Color	Description
CTRL	Tri-color	• ON (Green)—Link is established, rapid spanning tree protocol (RSTP) is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established
TMNG	Tri-color	• ON (Green)—Link is established, RSTP is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established

Timing and Alarm Panel (TAP)

The TAP provides interfaces for external timing synchronization and environmental alarm contacts. The TAP does not contain any active component. External timing synchronization is not supported. However, the TAP houses Telcordia and ITU Building Integrated Timing Supply (BITS) input and output timing interfaces. The BITS interfaces are labeled using the “A/B” convention for indicating paired interfaces. The configuration of the timing synchronization mode (T1 versus E1) determines which of the physical ports is referenced.

The TAP also houses alarm input and output contact sets. The TAP has 20 alarm input contact sets. Each input alarm contact set has two contacts. Sixteen alarm input contact sets are user customizable, while the rest are reserved for Bay LED and ACO inputs from an external chassis. Refer to “MTC Alarm Input Contact Pin Assignments” on page 3-66 for the list of the alarm contacts.

The TAP has 20 alarm output contact sets. Each output alarm contact set consists of Normally-closed, Normally-open and common contacts. Ten output contacts are user customizable, while the rest are reserved for office alarms and bay alarms. Refer to “MTC Alarm Output Contact Pin Assignments” on page 3-68 for the list of the alarm contacts.

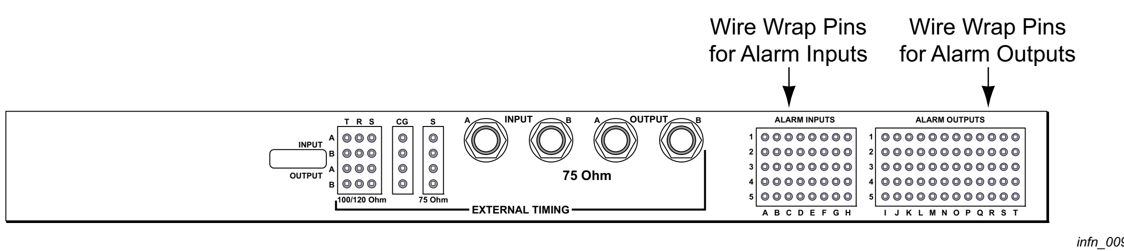
Chassis Level Audio Indicators

The TAP provides output alarm contacts for CRITICAL, MAJOR, and MINOR audible alarms. Audible alert is triggered when an alarm is raised on the chassis.

External Connectors

The input and output dry alarm contacts of 0.045sq. inch pins are accessible from the front of the TAP to facilitate easy interconnection. These contacts are used for integration with existing environmental alarm systems. The alarm pin positions are shown in Figure 3-21.

Figure 3-21 MTC TAP Front View



The input and output connector details are provided in Table 3-45.

Table 3-45 MTC TAP External Connectors

Connector	Type	Purpose
ALARM INPUTS	0.045sq. inch wire wrap pins	Environmental alarm inputs and office alarm input contacts
ALARM OUTPUTS	0.045sq. inch wire wrap pins	Environmental alarm output and office alarm output contacts

Technical Specifications

The environmental alarm contacts have the electrical ratings specified in Table 3-46.

Table 3-46 MTC Alarm Relay Contact Specifications

Parameter	Value
Maximum voltage	250V AC, 220V DC
Maximum current	2A
Rated load	0.5A @ 125V AC, 2A @ 30V DC
Wire size	24 AWG minimum
Maximum surge voltage between contact and coil	2,500V

Alarm Input Contact Pin Assignments

Table 3-47 lists the assignment of alarm input contact pins for the MTC. Four alarm contacts are pre-defined in the system and the remaining sixteen contacts can be customized by the users to monitor environmental alarms.

Table 3-47 MTC Alarm Input Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	A	Alarm Input Contact 1	User defined
1	B	Alarm Input Contact 1	User defined
1	C	Alarm Input Contact 6	User defined
1	D	Alarm Input Contact 6	User defined
1	E	Alarm Input Contact 11	User defined
1	F	Alarm Input Contact 11	User defined
1	G	Alarm Input Contact 16	User defined
1	H	Alarm Input Contact 16	User defined
2	A	Alarm Input Contact 2	User defined
2	B	Alarm Input Contact 2	User defined
2	C	Alarm Input Contact 7	User defined
2	D	Alarm Input Contact 7	User defined
2	E	Alarm Input Contact 12	User defined
2	F	Alarm Input Contact 12	User defined
2	G	Reserved for Critical Bay alarm	Predefined
2	H	Reserved for Critical Bay alarm	Predefined
3	A	Alarm Input Contact 3	User defined
3	B	Alarm Input Contact 3	User defined
3	C	Alarm Input Contact 8	User defined
3	D	Alarm Input Contact 8	User defined
3	E	Alarm Input Contact 13	User defined
3	F	Alarm Input Contact 13	User defined
3	G	Reserved for Major Bay alarm	Predefined
3	H	Reserved for Major Bay alarm	Predefined
4	A	Alarm Input Contact 4	User defined
4	B	Alarm Input Contact 4	User defined
4	C	Alarm Input Contact 9	User defined
4	D	Alarm Input Contact 9	User defined
4	E	Alarm Input Contact 14	User defined

Table 3-47 MTC Alarm Input Contact Pin Assignments

Pin		Description	Function
Row	Column		
4	F	Alarm Input Contact 14	User defined
4	G	Reserved for Minor Bay alarm	Predefined
4	H	Reserved for Minor Bay alarm	Predefined
5	A	Alarm Input Contact 5	User defined
5	B	Alarm Input Contact 5	User defined
5	C	Alarm Input Contact 10	User defined
5	D	Alarm Input Contact 10	User defined
5	E	Alarm Input Contact 15	User defined
5	F	Alarm Input Contact 15	User defined
5	G	Reserved for Alarm Cutoff (ACO)[a]	Predefined
5	H	Reserved for Alarm Cutoff (ACO)[a]	Predefined

a. ACO can be enabled using the input contact pins in addition to the ACO push button and the Infinera GNM user interface.

Alarm Output Contact Pin Assignments

Table 3-48 lists the assignment of alarm output contact pins for the MTC. Ten alarm contacts are pre-defined in the system and the remaining ten contacts can be customized by the users to monitor the environmental alarms.

Table 3-48 MTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	K	Alarm Output Contact 1, RETURN	User defined
1	L	Alarm Output Contact 1, NORMALLY OPEN	User defined
1	M	Alarm Output Contact 1, NORMALLY CLOSED	User defined
1	N	Alarm Output Contact 6, RETURN	User defined
1	O	Alarm Output Contact 6, NORMALLY OPEN	User defined
1	P	Alarm Output Contact 6, NORMALLY CLOSED	User defined
1	Q	Critical Audio Alarm, RETURN	Predefined
1	R	Critical Audio Alarm, NORMALLY OPEN	Predefined
1	S	Critical Audio Alarm, NORMALLY CLOSED	Predefined
1	T	Minor Visual Alarm, RETURN	Predefined
1	U	Minor Visual Alarm, NORMALLY OPEN	Predefined
1	V	Minor Visual Alarm, NORMALLY CLOSED	Predefined
2	K	Alarm Output Contact 2, RETURN	User defined
2	L	Alarm Output Contact 2, NORMALLY OPEN	User defined

Table 3-48 MTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
2	M	Alarm Output Contact 2, NORMALLY CLOSED	User defined
2	N	Alarm Output Contact 7, RETURN	User defined
2	O	Alarm Output Contact 7, NORMALLY OPEN	User defined
2	P	Alarm Output Contact 7, NORMALLY CLOSED	User defined
2	Q	Major Audio Alarm, RETURN	Predefined
2	R	Major Audio Alarm, NORMALLY OPEN	Predefined
2	S	Major Audio Alarm, NORMALLY CLOSED	Predefined
2	T	Power Fault Alarm, RETURN	Predefined
2	U	Power Fault Alarm, NORMALLY OPEN[a]	Predefined
2	V	Power Fault Alarm, NORMALLY CLOSED[a]	Predefined
3	K	Alarm Output Contact 3, RETURN	User defined
3	L	Alarm Output Contact 3, NORMALLY OPEN	User defined
3	M	Alarm Output Contact 3, NORMALLY CLOSED	User defined
3	N	Alarm Output Contact 8, RETURN	User defined
3	O	Alarm Output Contact 8, NORMALLY OPEN	User defined
3	P	Alarm Output Contact 8, NORMALLY CLOSED	User defined
3	Q	Minor Audio Alarm, RETURN	Predefined

Table 3-48 MTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
3	R	Minor Audio Alarm, NORMALLY OPEN	Predefined
3	S	Minor Audio Alarm, NORMALLY CLOSED	Predefined
3	T	Critical Bay Alarm, RETURN	Predefined
3	U	Critical Bay Alarm, NORMALLY OPEN	Predefined
3	V	Critical Bay Alarm, NORMALLY CLOSED	Predefined
4	K	Alarm Output Contact 4, RETURN	User defined
4	L	Alarm Output Contact 4, NORMALLY OPEN	User defined
4	M	Alarm Output Contact 4, NORMALLY CLOSED	User defined
4	N	Alarm Output Contact 9, RETURN	User defined
4	O	Alarm Output Contact 9, NORMALLY OPEN	User defined
4	P	Alarm Output Contact 9, NORMALLY CLOSED	User defined
4	Q	Critical Visual Alarm, RETURN	Predefined
4	R	Critical Visual Alarm, NORMALLY OPEN	Predefined
4	S	Critical Visual Alarm, NORMALLY CLOSED	Predefined
4	T	Major Bay Alarm, RETURN	Predefined
4	U	Major Bay Alarm, NORMALLY OPEN	Predefined
4	V	Major Bay Alarm, NORMALLY CLOSED	Predefined

Table 3-48 MTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
5	K	Alarm Output Contact 5, RETURN	User defined
5	L	Alarm Output Contact 5, NORMALLY OPEN	User defined
5	M	Alarm Output Contact 5, NORMALLY CLOSED	User defined
5	N	Alarm Output Contact 10, RETURN	User defined
5	O	Alarm Output Contact 10, NORMALLY OPEN	User defined
5	P	Alarm Output Contact 10, NORMALLY CLOSED	User defined
5	Q	Major Visual Alarm, RETURN	Predefined
5	R	Major Visual Alarm, NORMALLY OPEN	Predefined
5	S	Major Visual Alarm, NORMALLY CLOSED	Predefined
5	T	Minor Bay Alarm, RETURN	Predefined
5	U	Minor Bay Alarm, NORMALLY OPEN	Predefined
5	V	Minor Bay Alarm, NORMALLY CLOSED	Predefined

a. When there is no power fault condition, the Normally Open contact is closed and the Normally Closed contact is open. When both PEM A and PEM B have power fault condition, the Normally Open contact is open and Normally Closed contact is closed. The power fault is defined as when the power input into PEM A or PEM B is out of working range.

Fan Tray

The MTC contains two removable fan trays. Each fan tray consists of three individually controlled fans. The top fan tray is referred to as Fan Tray A, and the bottom tray is referred to as Fan Tray B. The thermal system employs a push-pull approach to move air through the system. The airflow enters from the bottom front and sides, and exits from the top rear and sides.

Both fan trays are required for normal operation and are not redundant. However, individual fans within a fan tray, are N+1 redundant with power hot-swap controllers. If one of the six fans is failed, the MTC system can operate indefinitely in an environment up to 50ºC. An alarm will be generated that indicates one of the fans has failed. Although the system can run reliably with one fan failed, the user should change the fan tray at the earliest convenience to ensure against a second fan failure.

The faulted fan tray should be kept installed inside the MTC until the replacement fan tray is available. If a fan tray is completely removed from the MTC, the chassis should be able to run without failure in an ambient up to 45ºC as long as the air filter is clean.

The fan trays should never be partially removed from the system unless performing air filter maintenance (when performing air filter maintenance, the fan trays should not be removed from the system for more than one minute).

A POWER LED and a FAULT LED are provided on each fan tray. The significance of an illuminated LED is described in Table 3-49.

Table 3-49 MTC Fan Tray Visual Alarm Indicators

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the fan tray
FAULT	Red	Indicates the presence (lit) or absence (dimmed) of a fault condition with the fan tray. Flashing Red indicates that the fan is not under control of the active MCM (for example, the active MCM has been reset or physically removed from the system)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding fan tray LED functions.

Technical Specifications

Table 3-50 provides the mechanical and electrical specifications for the MTC fan tray.

Table 3-50 MTC Fan Tray Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	2.15 inches / 54.61mm
	Width	17.48 inches / 443.99mm
	Depth	10.53 inches / 267.46mm
	Weight	10.0lb / 4.5kg
Electrical specifications	Power consumption	Included as part of base MTC system; see Table 3-1 on page 3-4

Air Filter

A replaceable air filter is necessary to filter out dust particles at the air intake of the MTC. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the MTC the air filter must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filter once every six months.

Mechanical Specifications

Table 3-51 provides the mechanical specifications for the MTC air filter.

Table 3-51 MTC Air Filter Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	17.32 inches / 439.93mm
	Depth	9.70 inches / 246.38mm
	Weight	Less than 0.5lb / 0.2kg
	Dust arrestance	80%

Card Cage

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The MTC contains a single card cage consisting of seven chassis slots which house the circuit packs that provide the optical and digital transport functions of the system as shown in Figure 3-22.

Slots 1 and 2 are half-height slots reserved for BMM1H/BMM2Hs, slots 3 through 6 are full-height slots reserved for CMMs, line modules, LM-80s, and/or TEMs, and slot 7 is divided into two half-height slots (7A and 7B) reserved for MCMs. Table 3-52 on page 3-75 outlines the MTC card slot assignments.

The MTC features a “Mesh” backplane switching mode when used in conjunction with XLM/AXLM/SLM/AXLM-80/SLM-80s (DLM/ADLM/ADLM-80s do not support Mesh switching mode). Mesh switching mode supports incremental line module-slot to line module-slot connectivity. For additional information, refer to the *Infinera DTN and DTN-X System Description Guide*.

Figure 3-22 MTC Card Cage

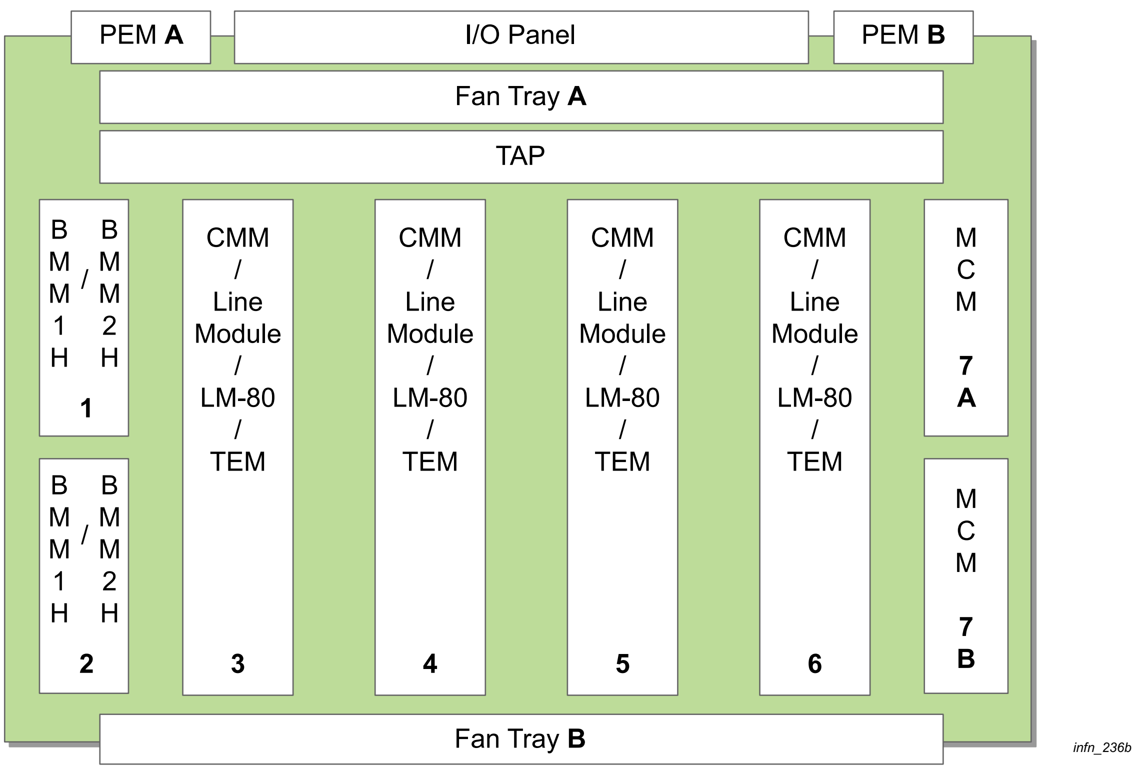


Table 3-52 MTC Card Slot Assignments

Slot Number	Module Type
1	BMM1H/BMM2H
2	
3	CMM/Line Module/LM-80/TEM
4	
5	
6	
7A	MCM
7B	

MTC Data Plane

Note: The MTC type chassis is set to Ring switching mode by default and can be set to Mesh switching mode only when all line modules are removed and deleted from the chassis or during initial commissioning of the chassis and before any line module is added (pre-provisioned/provisioned) to the chassis with no modules installed in slots 3, 4, 5, and 6.

Note: DLM/ADLM/ADLM-80s are not supported in a chassis that is set to Mesh switching mode. If a DLM/ADLM/ADLM-80 is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the DLM/ADLM/ADLM-80.

Note: In multi-chassis nodes, each chassis can be configured independently for Ring or Mesh mode. The chassis in a multi-chassis node do not all have to be configured to the same backplane mode.

In each MTC, slots 3 through 6 comprise the data plane. Table 3-53 on page 3-76 lists the maximum supported switching capacity across the data plane (per slot pair), based on installed line module/TEMs.

For additional information on data plane functionality, refer to the *Infinera DTN and DTN-X System Description Guide*.

Table 3-53 MTC Switching Capacity between Line Module/LM-80/TEMs Slots

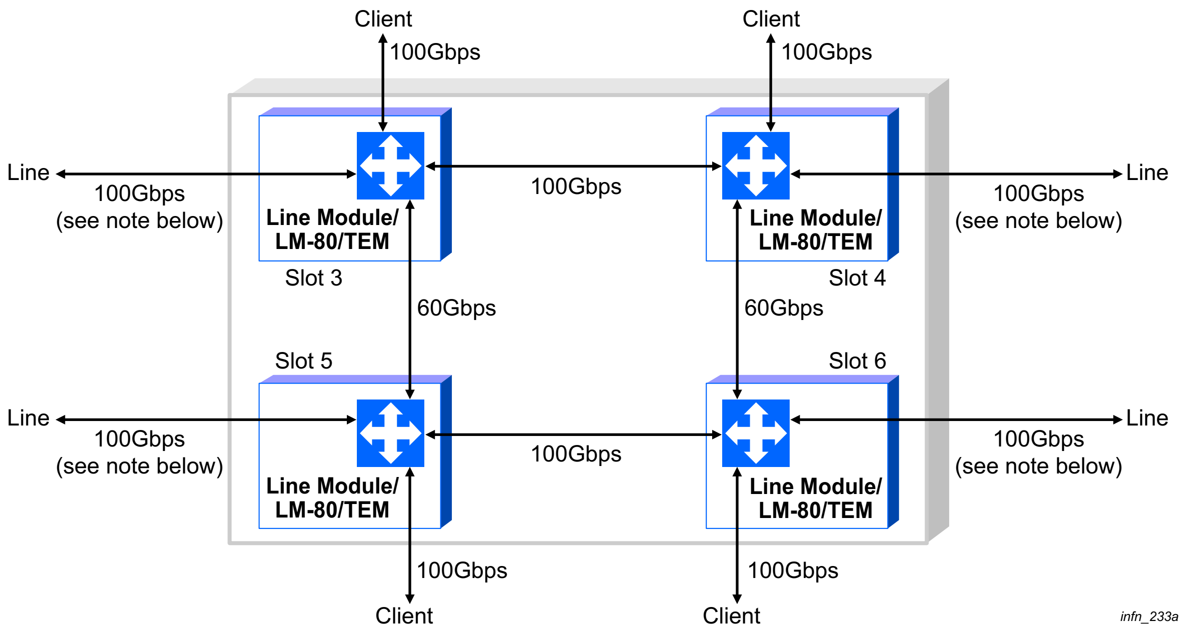
Slot Pair	Switching Capacity (Ring Mode) using Line Module/LM-80/TEMs	Switching Capacity (Mesh Mode) using XLM/AXLM/SLM/AXLM-80/ SLM-80s Only
3 and 4	100Gbps	100Gbps
3 and 5	60Gbps	100Gbps
3 and 6	No direct connectivity	100Gbps
4 and 5	No direct connectivity	100Gbps
4 and 6	60Gbps	100Gbps
5 and 6	100Gbps	100Gbps

Follow these guidelines for configuring Mesh switching mode on an MTC:

- DLM/ADLM/ADLM-80s are not supported in an MTC that is set to Mesh switching mode. If a DLM/ ADLM/ADLM-80 is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the DLM/ADLM/ADLM-80
- The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/ AXLM-80/SLM-80s in each slot. See Figure 3-23 on page 3-77
- If a TEM is used in a slot pair on an MTC configured for Mesh switching mode, the switching capacity for that particular slot pair is reduced to 60Gbps
  - Only one TEM can be used in slots 3 and 5, and slots 4 and 6 (the other slot must contain an XLM/AXLM/SLM/AXLM-80/SLM-80s to provide access to the virtual fabric). See Figure 3-25 on page 3-79

Figure 3-23 shows the bandwidth capabilities of an MTC configured for Ring switching mode and provisioned with line modules, LM-80s, and/or TEMs.

Figure 3-23 MTC Ring Switching Mode Bandwidth Capacity

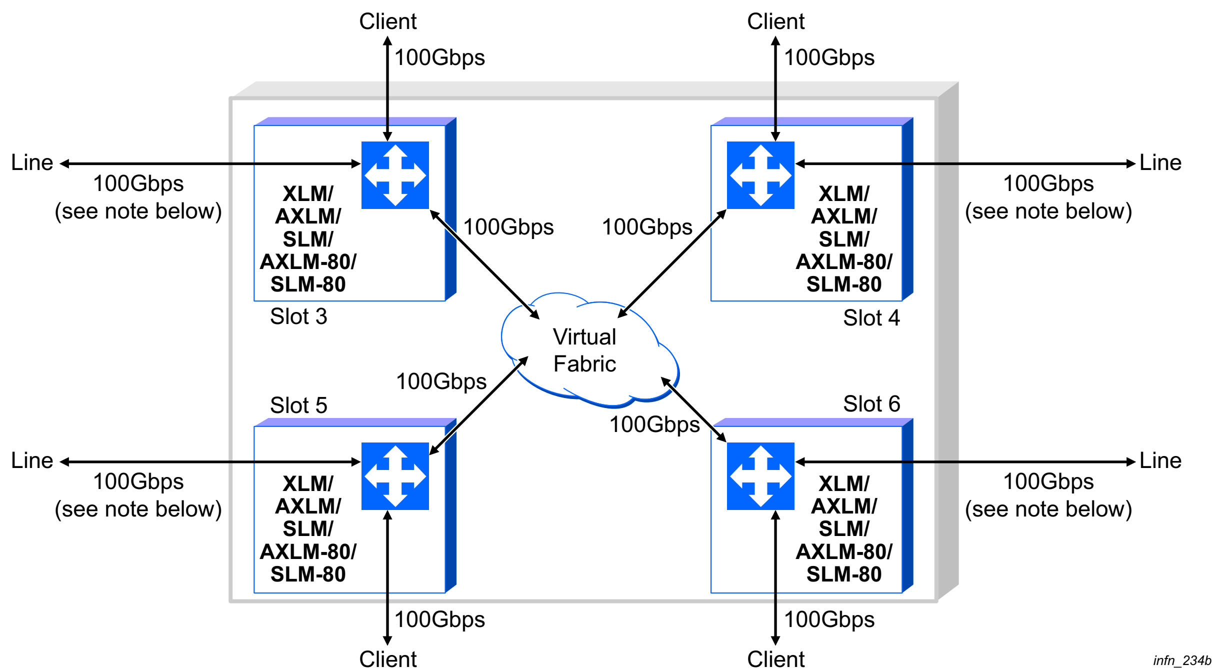


Note: The LM-80 only supports up to 80Gbps across the line side.

Note: The bandwidth capabilities for an MTC configured for Ring switching mode are the same regardless of whether the chassis is provisioned with line modules, LM-80s, and/or TEMs.

Figure 3-24 shows the bandwidth capabilities of an MTC configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s.

Figure 3-24 MTC Mesh Switching Mode Bandwidth Capacity (without TEMs)



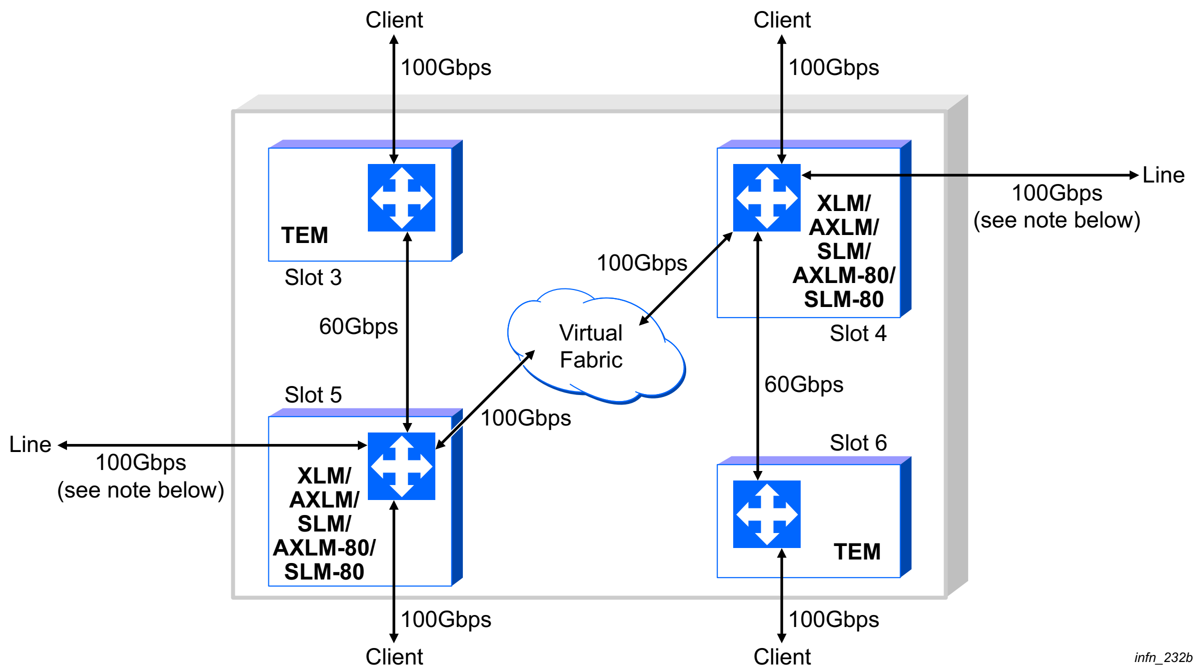
Note: The AXLM-80/SLM-80 only supports up to 80Gbps across the line side.

Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the MTC is configured for Mesh switching mode and provisioned with XLMAXLM/SLM/AXLM-80/SLM-80s in each slot.

Figure 3-25 shows the bandwidth capabilities of an MTC configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s and TEMs.

Note: When TEMs are used, the switching capacity for the particular slot pair is reduced to 60Gbps. Only one TEM can be used in slots 3 and 5, and slots 4 and 6 (the other slot must contain an XLM/AXLM/SLM/AXLM-80/SLM-80 to provide access to the virtual fabric).

Figure 3-25 MTC Mesh Switching Mode Bandwidth Capacity (with TEMs)



Note: The AXLM-80/SLM-80 only supports up to 80Gbps across the line side.

Note: Any attempt to provision a TEM in a chassis configured for Mesh switching mode in *both* slot 3 and slot 5 will be denied by the management interfaces, as will any attempt to provision a TEM in *both* slot 4 and slot 6.

Management Control Module (MCM)

Note: Unless specifically noted otherwise, all references to the MCM will refer to either the MCM-B and/or MCM-C interchangeably.

Table 3-54 MCM Product Details

Product Ordering Name (PON)	Description
MCM-B	Management Control Module
MCM-C	Management Control Module

Functional Description

The Management Control Module, referred to as MCM, is a half-height module that occupies reserved slot 7A and/or slot 7B of the DTC/MTC and provides shelf controller functionality for all modules resident within the chassis. Each DTC/MTC must have at least one MCM.

The MCM contains the system software and configuration database for the DTN and performs the following:

- Management gateway functions to the external DCN in the Main Chassis
- In a multi-chassis configuration, the MCM in the Main Chassis performs node controller functions controlling all chassis within the DTN
- In the Expansion Chassis, the MCM performs shelf controller functions controlling only the modules resident within that chassis

Note: Only MCMs in a Main Chassis will contain the configuration database.

The MCMs in the Main Chassis and Expansion Chassis are interconnected through NCT ports located on the I/O Panel.

For high-availability, redundant MCMs can be deployed in a DTC/MTC. One MCM actively performs the node/shelf control functions while the other MCM is in the standby mode. In a multi-chassis configuration, the interconnected redundant MCMs provide the inter-chassis redundancy.

Note: In a multi-chassis configuration the DCN and AUX ports on the I/O panel of the Main Chassis are active. The DCN and AUX ports on the I/O panel of an Expansion Chassis are disabled.

The MCM supports the local craft interfaces for local management access.

MCM-C

The MCM-C provides enhanced performance compared to previous version MCMs and allows for support of large-capacity DTNs (DTNs containing up to 96 line module/TEMs).

The MCM-C contains resource enhancements such as a higher performance CPU, increased flash memory for persistence storage, and increased/higher bandwidth physical memory.

Note: The MCM-C does not support the following DTC fan tray PON type: D-FANTRAY-A.

For single-chassis DTNs and for Expansion Chassis on multi-chassis DTNs, any combination of MCM-B and MCM-C can be used. For the Main Chassis on a multi-chassis DTN, the management interfaces (Infinera DNA/GNM/TL1) will raise the alarm OLDREV-CTRLR (older revision controller present in invalid configuration) if an MCM-B is installed on a node with more than 32 line modules provisioned.

Note: The OLDREV-CTRLR alarm is raised by the management interfaces (Infinera DNA/GNM/TL1) on nodes with an MCM-B node controller when the node is provisioned with 32 line modules, although the maximum number of line modules supported for an MCM-B node controller is 48. The OLDREV-CTRLR alarm has no functional impact and this discrepancy will be resolved in a future IQ NOS software release.

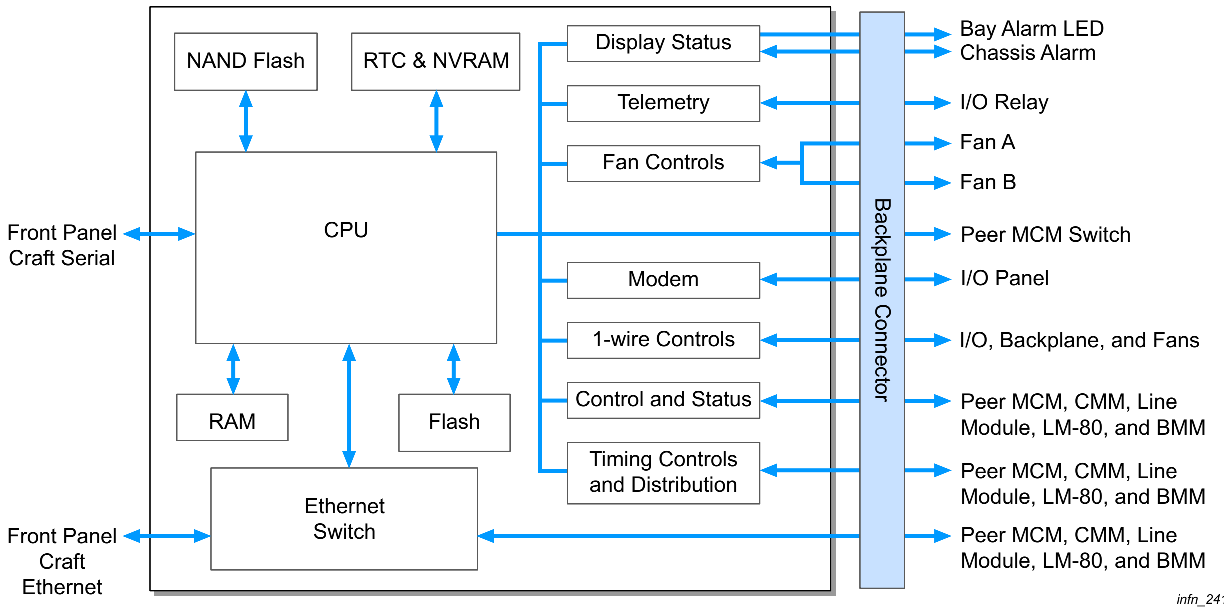
The MCM parameters are provided in Table 3-55.

Table 3-55 MCM Parameters

Parameter	MCM-B	MCM-C
CPU Frequency	466Mhz	1250Mhz
Persistence Storage	1GB	2GB
Physical Memory (SDRAM)	512MB	2GB

Block Diagram

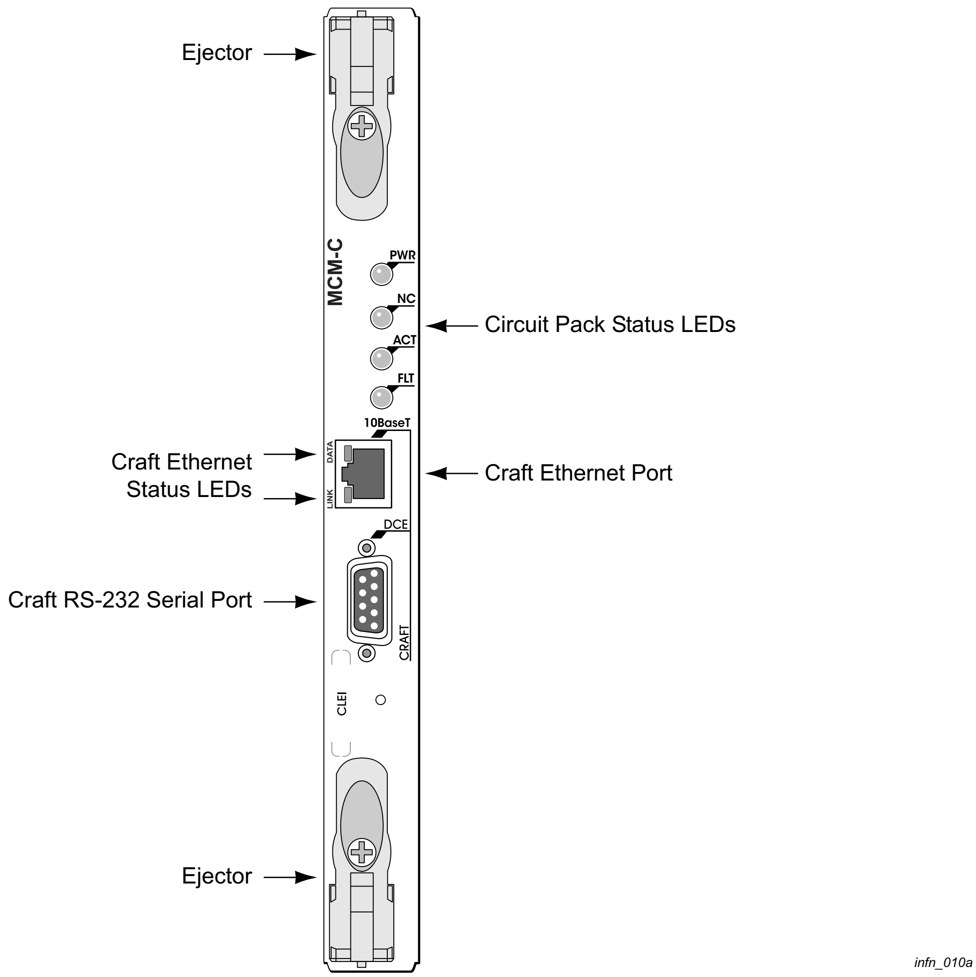
Figure 3-26 MCM Functional Block Diagram



External Indicators and Connectors

The MCM provides circuit pack status LED indicators and craft Ethernet/serial port connectors as shown in Figure 3-27.

Figure 3-27 MCM Faceplate



Note: Figure 3-27 shows the faceplate for an MCM-C but applies to all MCM types.

Circuit Pack Level LEDs

The MCM provides four LEDs to indicate the circuit pack status as described in Table 3-56.

Table 3-56 MCM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the MCM
NC (Node Controller)	Green	Indicates the circuit pack function: Active (Green) or Standby (off). Flashing Green indicates circuit pack is up but the management planes are not up
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions. The MCM circuit pack LED states are determined by controller configuration: Node Controller (NC) Active MCM, NC Standby MCM, Shelf Controller (SC) Active MCM, and SC Standby MCM.

Port Indicators

The craft Ethernet port on the front panel of the MCM has the craft Ethernet status LEDs: DATA and LINK. The LED illumination is as shown in Table 3-57.

Table 3-57 Port Visual Alarm Indicators on the MCM

LINK (Green)	DATA (Green)	Description
ON	ON	• Link established • Port is active
OFF	OFF	• Link not established
ON	OFF	• Link established • Port is not active

Connectors

The MCM provides craft Ethernet and craft serial ports for management purposes as described in Table 3-58.

Table 3-58 MCM Connectors

Connector	Type	Purpose
CRAFT10Base-T	10/100Base-Tx Auto-MDIX RJ-45	Used by maintenance personnel for managing the network element
CRAFT DCE	9600 RS-232 DCE DB-9 Female	Used by maintenance personnel for initial commissioning of a network element during turn-up and test. Also used for field-debugging

Technical Specifications

Table 3-59 provides the mechanical and electrical specifications for the MCM.

Table 3-59 MCM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	8.95 inches / 227.33mm
	Width	1.00 inches / 25.40mm
	Depth	11.1 inches / 281.94mm
	Weight	2.7lb / 1.2kg
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Band Multiplexing Module (BMM)

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

There are several different BMM types supported on the DTC/MTC, all of which provide Optical Carrier Group (OCG) multiplexing/de-multiplexing and EDFA gain with some accommodating mid-stage access for dispersion compensation. The BMM occupies reserved slot 1 and/or slot 2 of the DTC/MTC and can be broken down into the following categories:

- BMM-4-Cn (n=1,2,3)[1]: four-port, full-height BMM used on the DTC that multiplexes up to four OCGs in the C-Band, and has L-Band expansion capabilities. MS in the part number indicates mid-stage access. Versions A and B exist for this module. This BMM is used to support a 40-channel system

Note: When deploying a BMM-4-Cn Version A that has mid-stage access, if the DCM is between 0 and 800 ps/nm, the addition of a 5dB optical attenuator is required for normal operation. If the DCM is above 800 ps/nm then there is no requirement for the 5dB optical attenuator.

- BMM-4-CXn (n=1,2,3)[1]: four-port, full-height BMM used on the DTC that multiplexes up to four OCGs in the C-Band only. The X in the part number signifies that this BMM does not have L-Band expansion capabilities. MS in the part number indicates mid-stage access. BMM-4-CXn Version A performs the same function as BMM-4-Cn Version B. This BMM is used to support a 40-channel system
- BMM-8-CXHn (n=1,2,3)[1]: eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. The X in the part number signifies that this BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. This high power BMM is used to support an 80-channel system
- BMM2-8-CXH2-MS: Gen 2, eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. The X in the part number signifies that this BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. MS in the part number indicates mid-stage access. This high power BMM is used to support an 80-channel system
- BMM2-8-CH3-MS: Gen 2, eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. This BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. MS in the part number indicates mid-stage access. This high power BMM is used to support an 80-channel system or in conjunction with the BMM2-8-CEH3 expansion BMM2 to support a 160-channel system
- BMM2-8-CEH3: Gen 2, eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. This BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. The E in the part number indicates that this BMM is an expansion BMM2 used only in conjunction with the BMM2-8-CH3 to provide expansion capabilities to support a 160-channel system

1. Value (n=1,2,3) corresponds to differences in span loss specifications, see Table 3-60 on page 3-87.

- BMM2P-8-CH1-MS: Gen 2, eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. This BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. MS in the part number indicates mid-stage access. This high power BMM is used to support an 80-channel system or in conjunction with the BMM2P-8-CEH1 expansion BMM2P to support a 160-channel system
- BMM2P-8-CEH1: Gen 2, eight-port, full-height BMM used on the DTC that multiplexes up to eight OCGs in the C-Band only. This BMM does not have L-Band expansion capabilities. The H in the part number identifies it as a high power BMM. The E in the part number indicates that this BMM is an expansion BMM2P used only in conjunction with the BMM2P-8-CH1-MS to provide expansion capabilities to support a 160-channel system
- BMM1H-4-CX2: four-port, half-height BMM used on the MTC that multiplexes up to four OCGs in the C-Band only. The X in the part number signifies that this BMM does not have L-Band expansion capabilities. This BMM is used to support a 40-channel system
- BMM2H-4-R3-MS: Gen 2, four-port, half-height BMM used on the MTC that multiplexes up to four OCGs in the C-Band only. MS in the part number indicates mid-stage access. This BMM is used to support a 40-channel system or in conjunction with the BMM2H-4-B3 expansion BMM2H to support an 80-channel system
- BMM2H-4-B3: Gen 2, four-port, half-height BMM used on the MTC that multiplexes up to four OCGs in the C-Band only. This BMM is used only in conjunction with the BMM2H-4-R3-MS to provide expansion capabilities to support an 80-channel system

Table 3-60 lists the name and a brief description of the supported BMMs.

Table 3-60 BMM Product Details

Product Ordering Name (PON)	Description
Full-height BMMs that Support up to 40 Channels	
BMM-4-C1-A BMM-4-C1-B	Used on DTC only, C/L-Band, supports span losses from 0 to 20dB, with VOA, without mid-stage access, supports OCGs 1, 3, 5, and 7.
BMM-4-C2-MS-A BMM-4-C2-MS-B	Used on DTC only, C/L-Band, supports span losses from 19 to 26dB, with mid-stage access, supports OCGs 1, 3, 5, and 7.
BMM-4-C3-MS-A BMM-4-C3-MS-B	Used on DTC only, C/L-Band, supports span losses from 25 to 34dB, with mid-stage access, supports OCGs 1, 3, 5, and 7.
BMM-4-CX1-A	Used on DTC only, C-Band, supports span losses from 0 to 21dB, with VOA, without mid-stage access, supports OCGs 1, 3, 5, and 7.
BMM-4-CX2-MS-A	Used on DTC only, C-Band, supports span losses from 20 to 27.5dB, with mid-stage access, supports OCGs 1, 3, 5, and 7.
BMM-4-CX3-MS-A	Used on DTC only, C-Band, supports span losses from 26 to 34dB, with mid-stage access, supports OCGs 1, 3, 5, and 7.

Table 3-60 BMM Product Details

Product Ordering Name (PON)	Description
Full-height BMMs that Support up to 80 or 160 Channels	
BMM-8-CXH1	Used on DTC only, C-Band, high power, supports span losses from 0 to 20dB, with VOA, without mid-stage access, supports OCGs 1 - 8.
BMM-8-CXH2-MS	Used on DTC only, C-Band, high power, supports span losses from 19 to 26.5dB, with mid-stage access, supports OCGs 1 - 8.
BMM-8-CXH3-MS	Used on DTC only, C-Band, high power, supports span losses from 25 to 34dB, with mid-stage access, supports OCGs 1 - 8.
BMM2-8-CXH2-MS	Used on DTC only, C-Band, high power, supports span losses from 5 to 32.5dB, with mid-stage access, supports OCGs 1 - 8. **NOTE:** The BMM2-8-CXH2-MS requires a GAM-1 in order to interconnect with a DLM/XLM or ADLM/AXLM (set to Gen 1 mode) and is not designed to participate in 160-channel systems.
BMM2-8-CH3-MS	Used on DTC only, C-Band, high power, supports span losses from 5 to 31dB, with mid-stage access, supports OCGs 1 - 8. The BMM2-8-CH3-MS is the base BMM2 for 160-channel systems. The BMM2-8-CH3-MS multiplexes/de-multiplexes OCGs 1 - 8, and provides an expansion capability to interleave an additional 8 OCGs for a total of 160 channels using BMM2-8-CEH3. **NOTE:** For 160-channel systems, a configuration with up to 4 OCGs provisioned on the expansion BMM2 requires a minimum of 1 OCG to be provisioned on the base BMM2. A configuration with 5 to 8 OCGs provisioned on the expansion BMM2 requires a minimum of 2 OCGs to be provisioned on the base BMM2. **NOTE:** The BMM2-8-CH3-MS requires a GAM-1 in order to interconnect with a DLM/XLM or ADLM/AXLM (set to Gen 1 mode).
BMM2-8-CEH3	Used on DTC only, C-Band, high power, supports span losses from 5 to 31dB, without mid-stage access, supports OCGs 9 - 16. The BMM2-8-CEH3 is an expansion BMM2. The line side of this BMM2 is connected to the expansion band port of a base BMM2-8-CH3-MS to provide 160-channel support in the DTC with integrated OSC. The BMM2-8-CEH3 does not need to be in the same chassis as the base BMM2-8-CH3-MS. **NOTE:** A configuration with up to 4 OCGs provisioned on the expansion BMM2 requires a minimum of 1 OCG to be provisioned on the base BMM2. A configuration with 5 to 8 OCGs provisioned on the expansion BMM2 requires a minimum of 2 OCGs to be provisioned on the base BMM2. **NOTE:** The BMM2-8-CEH3 requires a GAM-1 in order to interconnect with a DLM/XLM or ADLM/AXLM (set to Gen 1 mode).

Table 3-60 BMM Product Details

Product Ordering Name (PON)	Description
BMM2P-8-CH1-MS	Used on DTC only, C-Band, high power, with mid-stage access, supports OCGs 1 - 8. The BMM2P-8-CH1-MS provides higher input power per OCG compared to previous BMM2s. The BMM2P-8-CH1-MS is the base BMM2P for 160-channel systems. The BMM2P-8-CH1-MS multiplexes/de-multiplexes OCGs 1 - 8, and provides an expansion capability to interleave an additional 8 OCGs for a total of 160 channels using BMM2P-8-CEH1. **NOTE**: Supported span losses for the BMM2P-CH1-MS depend on the adjoining preamplifier type (OAM-CXH1-MS, ORM-CXH1-MS, and/or ORM-CXH1) that is used in conjunction with the BMM2P for the particular span. **NOTE:** For 160-channel systems, a configuration with up to 4 OCGs provisioned on the expansion BMM2P requires a minimum of 1 OCG to be provisioned on the base BMM2P. A configuration with 5 to 8 OCGs provisioned on the expansion BMM2P requires a minimum of 2 OCGs to be provisioned on the base BMM2P. **NOTE:** The BMM2P-8-CH1-MS requires a GAM-2 in order to interconnect with an ADLM/AXLM (set to Gen 2 mode).
BMM2P-8-CEH1	Used on DTC only, C-Band, high power, without mid-stage access, supports OCGs 9 - 16. The BMM2P-8-CEH1 is an expansion BMM2P. The line side of this BMM2P is connected to the expansion band port of a base BMM2P-8-CH1-MS to provide 160-channel support in the DTC with integrated OSC. The BMM2P-8-CEH1 does not need to be in the same chassis as the base BMM2P-8-CH1-MS. **NOTE**: Supported span losses for the BMM2P-CEH1 depend on the adjoining preamplifier type (OAM-CXH1-MS, ORM-CXH1-MS, and/or ORM-CXH1) that is used in conjunction with the BMM2P for the particular span. **NOTE:** A configuration with up to 4 OCGs provisioned on the expansion BMM2P requires a minimum of 1 OCG to be provisioned on the base BMM2P. A configuration with 5 to 8 OCGs provisioned on the expansion BMM2 requires a minimum of 2 OCGs to be provisioned on the base BMM2P. **NOTE:** The BMM2P-8-CEH1 requires a GAM-2 in order to interconnect with an ADLM/AXLM (set to Gen 2 mode).
Half-height BMMs that Support up to 40 or 80 Channels	
BMM1H-4-CX2	Used on MTC only, C-Band, supports span losses from 5 to 24.5dB, without mid-stage access, supports OCGs 1, 3, 5, and 7.

Table 3-60 BMM Product Details

Product Ordering Name (PON)	Description
BMM2H-4-R3-MS	Used on MTC only, C-Band, supports span losses from 5 to 32dB, with mid-stage access, supports OCGs 1 - 4. The BMM2H-4-R3-MS is the base BMM2H for 80-channel systems. The BMM2-8-CH3-MS multiplexes/de-multiplexes OCGs 1 - 4, and provides an expansion capability to interleave an additional 4 OCGs for a total of 80 channels using BMM2H-4-B3. **NOTE:** For 80-channel systems, a configuration with up to 4 OCGs provisioned on the expansion BMM2H requires a minimum of 1 OCG to be provisioned on the base BMM2H. **NOTE:** The BMM2H-4-R3-MS requires a GAM-1 in order to interconnect with a DLM/XLM or ADLM/AXLM (set to Gen 1 mode).
BMM2H-4-B3	Used on MTC only, C-Band, supports span losses from 5 to 32dB, without mid-stage access, supports OCGs 5 - 8. The BMM2H-4-B3 is an expansion BMM2H. The line side of this BMM2H is connected to the expansion band port of a base BMM2H-4-R3-MS to provide 80-channel support in the MTC with integrated OSC. The BMM2H-4-B3 does not need to be in the same chassis as the base BMM2H-4-R3-MS. **NOTE:** A configuration with up to 4 OCGs provisioned on the expansion BMM2H requires a minimum of 1 OCG to be provisioned on the base BMM2H. **NOTE:** The BMM2H-4-B3 requires a GAM-1 in order to interconnect with a DLM/XLM or ADLM/AXLM (set to Gen 1 mode).

Functional Description

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

Note: BMM2s that are set to Native Automated mode (the default mode) support Auto-discovery only for DLMs, XLMs, ADLMs, and/or AXLMs (Auto-discovery will not complete if a BMM2 is set to Native Automated and is connected to an SLM). Furthermore, BMM2s that are set to SLTE Mode 1 support Auto-discovery only for SLMs (Auto-discovery will not complete if a BMM2 is set to SLTE Mode 1 and is connected to a DLM, XLM, ADLM, or AXLM.

Note: For 160-channel systems using full-height BMM2/BMM2Ps, a configuration with up to 4 OCGs provisioned on the expansion BMM2/BMM2P requires a minimum of 1 OCG to be provisioned on the base BMM2/BMM2P. A configuration with 5 to 8 OCGs provisioned on the expansion BMM2/BMM2P requires a minimum of 2 OCGs to be provisioned on the base BMM2/BMM2P.

Note: For 80-channel systems using half-height BMM2Hs, a configuration with up to 4 OCGs provisioned on the expansion BMM2H requires a minimum of 1 OCG to be provisioned on the base BMM2H.

Note: An intermediary GAM may be required between a BMM and a line module due to the increased launch power required on certain BMMs (BMM2/BMM2H/BMM2Ps). For details on the possible GAM/BMM/line module configurations, see "GAM/BMM/Line Module Supported Combinations" on page 3-171.

The Band Multiplexing Module, referred to as BMM, optically multiplexes/de-multiplexes up to 6.4Tbps of traffic signals (for 160-channel systems equipped with LM-80s and CMMs), and also amplifies the DWDM signal.

Note: The BMM2/BMM2P optically multiplexes/de-multiplexes up to 8Tbps of traffic signals (for 160-channel systems equipped with AOLM-500/AOLX-500/SOLM-500/SOLM-500s). Refer to "Infinera DTN-X" on page 2-1 for additional information.

The BMM performs the following functions when connected to line modules/CMMs:

- Optically multiplexes supported DWDM channels from the line modules or CMMs, known as Optical Carrier Groups (OCGs), onto the line side facility

- Optically de-multiplexes the OCGs from the line side facility and passes them to the local line modules or CMMs
- Provides optical insertion and extraction of the 1510nm Optical Supervisory Channel (OSC) by using a 1510nm optical filter
- Optically amplifies the multiplexed OCG signals on the transmit and receive side by using an optical pre-amplifier
- Manages Infinera's Automated Gain Control (AGC)
- Provides higher power for 80-channel systems (BMM-8, BMM2-8-CXH2-MS, BMM2-8-CH3-MS, BMM2P-8-CH1-MS, and BMM2H-4-R3-MS when used in conjunction with BMM2H-4-B3)
- Provides higher power for 160-channel systems (BMM2-8-CH3-MS when used in conjunction with BMM2-8-CEH3, or BMM2P-8-CH1-MS when used in conjunction with BMM2P-8-CEH1)
- Provides user-configurable launch power offset from -2.0dB to +2.0dB to configure the launch power from the EDFA in the transmit direction

Note: The valid range for the launch power offset for the BMM2P-8-CH1-MS is -10.0dB to +10dB. Adhere to the value provided by Network Design or by an Infinera Technical Assistance Center (TAC) resource.

- Provides user-configurable gain tilt offset from -0.5dB to +0.5dB in order to offset the positive gain tilt that Raman modules add to the wavelengths. Gain tilt offset is not supported on constant gain BMMs

Note: Do not configure the gain tilt offset unless consulted to do so by an Infinera TAC resource.

- Provides user-configurable target power offset on the OCG in order to improve the reach of phase-modulated signals such as polarization multiplexed-quadrature phase shift keying (PM-QPSK) when the signal co-exists with signals that use OOK (On Off Keying) modulation, see "Required Number of Effective Channels for Release 8.0" on page 3-97
- Support for submarine line terminal equipment (SLTE) Mode 1 on full-height BMM2s (BMM2-8-CH3-MS, BMM2-8-CEH3, and/or BMM2-8-CXH2-MS). SLTE Mode 1 allows for a full-height BMM2 to interoperate with a third-party submarine amplifier system
- Support for manually configuring the receive EDFA gain on BMM2s set to SLTE Mode 1. The receive EDFA gain is an absolute value, not an offset value, and is independently configured on base and expansion BMM2s

Note: Do not configure the receive EDFA gain unless consulted to do so by an Infinera TAC resource.

- Detects a break in the transmission fiber and performs Automatic Laser Shutdown (ALS) to minimize potential laser radiation exposure to field personnel; ALS can be disabled by the user from any of the management interfaces for a provisionable period of time (1 to 480 minutes)

Note: ALS cannot be disabled for OAM/ORM (OAM-CXH1-MS/ORM-CXH1-MS/ORM-CXH1) preamplifier configurations.

- Provides the following optical spectrum analyzer (OSA) ports for test purposes:
  - OSA port for the receive EDFA output (available only on BMM-4/BMM-8s)
  - OSA port for the aggregate line input
  - OSA port for the aggregate line output (not available on BMM2-8-CEH3, BMM2P-8-CEH1, and/or BMM2H-4-B3)
- Accommodates mid-stage access for DCMs and/or DSEs (BMM2 only). The user can view the expected mid-stage loss (via the management interfaces) based on the provisioned DCMs and/or DSEs

  Table 3-61 lists the maximum expected mid-stage loss and the associated threshold value (Mid-stage Port OPR Out of Range - Low Alarm) for the supported BMMs.

Table 3-61 BMM Maximum Mid-stage Loss Supported

BMM Type	Maximum Mid-stage Loss (MSL) Supported (dB)						Mid-stage Port OPR Out of Range - Low Alarm Threshold (dB)		
	R5.0.x		R5.1.x		R6.0.x/ R7.0.x		R5.0.x = MSL + 0.5[a]	R5.1.x = MSL	R6.0.x/ R7.0.x = MSL
	Min	Max	Min	Max	Min	Max			
BMM-4/BMM-8 (with mid-stage access)	0.0	10.5	0.0	10.5	0.0	10.5	N/A	10.5	10.5
BMM2-8-CXH2-MS	0.0	8.5	0.0	8.5	0.0	8.5	9.0	8.5	8.5
BMM2-8-CH3-MS	0.0	8.5	0.0	8.5	0.0	8.5	9.0	8.5	8.5
BMM2H-4-R3-MS	N/A	N/A	0.0	8.5	0.0	8.5	N/A	8.5	8.5
BMM2P-CH1-MS (with preamplifier)	N/A	N/A	N/A	N/A	0.0	8.5	N/A	N/A	8.5

a. The 0.5dB margin implemented in IQ NOS Release 5.0.x was removed in Release 5.1.x.

Note: As a precaution during initial system turn-up, the Dispersion Compensation Fiber (DCF) Optical Loss of Light (OLOS) alarm is generated if the measured mid-stage loss is out of tolerance relative to the provisioned expected mid-stage loss. If there is no DCF fiber connected (for example, no DCF input), then a DCF OLOS alarm will be reported. If there is a DCF fiber connected and the mid-stage loss is high, then a DCF OOR Low (Out of Range, Low) alarm will be reported.

Note: In addition to BMM-to-DLM/XLM/ADLM/AXLM/SLM connections, the BMMs can also be configured in BMM-to-BMM connections in order to optically express OCGs through a node without converting the optical signals to electrical. Optical Express connections between BMMs require special attenuation and reach considerations, refer to the *Infinera DTN and DTN-X Turn-up and Test Guide.* For additional information on Optical Express, refer to the *Infinera DTN and DTN-X System Description Guide*.

Note: Connecting a BMM to a BMM2 along a digital link is not a valid configuration. The only time a BMM should be connected to a BMM2 along a digital link is during an equipment/span upgrade for BMM2 deployment.

- Support for 40-Channel to 80-Channel interoperability across spans. Release 8.0 supports the interoperability of 40-channel to 80-channel BMMs and of 40-channel to 80-channel BMM2s. The following guidelines apply to 40-channel to 80-channel interoperability:

Note: For BMMs (opposed to BMM2s), 40-channel to 80-channel interoperability should be used as a transitional configuration only. During the transition, a misconnection (MIS-CONN) alarm on the Band CTP will be raised until both ends of the span are equipped with either 40-channel or 80-channel BMMs. In addition, Optical Express is not supported on 40-channel to 80-channel BMM spans.

  - For BMMs, a 40-channel BMM can be connected to an 80-channel BMM using OCGs 1, 3, 5, and/or 7
  - For BMM2s, a 40-channel half-height BMM2H can be connected to an 80-channel full-height BMM2 using OCGs 1, 2, 3, and/or 4 (if only the base BMM2H is connected); or using OCGs 1, 2, 3, 4, 5, 6, 7, and/or 8 (if both the base and expansion BMM2Hs are connected)
  - BMM-to-BMM2/BMM2P interoperability is not supported. BMMs must be connected to BMMs, BMM2s must be connected to BMM2s, and BMM2Ps must be connected to BMM2Ps
  - In all cases of 40-channel and 80-channel BMM or BMM2 interoperability, the number of channels must be set to the same value on each side of the span. For example, if a BMM on one side of the span is set to 20 channels, the BMM on the other side of the span must also be set to 20 channels
  - Optical Line Amplifiers with OAMs/ORMs are supported on spans that use 40-channel to 80-channel interoperability

When BMMs are deployed utilizing TW-C fiber type, optical attenuation is required to reduce optical fiber nonlinearities, refer to Table 3-62.

Table 3-62 BMM Optical Attenuator Pad Requirement for TW-C Fiber Type

Channel Count	TW-C Target Launch Power (dBm/ch)	BMM Launch Power (dBm/ch)		
		Gen 1	**Gen 2 (80 Channels)**	**Gen 2 (160 Channels)**
		0	**1.5**	**-1.5**
		Required Optical Attenuator Pad (dB)		
10 to 40	-3.0	3	5	2
41 to 80	-3.0	3	5	2
81 to 160	-6.0	N/A	N/A	5

Note: Attenuation is required for all links (BMM/BMM2-to-Raman, BMM/BMM2-to-ORM, BMM-to-BMM, and/or BMM2-to-BMM2) when TW-C fiber is deployed. Ensure that the appropriate optical attenuator pad is installed at the BMM/BMM2 Line Out port.

BMM OCG Optical Power Specifications

The OCG optical power specifications (per OCG port) for the different BMM types are listed in Table 3-63.

Table 3-63 BMM OCG Optical Specifications

BMM Type	Input Power (dBm)	Output Power (dBm)
BMM/BMM1H	-14 to -12.5	6.5 to 8.5
BMM2/BMM2H	-1.5 to 9.0	0.0 to 9.0
BMM2P	2.0 to 10.5	2.5 to 10.5

BMM Maximum Gain and Span Loss Specifications

The maximum gain and span losses supported for the different BMM types are listed in Table 3-64.

Table 3-64 BMM Maximum Gain and Span Loss Specifications

BMM Type	Maximum Gain (dB)	Span Loss Range (dB)
BMM-4-C1-A	20.5	0.0 to 20.0
BMM-4-C1-B	20.5	0.0 to 20.0
BMM-4-C2-MS-A	26.5	19.0 to 26.0
BMM-4-C2-MS-B	26.5	19.0 to 26.0
BMM-4-C3-MS-A	34.0	25.0 to 34.0
BMM-4-C3-MS-B	34.0	25.0 to 34.0
BMM-4-CX1-A	20.5	0.0 to 21.0
BMM-4-CX2-MS-A	26.5	20.0 to 27.5
BMM-4-CX3-MS-A	34.0	26.0 to 34.0
BMM-8-CXH1	20.5	0.0 to 20.0
BMM-8-CXH2-MS	26.5	19.0 to 26.5
BMM-8-CXH3-MS	34.0	25.0 to 34.0
BMM2-8-CXH2-MS	27.5	5.0 to 32.5
BMM2-8-CH3-MS	29.0	5.0 to 31.0
BMM2-8-CEH3	N/A	5.0 to 31.0
BMM2P-CH1-MS	18.0	See note below
BMM2P-CEH1	N/A	See note below
BMM1H-4-CX2	24.0	5.0 to 24.5
BMM2H-4-R3-MS	27.0	5.0 to 32.0
BMM2H-4-B3	N/A	5.0 to 32.0

Note: Supported span losses for the BMM2P-CH1-MS and BMM2P-CEH1 depend on the adjoining preamplifier type (OAM-CXH1-MS, ORM-CXH1-MS, and/or ORM-CXH1) that is used in conjunction with the BMM2P for the particular span.

Required Number of Effective Channels for Release 8.0

Note: Contact Infinera Technical Assistance Center (TAC) before configuring target power offset.

Before Release 8.0, the BMMs used identical launch power to transmit each channel across the optical transport section (OTS), and all of the line modules used OOK modulation. In Release 7.0, the LM-80s support new modulation formats (PM-BPSK and PM-QPSK), which means that a BMM may be transmitting a combination of PM-QPSK, PM-BPSK, and OOK modulated channels across the line. This co-existence of different modulation schemes in the same OCG can present a problem: The reach of a phase-modulated signal such as PM-QPSK can be impaired by neighboring channels that use OOK modulation if all channels have equal channel power. This problem can be corrected by modifying the launch power for various channels or OCGs based on link design. For this reason, Release 7.0 allows the user to configure the target power offset on a per-OCG basis on the BMM and on a per-optical channel (OCH) basis on the LM-80:

- On the OCG level, the power of the ingress signal to the BMM on that OCG is reduced by the power as defined by the target power offset value configured on the BMM OCG. Different channel offset values (within the supported range) can be provisioned for every OCG within an OTS

Note: When target power offset on the BMM OCG is changed from a more negative to a less negative or zero offset (e.g., from -4dB to 0dB), the "OPR-OOR-L" and "Power Adjustment Incomplete" alarms may be reported for the duration of the time it takes to adjust the power to incorporate the new offset value.

- On the OCH level the power of the ingress signal to the CMM from the LM-80 OCH is reduced by the power as defined by the target power offset value configured on the CMM OCH PTP. Thus, the power of individual channels within an OCG can also be offset. Different channel offset values (within the supported range) can be provisioned for every LM-80 OCH within an OCG

Infinera's AGC relies on a minimum power received (and thus a minimum number of channels) in order to detect a signal and complete Auto-discovery of optical connections. In order to complete Auto-discovery, AGC requires:

- At least 2 channels per OCG
- At least 8 channels per OTS
- At least 8 channels from an expansion BMM to its associated base BMM

Note: For LM-80s, if an optical channel (OCH PTP) is in the Locked state, that channel does not count towards the minimum channel count.

Even if the above requirements are satisfied, it is possible that the launch power over the line is reduced due to target power offset, thus dropping the launch power below what would be expected for two channels, and this may also prevent Auto-discovery from completing.

With the introduction of target power offset, it becomes important to consider the number of “effective channels” carried by the OCG and also by the OTS.

For example, an OCG might contain two channels, but if a target power offset has been applied to the OCG and/or to any of the channels in the OCG, the number of effective channels may be less than the minimum requirement of two channels. Furthermore, because an LM-80’s channel power can be offset by both the OCH target power offset and by the containing OCG target power offset, it is important to note that each channel can support a maximum of -4dB total target power offset. For example, if the BMM OCG target power offset is set to -3dB, the channels in that OCG can support a maximum CMM OCH target power offset of -1dB, for a total target power offset of -4dB.

Table 3-65 shows how the total target power offset applied to OCG reduces the number of effective channels in the OTS. For example, if an OCG has three channels and is configured with a target power offset of -2dB, the effective channel count will be 1.9, which does not meet the minimum channel requirement per OCG. Table 3-65 shows in red the target power offset values that will not meet the minimum channel requirement per OCG.

Table 3-65 Effective Channels as a Result of OCG Target Power Offset

Total Target Power Offset Value (dB)	Number of Actual Channels									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	**1.0**	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
-1	**0.8**	**1.6**	2.4	3.2	4.0	4.8	5.6	6.4	7.1	7.9
-2	**0.6**	**1.3**	**1.9**	2.5	3.2	3.8	4.4	5.0	5.7	6.3
-3	**0.5**	**1.0**	**1.5**	2.0	2.5	3.0	3.5	4.0	4.5	5.0
-4	**0.4**	**0.8**	**1.2**	**1.6**	2.0	2.4	2.8	3.2	3.6	4.0

Similarly, Table 3-66 shows how the target offset applied to channels at the LM-80 OCH PTP level affects the effective channel count in the OCG. For example, if an OCG has three channels and each channel is configured with a target power offset of -2dB, the effective channel count will be 1.8, which does not meet the minimum channel requirement per OCG. Table 3-66 shows in red the target power offset values that will not meet the minimum channel requirement per OCG.

Table 3-66 Effective Channels as a Result of LM-80 OCH PTP Target Power Offset

Target Power Offset Value (dB)	Number of Actual Channels									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	**1.0**	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
-1	**0.8**	**1.6**	2.4	3.2	4.0	4.8	5.6	6.4	7.1	7.9
-2	**0.6**	**1.3**	**1.9**	2.5	3.2	3.8	4.4	5.0	5.7	6.3
-3	**0.5**	**1.0**	**1.5**	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Because of this, it is important to ensure that the total number of active channels included in each OCG, OTS, and between base/expansion BMMs meets the minimum channel requirement, taking into account the total target power offset for the OCG and for all LM-80 channels in the OCG, and also taking into account any optical channels on the LM-80 that are in the Locked state (because locked channels do not count towards the number of effective channels in the OCG):

- The effective channel count in an OTS is the sum of the channel counts from each OCG
- The effective channel count in a CMM OCG is the sum of the channel counts from each LM-80/CMM OCH

For example, if there are five LM-80 OCH channels in a CMM OCG:

- LM-80 OCH Channel 1 (configured in the corresponding CMM OCH) is assigned a target offset of -3dB. The effective channel count for this channel is 0.5
- LM-80 OCH Channel 2 (configured in the corresponding CMM OCH) is assigned a target offset of 0dB. The effective channel count for this channel is 1
- LM-80 OCH Channel 3 (configured in the corresponding CMM OCH) is assigned a target offset of -3dB. The effective channel count for this channel is 0.5
- LM-80 OCH Channel 4 (configured in the corresponding CMM OCH) is assigned a target offset of 0dB. The effective channel count for this channel is 1
- LM-80 OCH Channel 5 (configured in the corresponding CMM OCH) is assigned a target offset of 0dB, but the LM-80 OCH is in the Locked state. The effective channel count for this channel is 0
- Total effective channel count in the CMM/BMM OCG will be 0.5 + 1 + 0.5 + 1 + 0 = 3

Line System Configurations

Line system configurations are supported to provide a longer reach across digital spans by improving the optical add/drop multiplexer (OADM) performance of the Infinera Digital Optical Network. A preamplifier configuration is supported at a DTN site.

Table 3-67 lists the required modules for a DTN with a preamplifier configuration.

Table 3-67 Line System Configuration Supported

Node Type	Main Module	Booster Module	Preamplifier Module
DTN	BMM2P-8-CH1-MS	Not supported	Any one of the following: • OAM-CXH1-MS • ORM-CXH1-MS • ORM-CXH1

Note: Preamplifier modules must be associated with the main module (from the management interfaces) to provide preamplifier functions for the required digital span(s). Otherwise, Infinera's AGC will not function along the span(s).

Note: The ORM-CXH1-MS and ORM-CXH1 can be configured as preamplifiers. When configured as a preamplifier, these ORMs can be provisioned in an OTC Expansion Chassis of a DTN.

Block Diagrams

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

This section provides the BMM control and data plane block diagrams as follows:

- BMM control plane block diagram as shown in Figure 3-28 on page 3-102
- BMM-4-Cn data plane block diagram as shown in Figure 3-29 on page 3-103
- BMM-4-CXn-A data plane block diagram as shown in Figure 3-30 on page 3-104
- BMM-8-CXHn data plane block diagram as shown in Figure 3-31 on page 3-105
- BMM2-8-CXH2-MS data plane block diagram as shown in Figure 3-32 on page 3-106
- BMM2-8-CH3-MS data plane block diagram as shown in Figure 3-33 on page 3-107
- BMM2-8-CEH3 data plane block diagram as shown in Figure 3-34 on page 3-108
- BMM2P-8-CH1-MS data plane block diagram as shown in Figure 3-35 on page 3-109
- BMM2P-8-CEH1 data plane block diagram as shown in Figure 3-36 on page 3-110
- BMM1H-4-CX2 data plane block diagram as shown in Figure 3-37 on page 3-111
- BMM2H-4-R3-MS data plane block diagram as shown in Figure 3-38 on page 3-112
- BMM2H-4-B3 data plane block diagram as shown in Figure 3-39 on page 3-112

Figure 3-28 BMM Control Plane Block Diagram

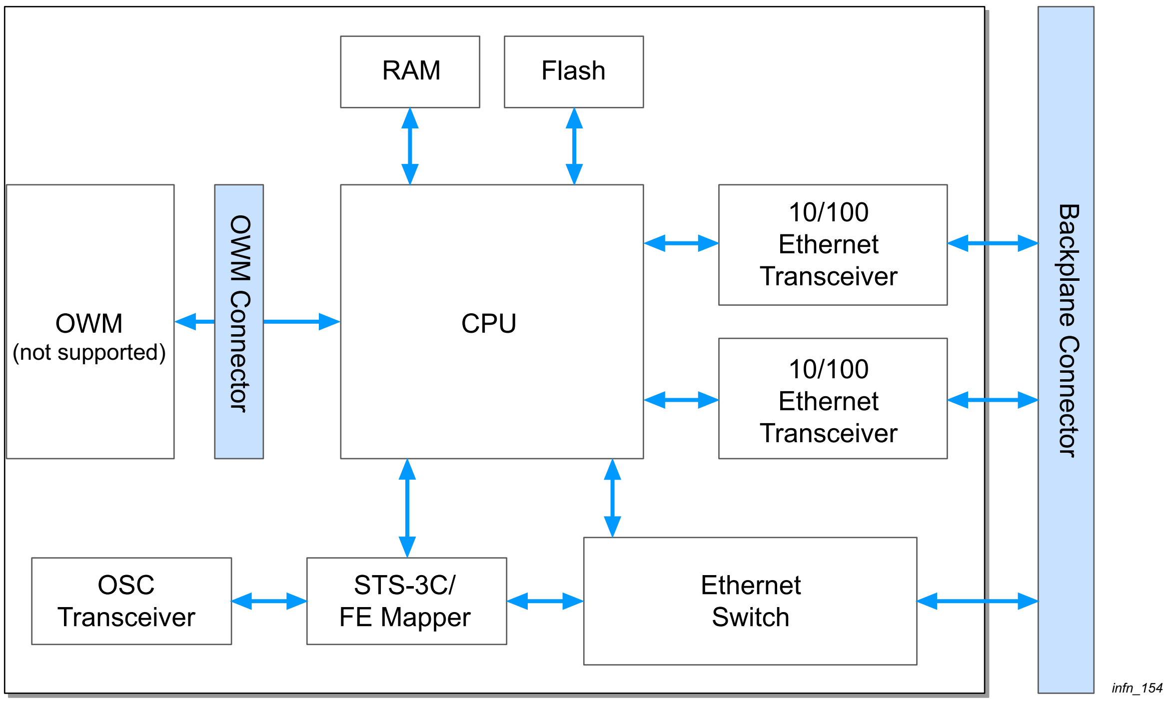


Figure 3-29 BMM-4-Cn Data Plane Block Diagram

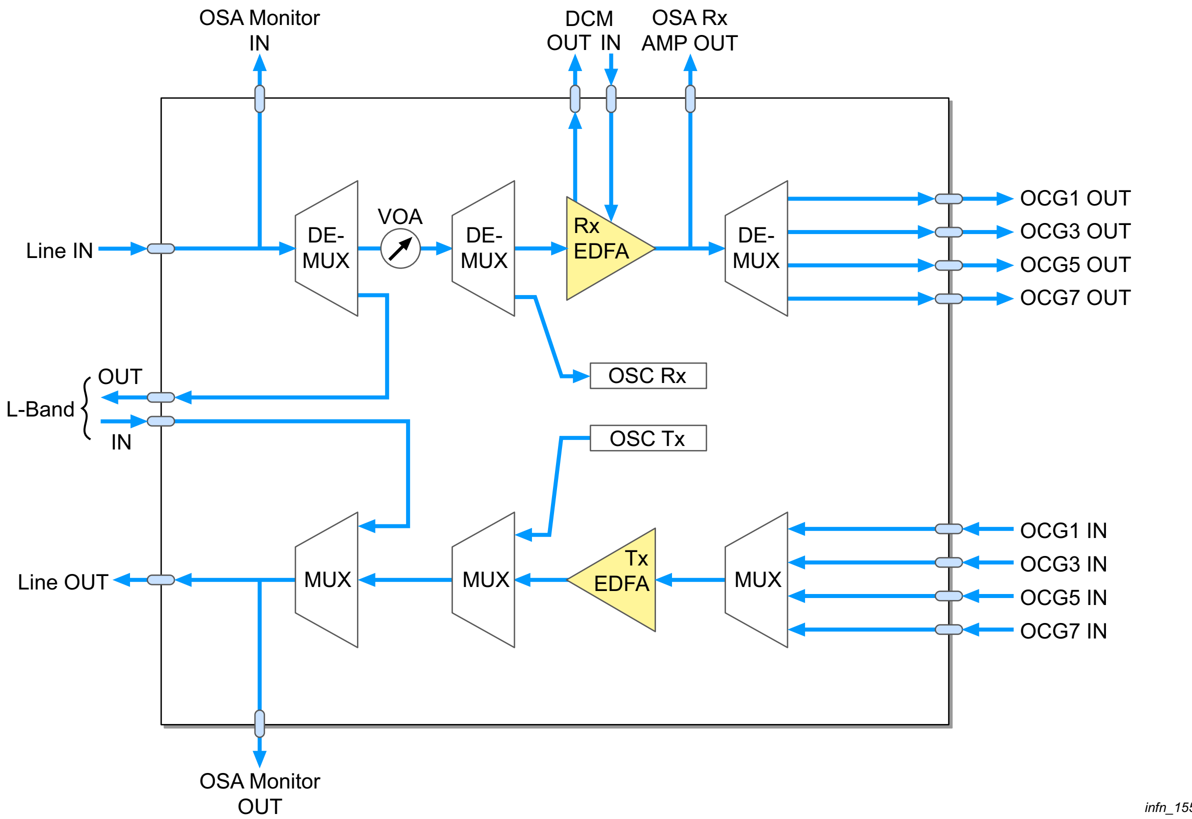
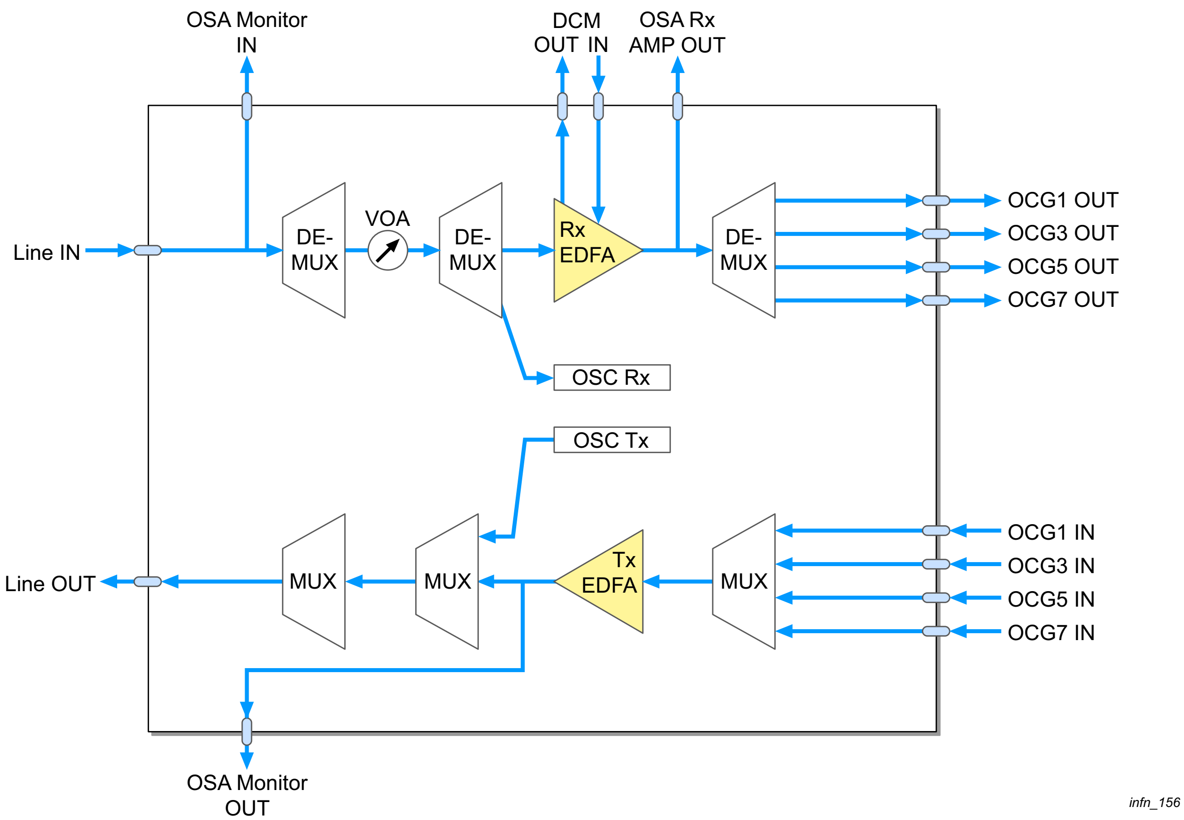
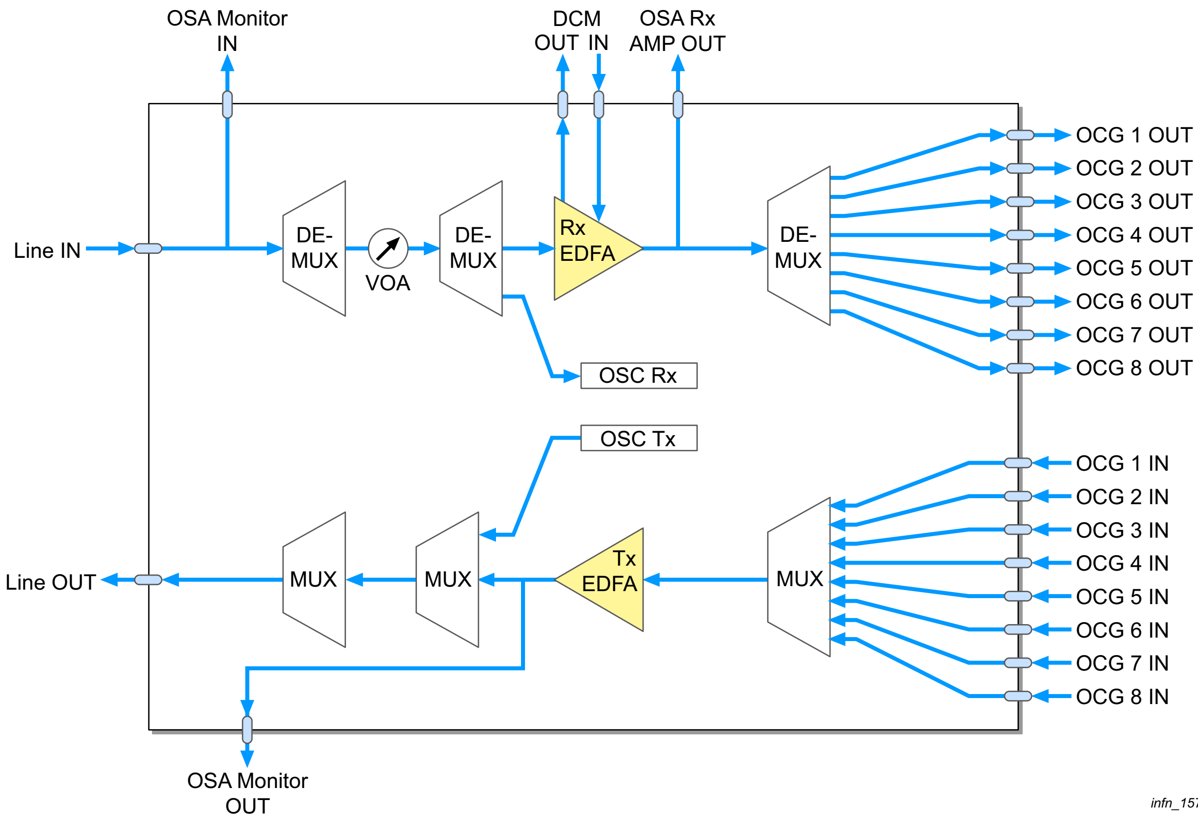


Figure 3-30 BMM-4-CXn-A Data Plane Block Diagram



Note: VOA will not be present on C2 and C3 versions of a BMM.

Figure 3-31 BMM-8-CXHn Data Plane Block Diagram



Note: VOA will not be present on C2 and C3 versions of a BMM.

Figure 3-32 BMM2-8-CXH2-MS Data Plane Block Diagram

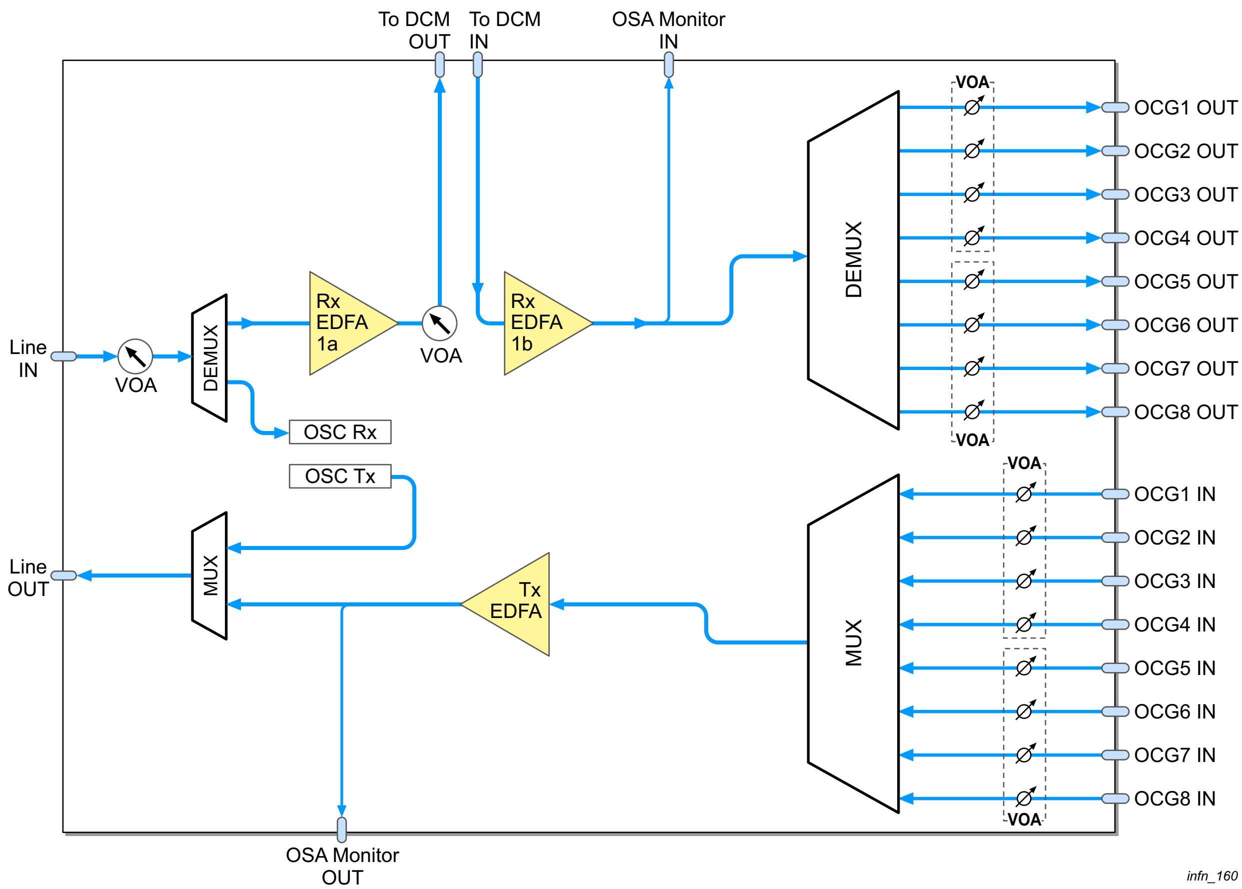


Figure 3-33 BMM2-8-CH3-MS Data Plane Block Diagram

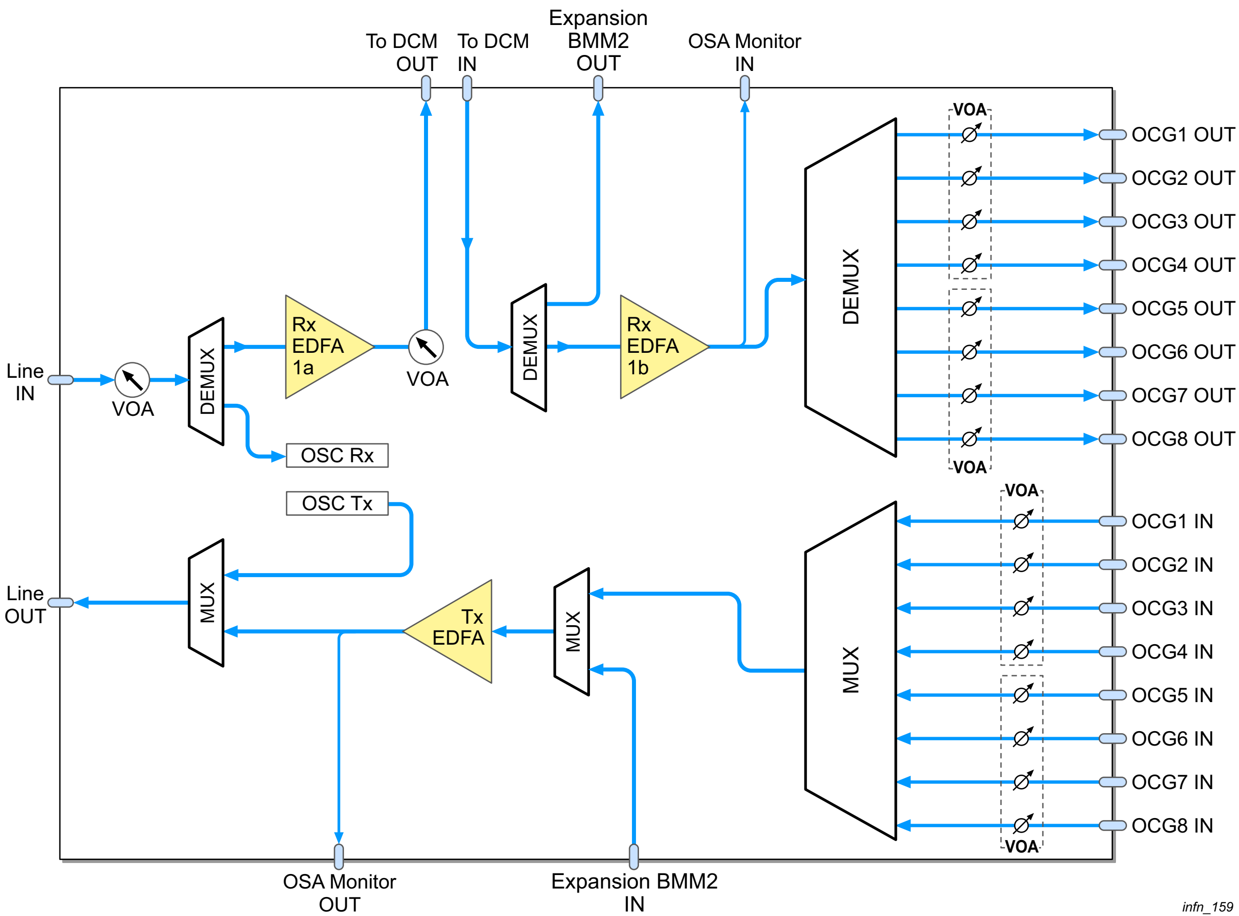


Figure 3-34 BMM2-8-CEH3 Data Plane Block Diagram

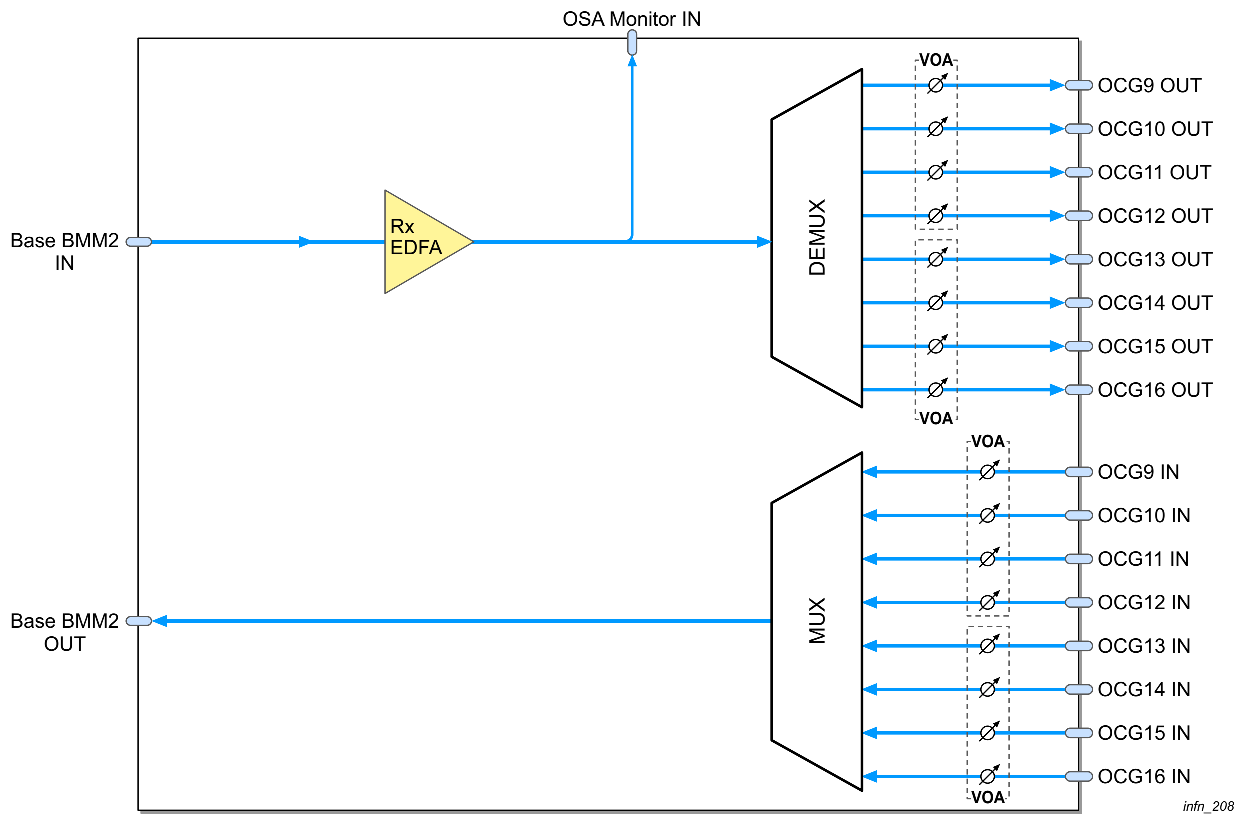


Figure 3-35 BMM2P-8-CH1-MS Data Plane Block Diagram

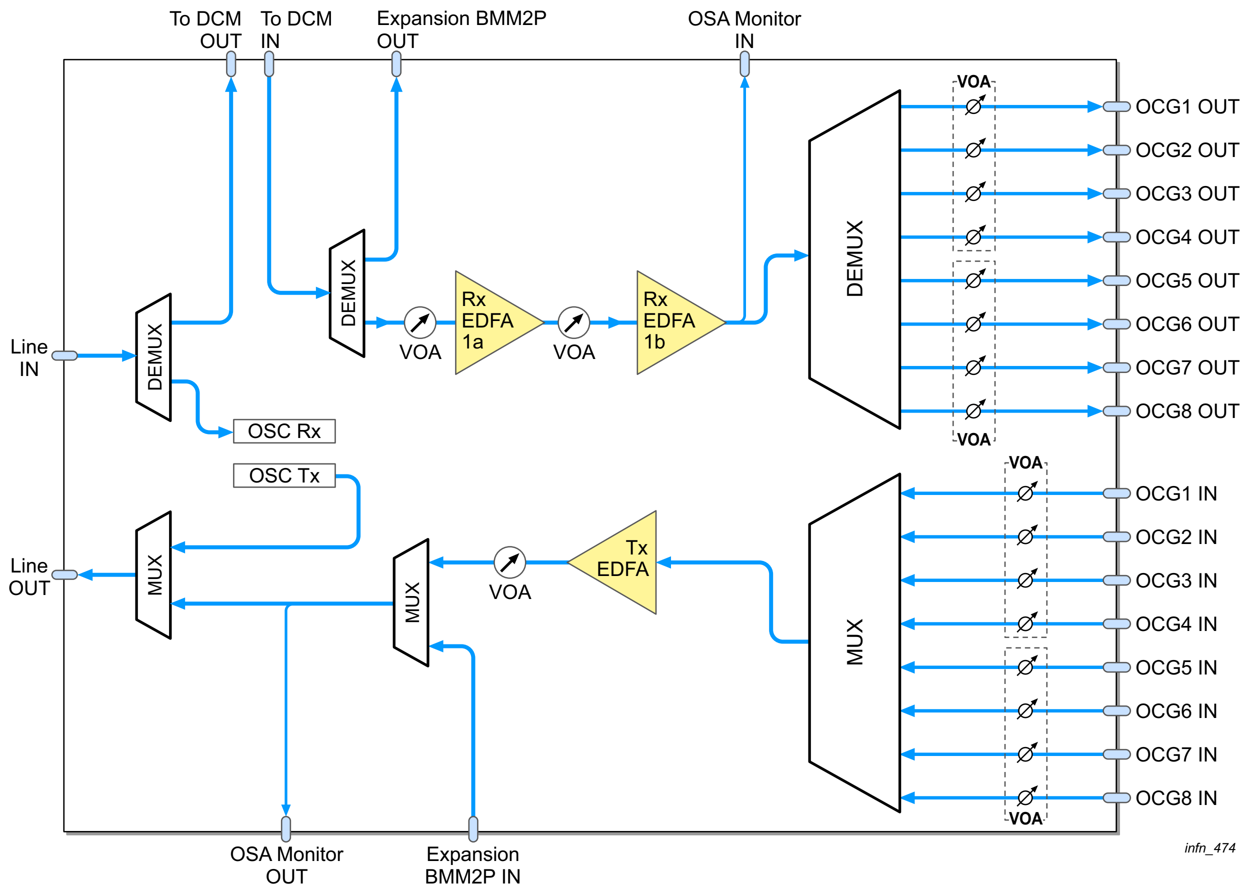


Figure 3-36 BMM2P-8-CEH1 Data Plane Block Diagram

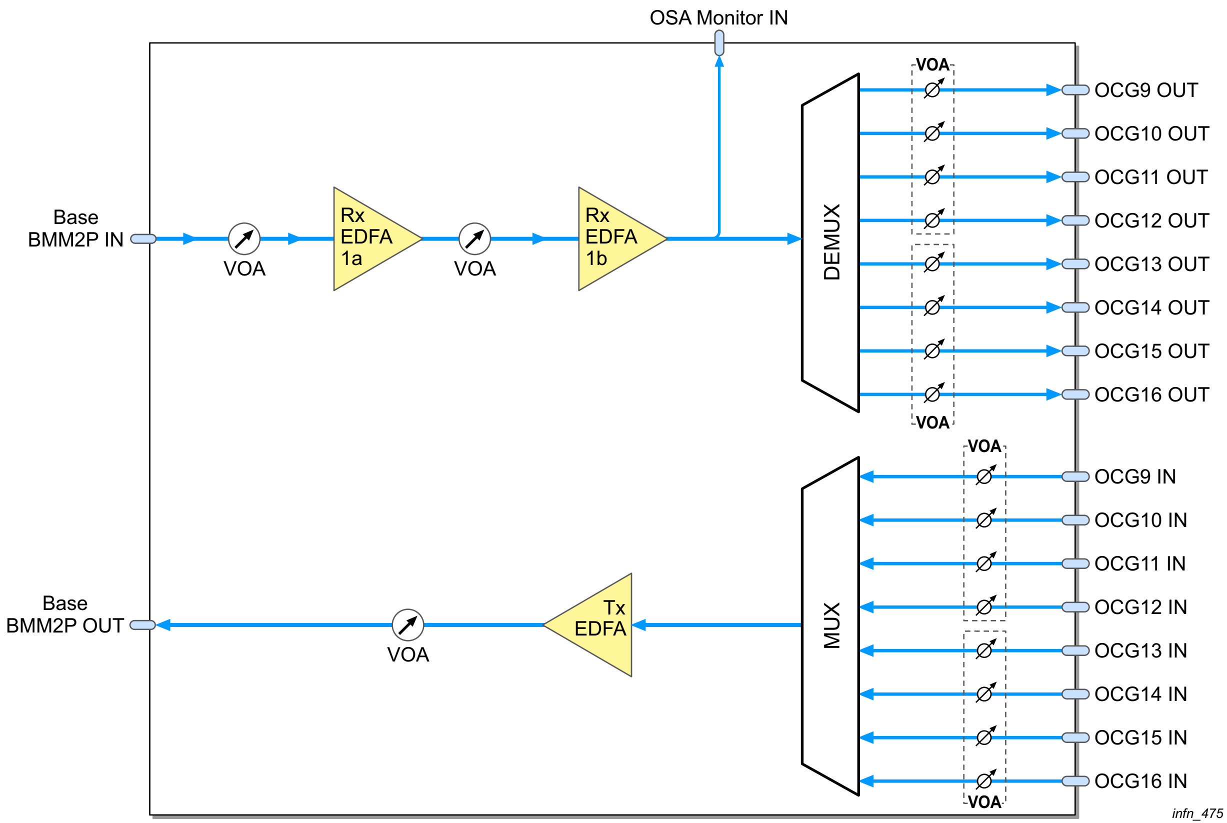


Figure 3-37 BMM1H-4-CX2 Data Plane Block Diagram

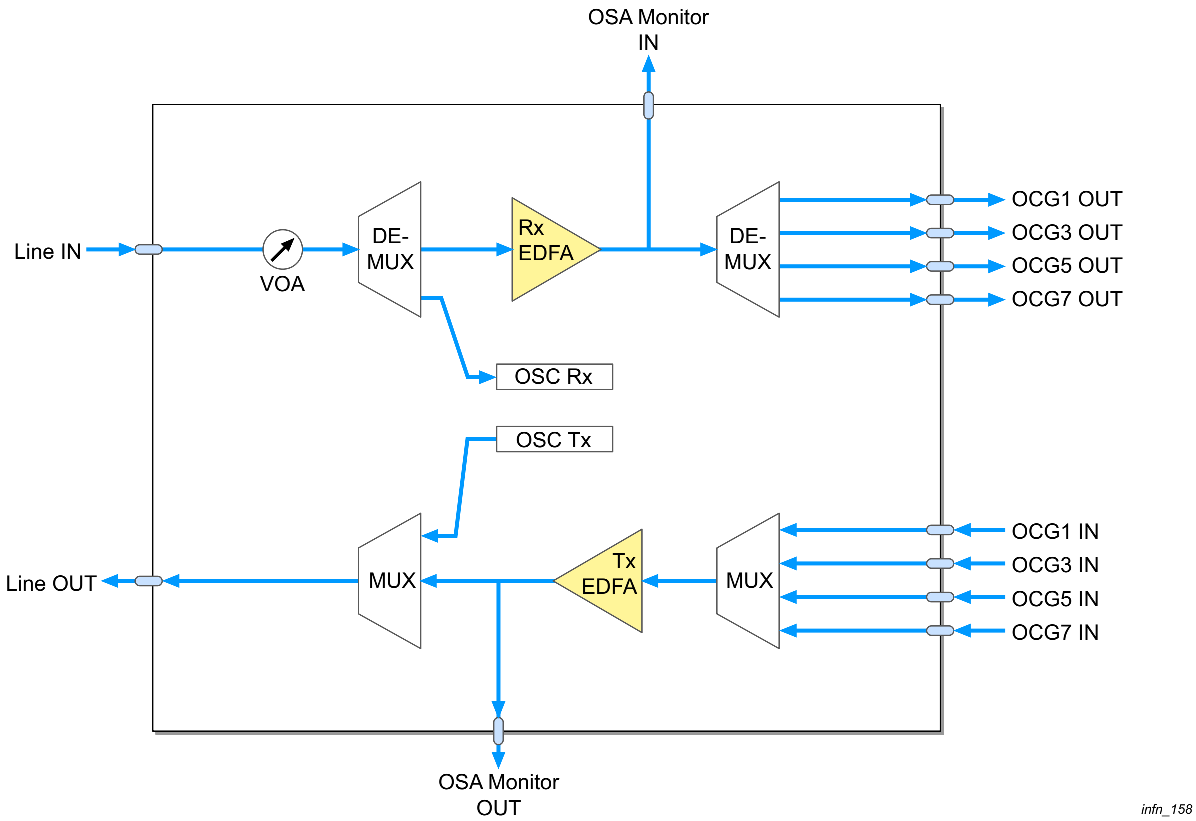


Figure 3-38 BMM2H-4-R3-MS Data Plane Block Diagram

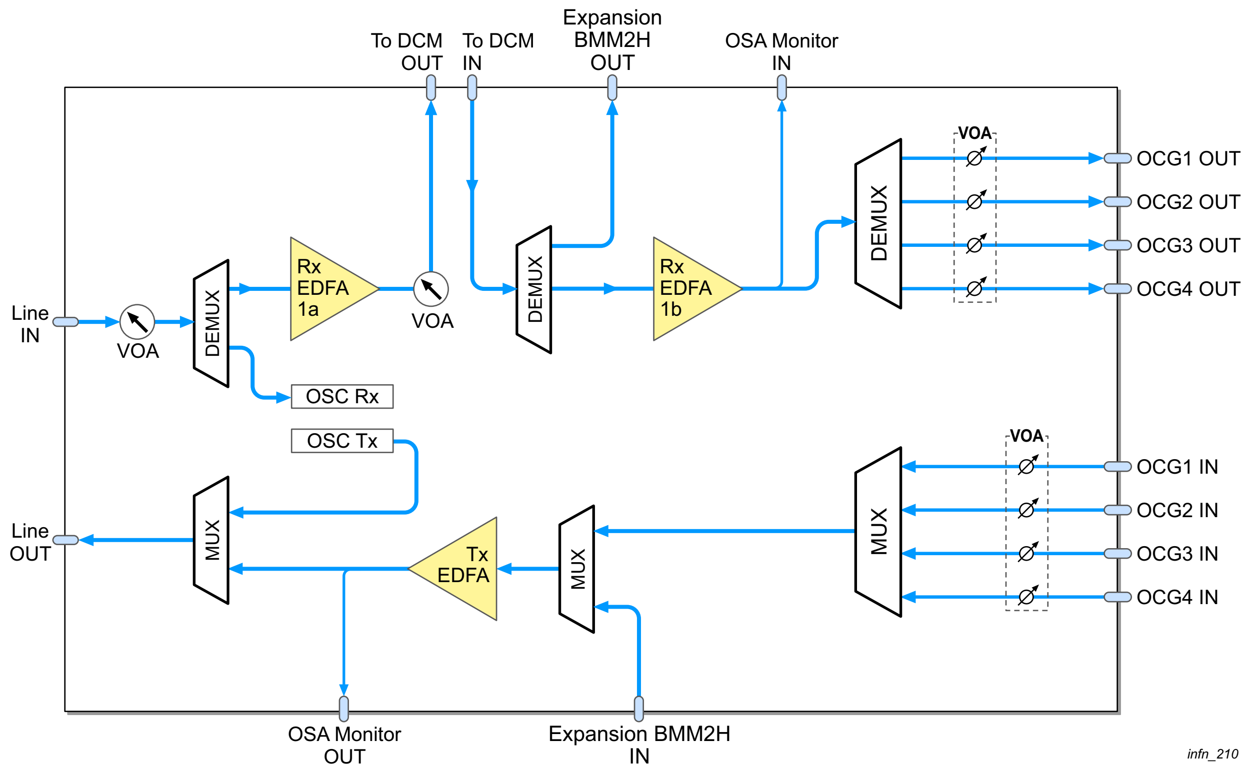
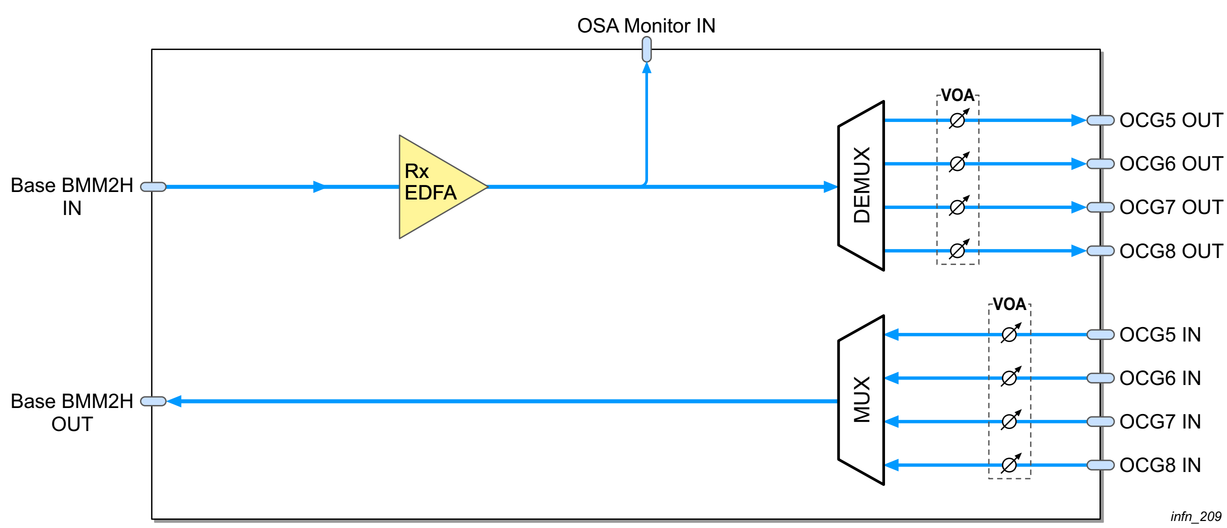


Figure 3-39 BMM2H-4-B3 Data Plane Block Diagram



External Indicators and Connectors

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The BMM provides circuit pack status/port LED indicators, and line/port connectors as follows:

- BMM-4-Cn-A as shown in Figure 3-40 on page 3-114
- BMM-4-Cn-B as shown in Figure 3-41 on page 3-115
- BMM-4-CXn-A as shown in Figure 3-42 on page 3-116
- BMM-8-CXHn as shown in Figure 3-43 on page 3-117
- BMM2-8-CXH2-MS as shown in Figure 3-44 on page 3-118
- BMM2-8-CH3-MS as shown in Figure 3-45 on page 3-119
- BMM2-8-CEH3 as shown in Figure 3-46 on page 3-120
- BMM2P-8-CH1-MS as shown in Figure 3-47 on page 3-121
- BMM2P-8-CEH1 as shown in Figure 3-48 on page 3-122
- BMM1H-4-CX2 as shown in Figure 3-49 on page 3-123
- BMM2H-4-R3-MS as shown in Figure 3-50 on page 3-124
- BMM2H-4-B3 as shown in Figure 3-51 on page 3-125

Figure 3-40 BMM-4-Cn-A Faceplate

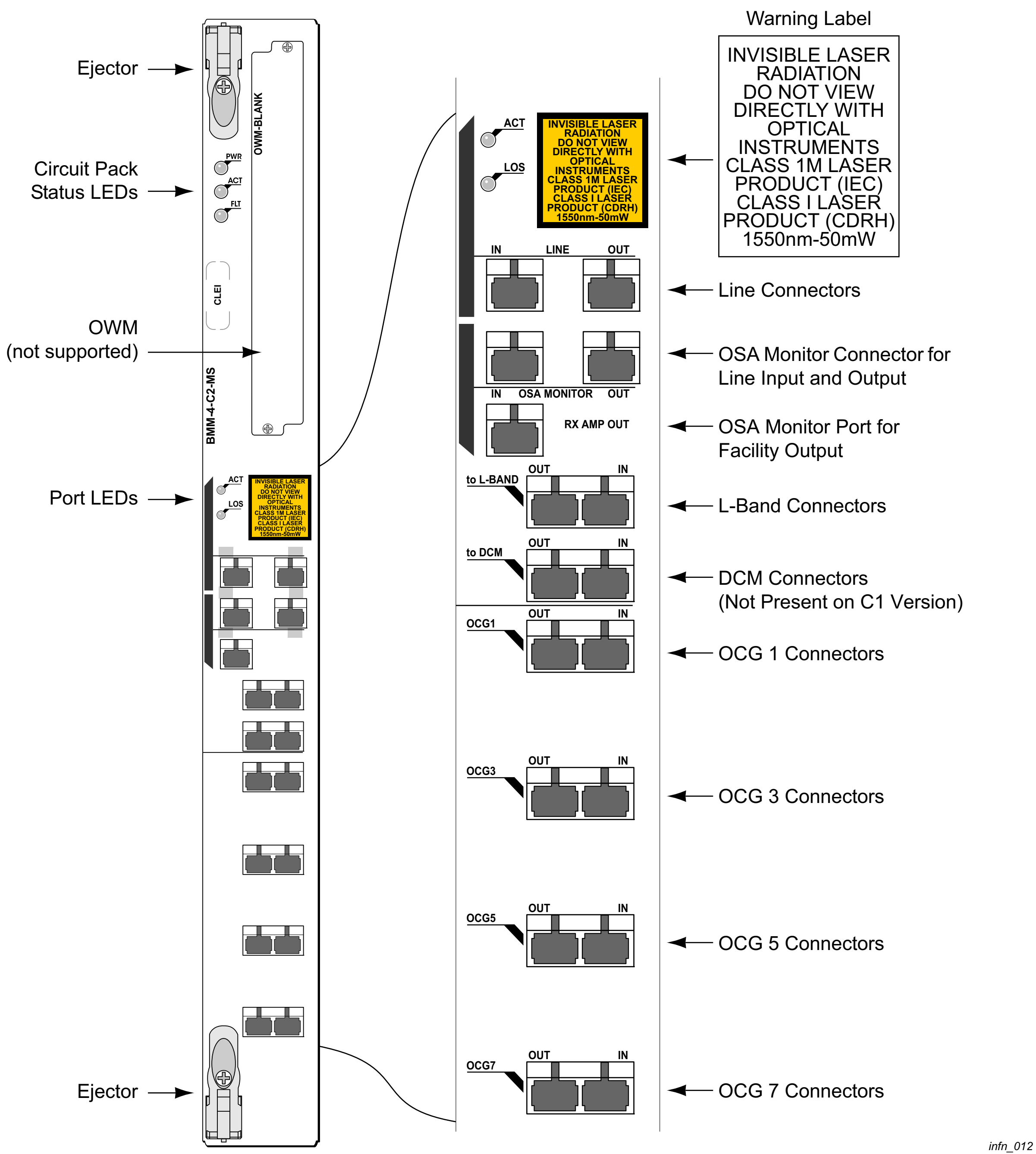


Figure 3-41 BMM-4-Cn-B Faceplate

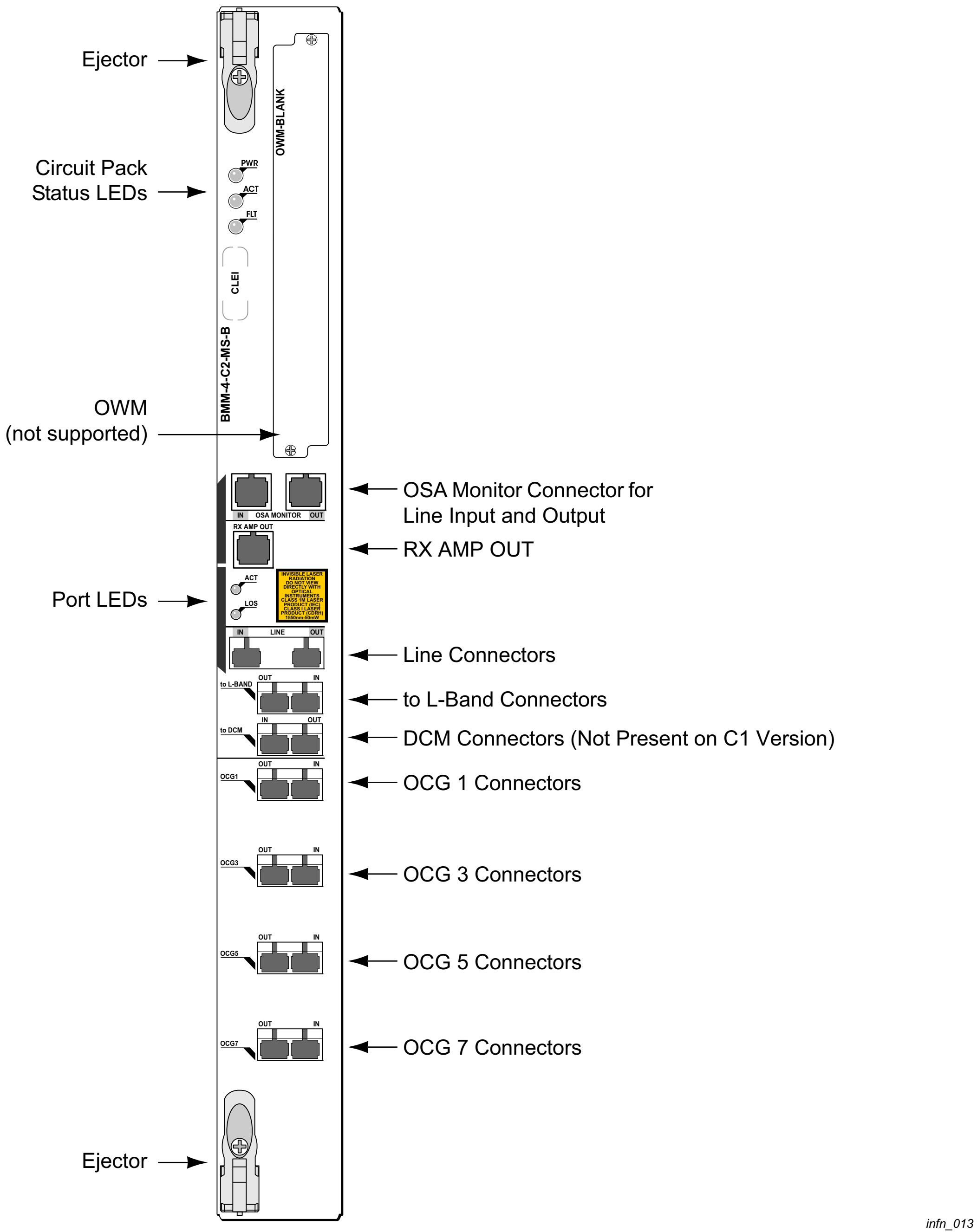
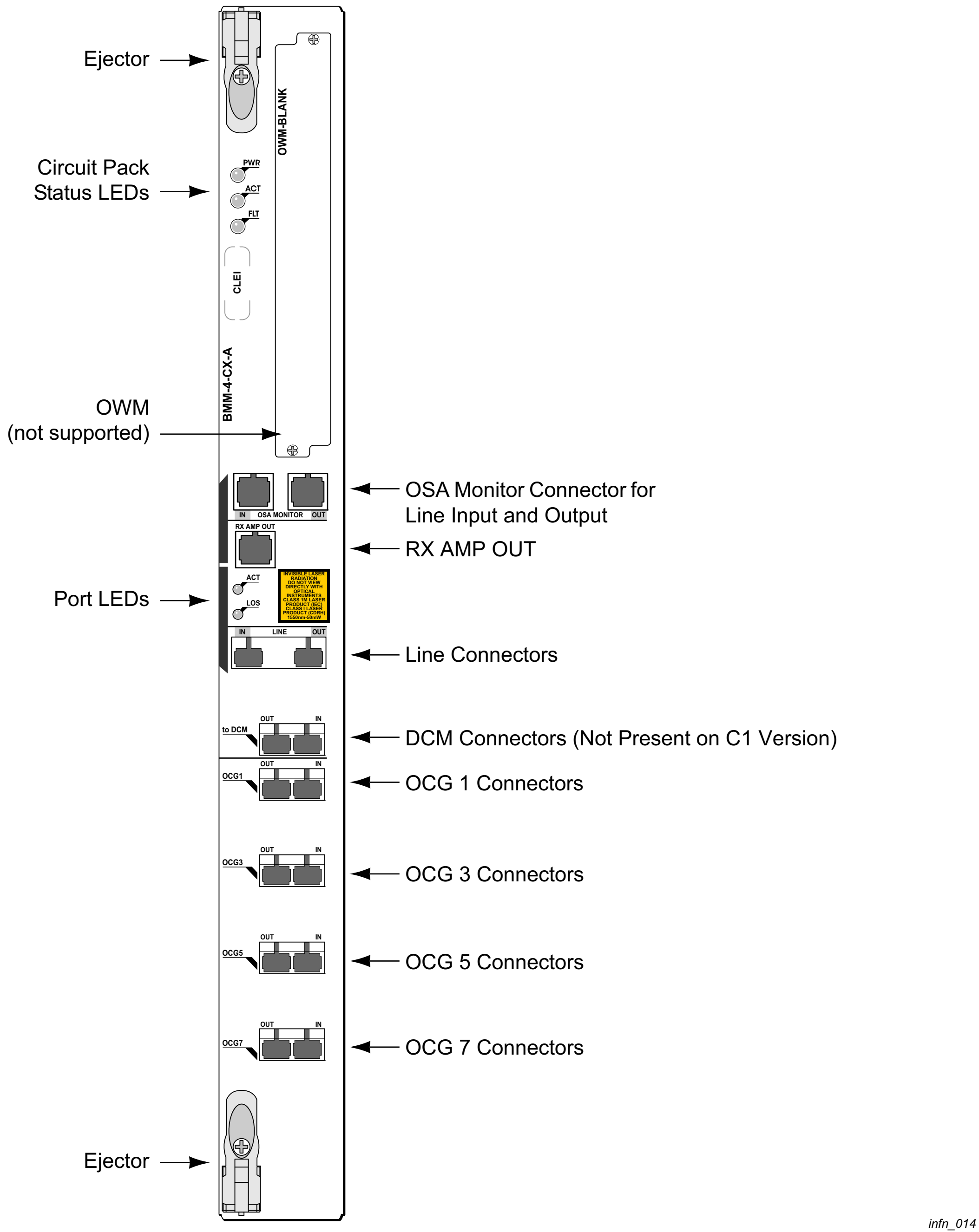
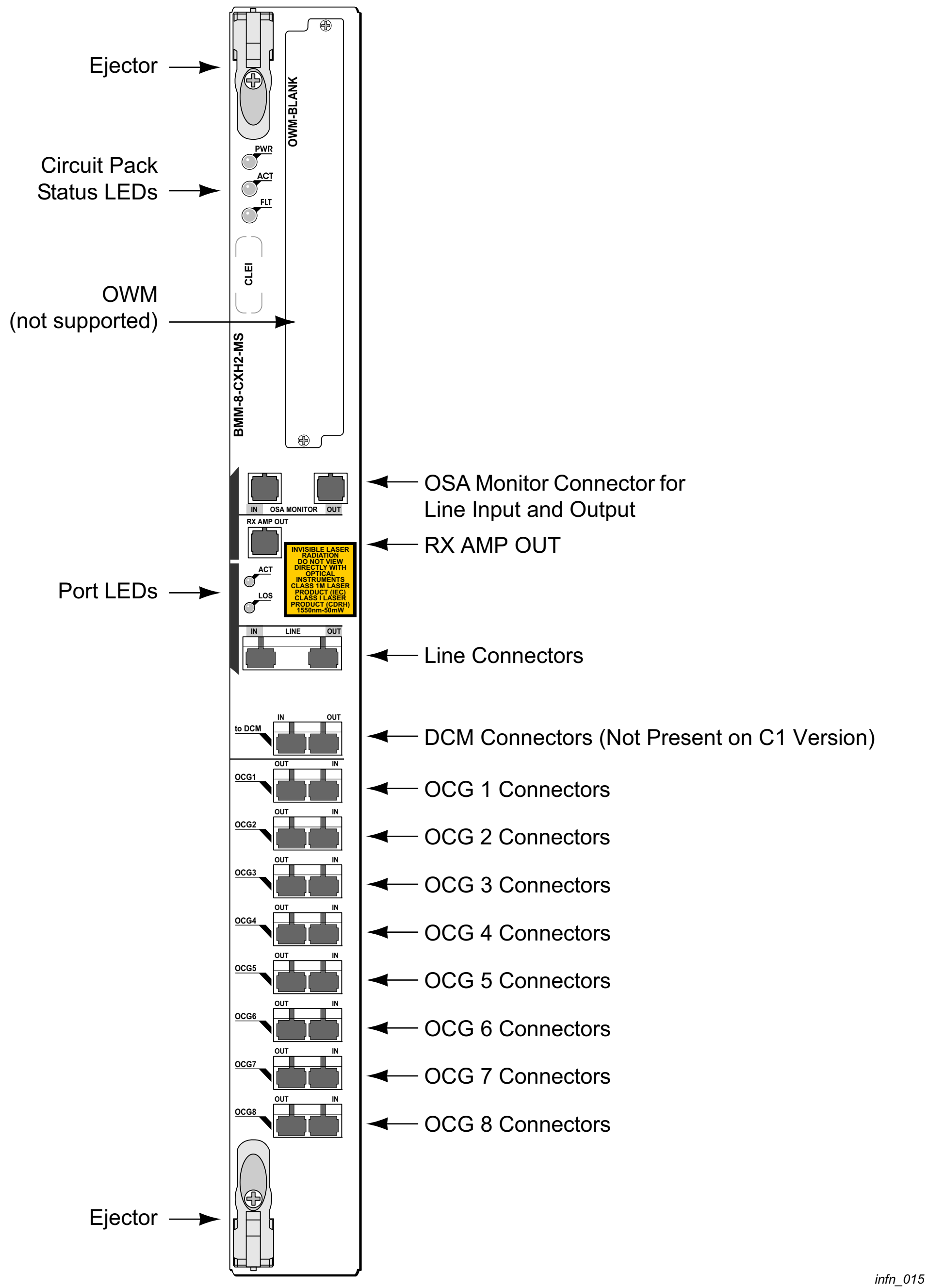


Figure 3-42 BMM-4-CXn-A Faceplate



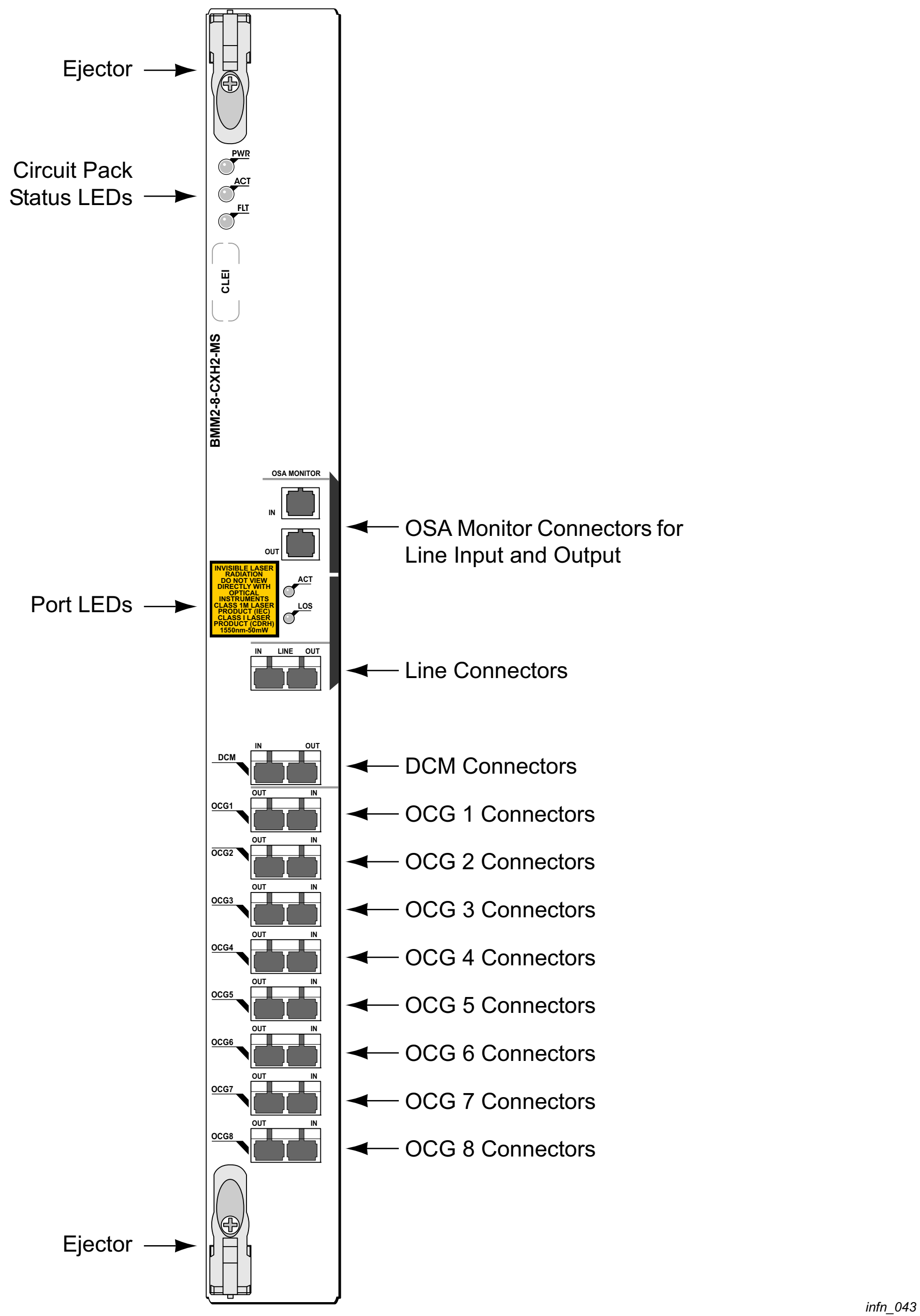
Note: The BMM-4-CXn-A faceplate does not have L-Band connectors.

Figure 3-43 BMM-8-CXHn Faceplate



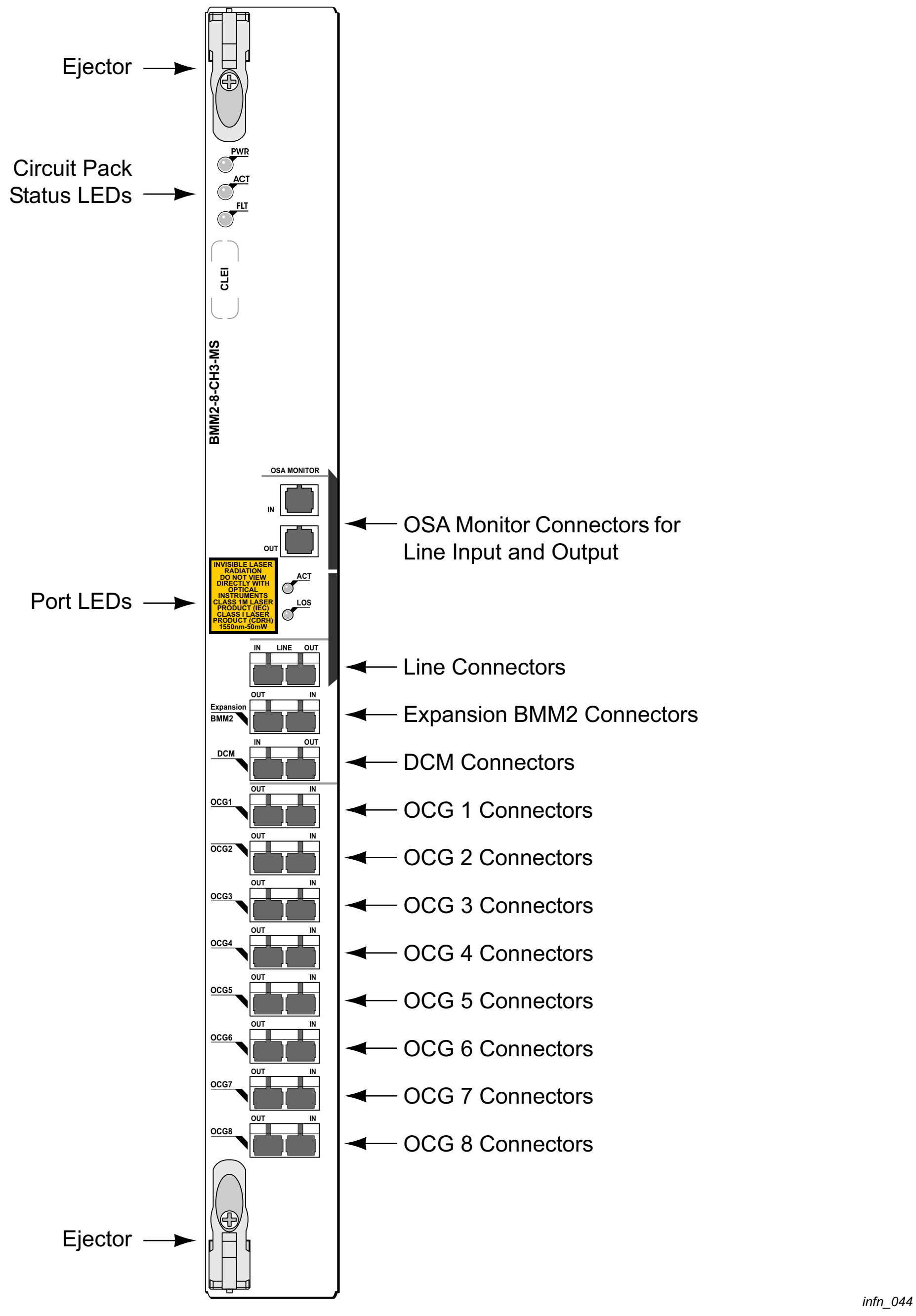
Note: The BMM-8-CXHn faceplate does not have L-Band connectors.

Figure 3-44 BMM2-8-CXH2-MS Faceplate



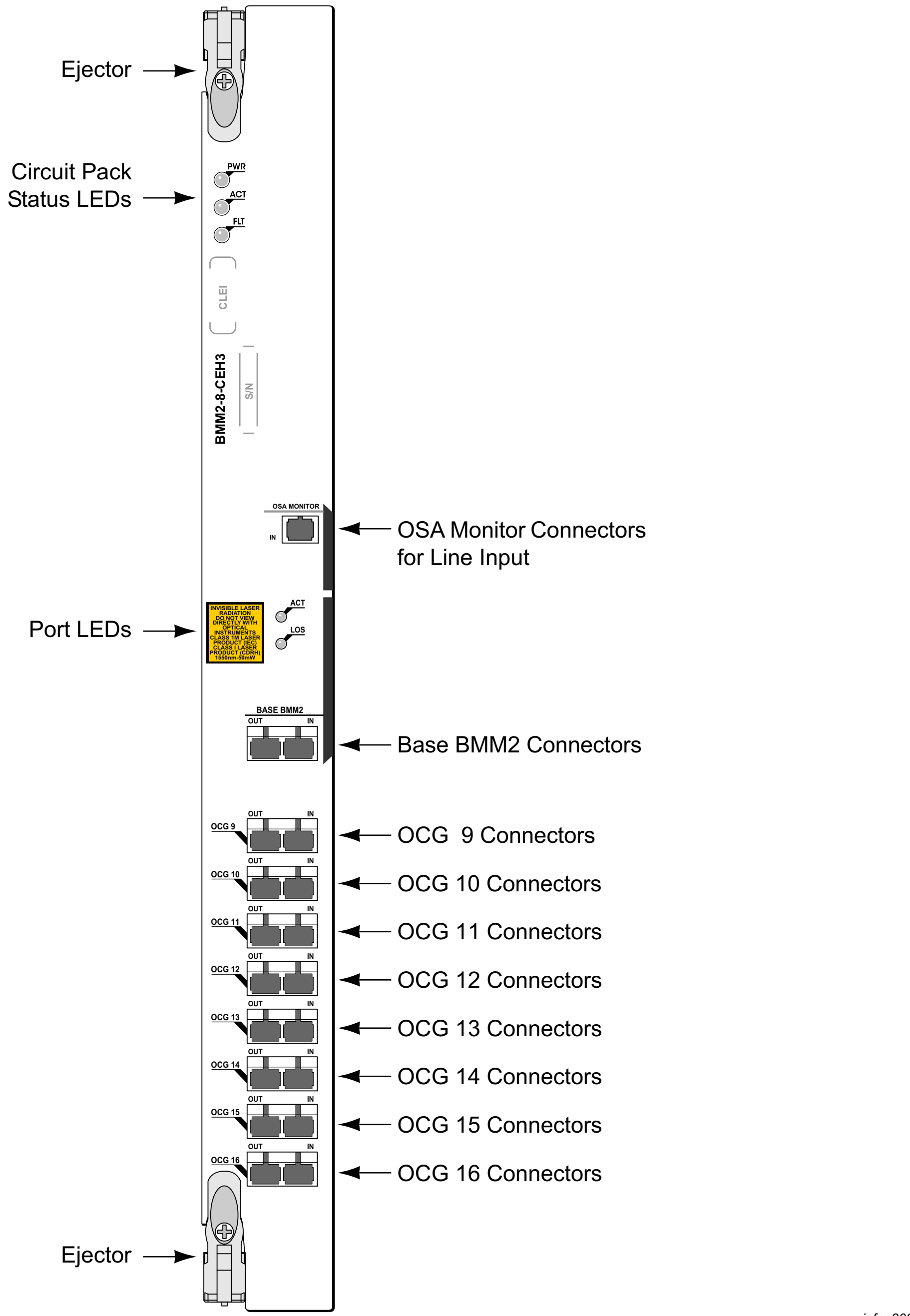
Note: The BMM2-8-CXH2-MS faceplate does not have expansion or base BMM2 connectors.

Figure 3-45 BMM2-8-CH3-MS Faceplate



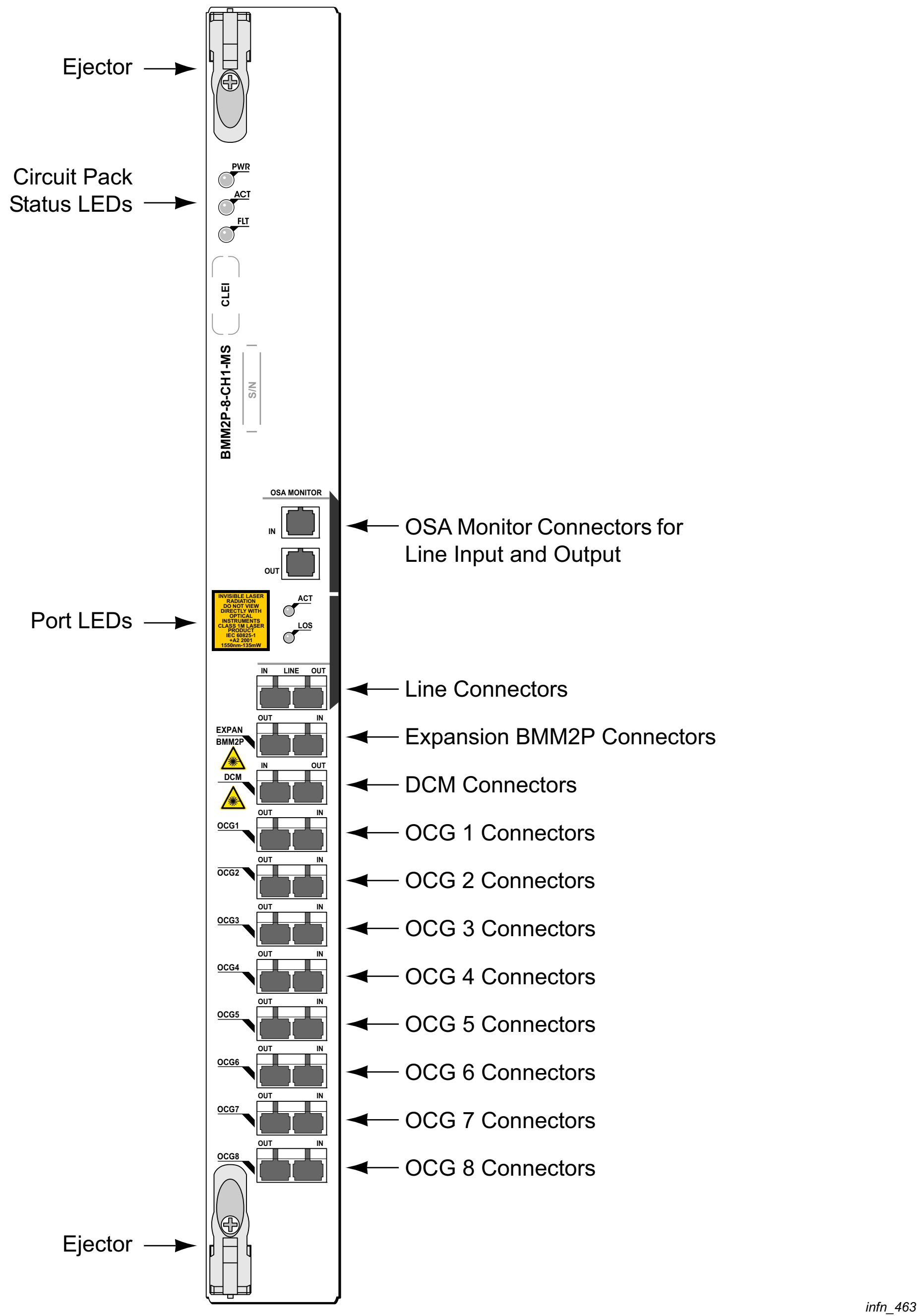
Note: The BMM2-8-CH3-MS faceplate has expansion BMM2 connectors.

Figure 3-46 BMM2-8-CEH3 Faceplate



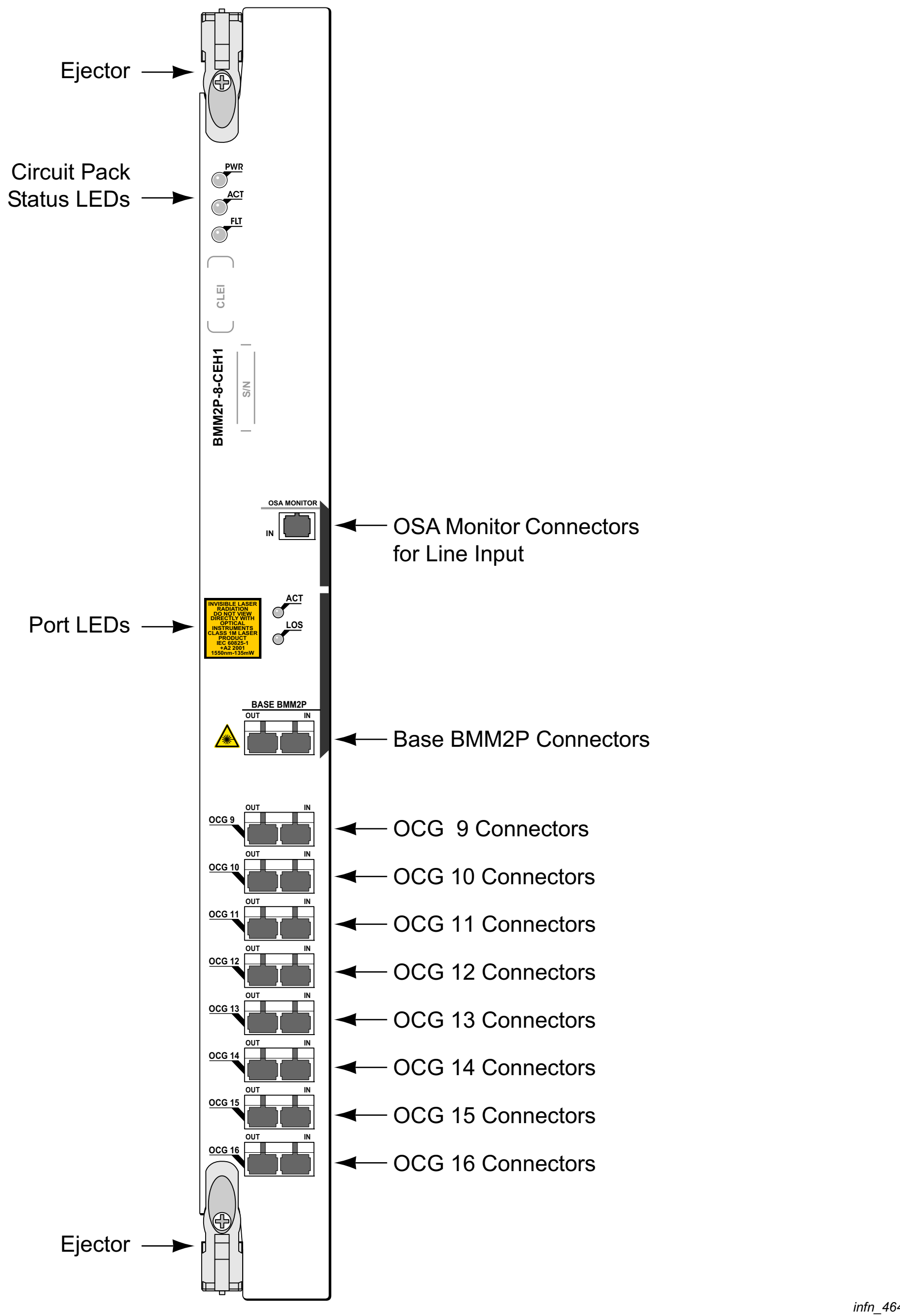
Note: The BMM2-8-CEH3 faceplate has base BMM2 connectors.

Figure 3-47 BMM2P-8-CH1-MS Faceplate



Note: The BMM2P-8-CH1-MS faceplate has expansion BMM2P connectors.

Figure 3-48 BMM2P-8-CEH1 Faceplate



Note: The BMM2P-8-CEH1 faceplate has base BMM2P connectors.

Figure 3-49 BMM1H-4-CX2 Faceplate

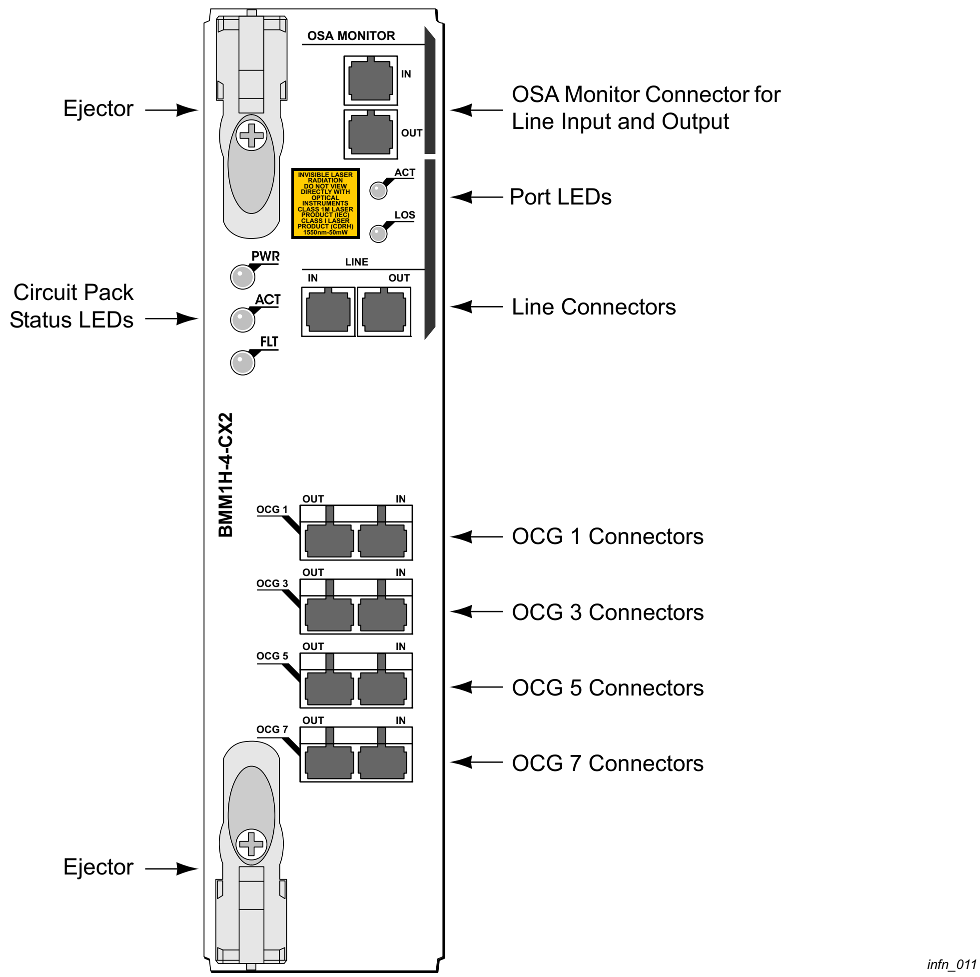
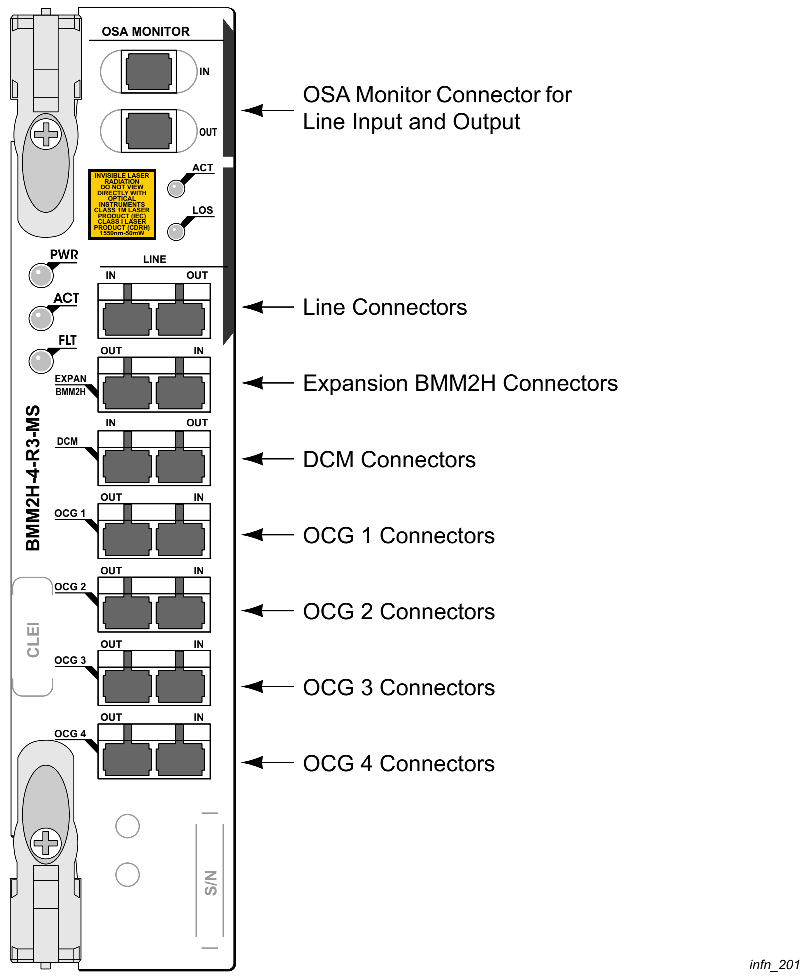
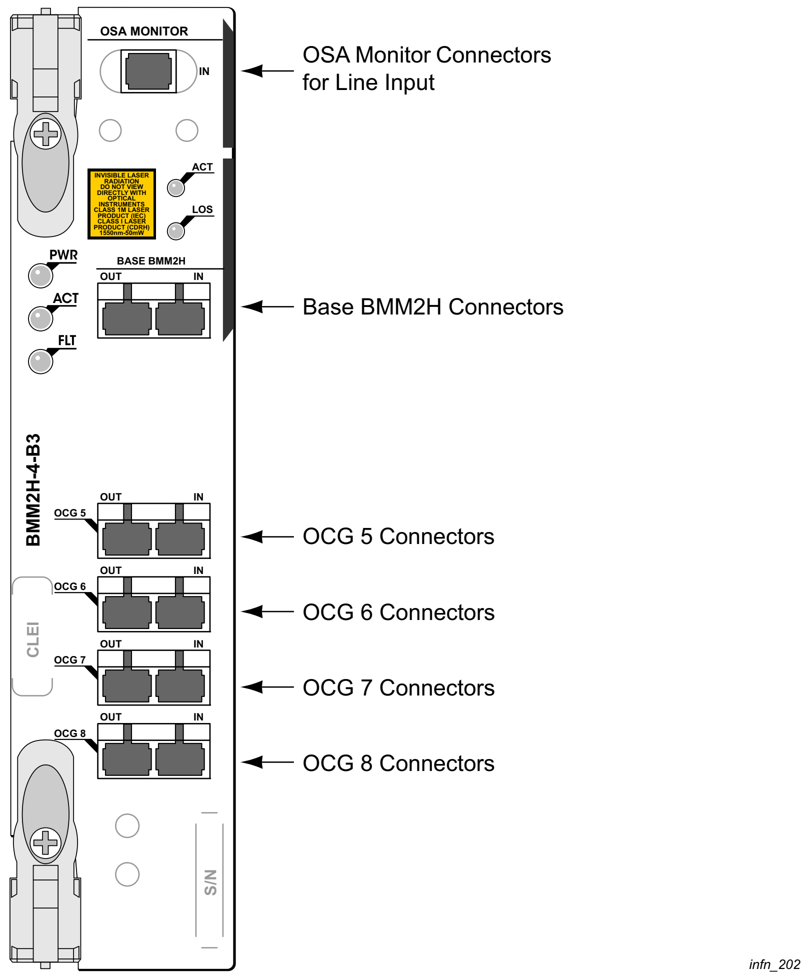


Figure 3-50 BMM2H-4-R3-MS Faceplate



Note: The BMM2H-4-R3-MS faceplate has expansion BMM2H connectors.

Figure 3-51 BMM2H-4-B3 Faceplate



Note: The BMM2H-4-B3 faceplate has base BMM2H connectors.

Circuit Pack Level LEDs

The BMM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-68.

Table 3-68 BMM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the BMM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service) or flashing Yellow (In maintenance)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the BMM to indicate the line port status. The significance of an illuminated LED is described in Table 3-69.

Table 3-69 Port Visual Alarm Indicators on the BMM

LED	State	Description
ACT (Active)	Green / Yellow / Dimmed	Indicates the line port administrative status: Solid Green (Active), flashing Green (ALS is disabled [base BMM2/BMM2Hs only]; not applicable to expansion BMM2/BMM2Hs), flashing Yellow (Locked), or dimmed (during OTS LOS, C-Band LOS, or EDFA is locked)
LOS	Red / Dimmed	Indicates the status of the incoming signal. During an OTS Loss of Signal (LOS) or C-Band LOS condition, this indicator will be lit. When dimmed, indicates that power is being received

Connectors

The BMM provides connectors for the external fiber plant, and for management and control of traffic. Table 3-70 lists the connectors for the BMM-4-Cn-A and BMM-4-Cn-B.

Table 3-70 BMM-4-Cn-A and BMM-4-Cn-B Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
RX AMP OUT	SC, Front access	Port to monitor line input power after amplification
L-Band IN	SC, Front access	Port used to pass L-Band channels
L-Band OUT	SC, Front access	Port used to pass L-Band channels
DCM IN	SC, Front access	Connects from a DCM (not present on BMM-4-C1-A or BMM-4-C1-B)
DCM OUT	SC, Front access	Connects to a DCM (not present on BMM-4-C1-A or BMM-4-C1-B)
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-3
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-5
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-7

Table 3-71 lists the connectors for the BMM-4-CXn-A.

Table 3-71 BMM-4-CXn-A Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
RX AMP OUT	SC, Front access	Port to monitor line input power after amplification
DCM IN	SC, Front access	Connects from a DCM (not present on BMM-4-CX1-A)
DCM OUT	SC, Front access	Connects to a DCM (not present on BMM-4-CX1-A)
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-3
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-5
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-7

Note: The BMM-4-CXn-A does not have L-Band connectors.

Table 3-72 lists the connectors for the BMM-8-CXHn.

Table 3-72 BMM-8-CXHn Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
RX AMP OUT	SC, Front access	Port to monitor line input power after amplification
DCM IN	SC, Front access	Connects from a DCM (not present on BMM-8-CXH1-A)
DCM OUT	SC, Front access	Connects to a DCM (not present on BMM-8-CXH1-A)
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1
OCG 2 IN	SC, Front access	Connects from the DLM/XLM or ADLM/AXLM-1 (tuned as OCG 2)
OCG 2 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1 (tuned as OCG 2)
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-3
OCG 4 IN	SC, Front access	Connects from the DLM/XLM-4 or ADLM/AXLM-3 (tuned as OCG 4)
OCG 4 OUT	SC, Front access	Connects to the DLM/XLM-4 or ADLM/AXLM-3 (tuned as OCG 4)
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-5
OCG 6 IN	SC, Front access	Connects from the DLM/XLM-6 or ADLM/AXLM-5 (tuned as OCG 6)
OCG 6 OUT	SC, Front access	Connects to the DLM/XLM-6 or ADLM/AXLM-5 (tuned as OCG 6)
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-7
OCG 8 IN	SC, Front access	Connects from the DLM/XLM-8 or ADLM/AXLM-7 (tuned as OCG 8)
OCG 8 OUT	SC, Front access	Connects to the DLM/XLM-8 or ADLM/AXLM-7 (tuned as OCG 8)

Note: The BMM-8-CXHn does not have L-Band connectors.

Table 3-73 lists the connectors for the BMM2-8-CXH2-MS.

Table 3-73 BMM2-8-CXH2-MS Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
DCM IN	SC, Front access	Connects from a DCM or DSE
DCM OUT	SC, Front access	Connects to a DCM or DSE
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-1
OCG 2 IN	SC, Front access	Connects from the DLM/XLM-2 or ADLM/AXLM/SLM-1 (tuned as OCG 2)
OCG 2 OUT	SC, Front access	Connects to the DLM/XLM-2 or ADLM/AXLM/SLM-1 (tuned as OCG 2)
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-3
OCG 4 IN	SC, Front access	Connects from the DLM/XLM-4 or ADLM/AXLM/SLM-3 (tuned as OCG 4)
OCG 4 OUT	SC, Front access	Connects to the DLM/XLM-4 or ADLM/AXLM/SLM-3 (tuned as OCG 4)
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-5
OCG 6 IN	SC, Front access	Connects from the DLM/XLM-6 or ADLM/AXLM/SLM-5 (tuned as OCG 6)
OCG 6 OUT	SC, Front access	Connects to the DLM/XLM-6 or ADLM/AXLM/SLM-5 (tuned as OCG 6)
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-7
OCG 8 IN	SC, Front access	Connects from the DLM/XLM-8 or ADLM/AXLM/SLM-7 (tuned as OCG 8)
OCG 8 OUT	SC, Front access	Connects to the DLM/XLM-8 or ADLM/AXLM/SLM-7 (tuned as OCG 8)

Note: When connecting the BMM2-8-CXH2-MS to a DLM/XLM or an ADLM/AXLM (set to Gen 1 mode), the BMM2 OCG ports must be connected to the GAM-1 LINE IN and LINE OUT connectors that correspond to the DLM/XLM OCG that is connected to the GAM-1. See “Gain Adapter Module (GAM)” on page 3-170 for more details.

Table 3-74 lists the connectors for the BMM2-8-CH3-MS.

Table 3-74 BMM2-8-CH3-MS Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
BMM2 Expansion IN	SC, Front access	Connects from expansion BMM2
BMM2 Expansion OUT	SC, Front access	Connects to expansion BMM2
DCM IN	SC, Front access	Connects from a DCM or DSE
DCM OUT	SC, Front access	Connects to a DCM or DSE
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-1
OCG 2 IN	SC, Front access	Connects from the DLM/XLM-2 or ADLM/AXLM/SLM-1 (tuned as OCG 2)
OCG 2 OUT	SC, Front access	Connects to the DLM/XLM-2 or ADLM/AXLM/SLM-1 (tuned as OCG 2)
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-3
OCG 4 IN	SC, Front access	Connects from the DLM/XLM-4 or ADLM/AXLM/SLM-3 (tuned as OCG 4)
OCG 4 OUT	SC, Front access	Connects to the DLM/XLM-4 or ADLM/AXLM/SLM-3 (tuned as OCG 4)
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-5
OCG 6 IN	SC, Front access	Connects from the DLM/XLM-6 or ADLM/AXLM/SLM-5 (tuned as OCG 6)
OCG 6 OUT	SC, Front access	Connects to the DLM/XLM-6 or ADLM/AXLM/SLM-5 (tuned as OCG 6)
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM/SLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM/SLM-7
OCG 8 IN	SC, Front access	Connects from the DLM/XLM-8 or ADLM/AXLM/SLM-7 (tuned as OCG 8)
OCG 8 OUT	SC, Front access	Connects to the DLM/XLM-8 or ADLM/AXLM/SLM-7 (tuned as OCG 8)

Note: When connecting the BMM2-8-CH3-MS to a DLM/XLM or an ADLM/AXLM (set to Gen 1 mode), the BMM2 OCG ports must be connected to the GAM-1 LINE IN and LINE OUT connectors that correspond to the DLM/XLM OCG that is connected to the GAM-1. See "Gain Adapter Module (GAM)" on page 3-170 for more details.

Table 3-75 lists the connectors for the BMM2-8-CEH3.

Table 3-75 BMM2-8-CEH3 Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
Base BMM2 IN	SC, Front access	Connects from base BMM2
Base BMM2 OUT	SC, Front access	Connects to base BMM2
OCG 9 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-1 (tuned as OCG 9)
OCG 9 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-1 (tuned as OCG 9)
OCG 10 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-1 (tuned as OCG 10)
OCG 10 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-1 (tuned as OCG 10)
OCG 11 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-3 (tuned as OCG 11)
OCG 11 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-3 (tuned as OCG 11)
OCG 12 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-3 (tuned as OCG 12)
OCG 12 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-3 (tuned as OCG 12)
OCG 13 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-5 (tuned as OCG 13)
OCG 13 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-5 (tuned as OCG 13)
OCG 14 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-5 (tuned as OCG 14)
OCG 14 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-5 (tuned as OCG 14)
OCG 15 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-7 (tuned as OCG 15)
OCG 15 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-7 (tuned as OCG 15)
OCG 16 IN	SC, Front access	Connects from the ADLM/AXLM/SLM-7 (tuned as OCG 16)
OCG 16 OUT	SC, Front access	Connects to the ADLM/AXLM/SLM-7 (tuned as OCG 16)

Note: When connecting the BMM2-8-CEH3 to an ADLM/AXLM set to Gen 1 mode, the BMM2 OCG ports must be connected to the GAM-1 LINE IN and LINE OUT connectors that correspond to the ADLM/AXLM OCG that is connected to the GAM-1. See "Gain Adapter Module (GAM)" on page 3-170 for more details.

Table 3-76 lists the connectors for the BMM2P-8-CH1-MS.

Table 3-76 BMM2P-8-CH1-MS Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
BMM2P Expansion IN	SC, Front access	Connects from expansion BMM2P
BMM2P Expansion OUT	SC, Front access	Connects to expansion BMM2P
DCM IN	SC, Front access	Connects from a DCM
DCM OUT	SC, Front access	Connects to a DCM
OCG 1 IN	SC, Front access	Connects from the ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the ADLM/AXLM-1
OCG 2 IN	SC, Front access	Connects from the ADLM/AXLM-1 (tuned as OCG 2)
OCG 2 OUT	SC, Front access	Connects to the ADLM/AXLM-1 (tuned as OCG 2)
OCG 3 IN	SC, Front access	Connects from the ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the ADLM/AXLM-3
OCG 4 IN	SC, Front access	Connects from the ADLM/AXLM-3 (tuned as OCG 4)
OCG 4 OUT	SC, Front access	Connects to the ADLM/AXLM-3 (tuned as OCG 4)
OCG 5 IN	SC, Front access	Connects from the ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the ADLM/AXLM-5
OCG 6 IN	SC, Front access	Connects from the ADLM/AXLM-5 (tuned as OCG 6)
OCG 6 OUT	SC, Front access	Connects to the ADLM/AXLM-5 (tuned as OCG 6)
OCG 7 IN	SC, Front access	Connects from the ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the ADLM/AXLM-7
OCG 8 IN	SC, Front access	Connects from the ADLM/AXLM-7 (tuned as OCG 8)
OCG 8 OUT	SC, Front access	Connects to the ADLM/AXLM-7 (tuned as OCG 8)

Note: When connecting the BMM2P-8-CH1-MS to an ADLM/AXLM, a GAM-2 is required. See "Gain Adapter Module (GAM)" on page 3-170 for more details.

Table 3-77 lists the connectors for the BMM2P-8-CEH1.

Table 3-77 BMM2P-8-CEH1 Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
Base BMM2P IN	SC, Front access	Connects from base BMM2P
Base BMM2P OUT	SC, Front access	Connects to base BMM2P
OCG 9 IN	SC, Front access	Connects from the ADLM/AXLM-1 (tuned as OCG 9)
OCG 9 OUT	SC, Front access	Connects to the ADLM/AXLM-1 (tuned as OCG 9)
OCG 10 IN	SC, Front access	Connects from the ADLM/AXLM-1 (tuned as OCG 10)
OCG 10 OUT	SC, Front access	Connects to the ADLM/AXLM-1 (tuned as OCG 10)
OCG 11 IN	SC, Front access	Connects from the ADLM/AXLM-3 (tuned as OCG 11)
OCG 11 OUT	SC, Front access	Connects to the ADLM/AXLM-3 (tuned as OCG 11)
OCG 12 IN	SC, Front access	Connects from the ADLM/AXLM-3 (tuned as OCG 12)
OCG 12 OUT	SC, Front access	Connects to the ADLM/AXLM-3 (tuned as OCG 12)
OCG 13 IN	SC, Front access	Connects from the ADLM/AXLM-5 (tuned as OCG 13)
OCG 13 OUT	SC, Front access	Connects to the ADLM/AXLM-5 (tuned as OCG 13)
OCG 14 IN	SC, Front access	Connects from the ADLM/AXLM-5 (tuned as OCG 14)
OCG 14 OUT	SC, Front access	Connects to the ADLM/AXLM-5 (tuned as OCG 14)
OCG 15 IN	SC, Front access	Connects from the ADLM/AXLM-7 (tuned as OCG 15)
OCG 15 OUT	SC, Front access	Connects to the ADLM/AXLM-7 (tuned as OCG 15)
OCG 16 IN	SC, Front access	Connects from the ADLM/AXLM-7 (tuned as OCG 16)
OCG 16 OUT	SC, Front access	Connects to the ADLM/AXLM-7 (tuned as OCG 16)

Note: When connecting the BMM2P-8-CEH1 to an ADLM/AXLM, a GAM-2 is required. See "Gain Adapter Module (GAM)" on page 3-170 for more details.

Table 3-78 lists the connectors for the BMM1H-4-CX2.

Table 3-78 BMM1H-4-CX2 Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-3
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-5
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-7

Table 3-79 lists the connectors for the BMM2H-4-R3-MS.

Table 3-79 BMM2H-4-R3-MS Connectors

Connector	Type	Purpose
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Port to monitor line output
BMM2H Expansion IN	SC, Front access	Connects from expansion BMM2H
BMM2H Expansion OUT	SC, Front access	Connects to expansion BMM2H
DCM IN	SC, Front access	Connects from a DCM
DCM OUT	SC, Front access	Connects to a DCM
OCG 1 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-1
OCG 1 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-1
OCG 2 IN	SC, Front access	Connects from the DLM/XLM-2 or ADLM/AXLM-1 (tuned as OCG 2)
OCG 2 OUT	SC, Front access	Connects to the DLM/XLM-2 or ADLM/AXLM-1 (tuned as OCG 2)
OCG 3 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-3
OCG 3 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-3
OCG 4 IN	SC, Front access	Connects from the DLM/XLM-4 or ADLM/AXLM-3 (tuned as OCG 4)
OCG 4 OUT	SC, Front access	Connects to the DLM/XLM-4 or ADLM/AXLM-3 (tuned as OCG 4)

Note: When connecting the BMM2H-4-R3-MS to a DLM/XLM or an ADLM/AXLM (set to Gen 1 mode), a GAM-1 is required. See “Gain Adapter Module (GAM)” on page 3-170 for more details.

Table 3-80 lists the connectors for the BMM2H-4-B3.

Table 3-80 BMM2H-4-B3 Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
Base BMM2H IN	SC, Front access	Connects from base BMM2H
Base BMM2H OUT	SC, Front access	Connects to base BMM2H
OCG 5 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-5
OCG 5 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-5
OCG 6 IN	SC, Front access	Connects from the DLM/XLM-6 or ADLM/AXLM-5 (tuned as OCG 6)
OCG 6 OUT	SC, Front access	Connects to the DLM/XLM-6 or ADLM/AXLM-5 (tuned as OCG 6)
OCG 7 IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM-7
OCG 7 OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM-7
OCG 8 IN	SC, Front access	Connects from the DLM/XLM-8 or ADLM/AXLM-7 (tuned as OCG 8)
OCG 8 OUT	SC, Front access	Connects to the DLM/XLM-8 or ADLM/AXLM-7 (tuned as OCG 8)

Note: When connecting the BMM2H-4-B3 to a DLM/XLM or an ADLM/AXLM (set to Gen 1 mode), a GAM-1 is required. See "Gain Adapter Module (GAM)" on page 3-170 for more details.

Technical Specifications

Table 3-81 provides the mechanical and electrical specifications for all BMM-4/BMM-8s: BMM-4-Cn-A, BMM-4-Cn-B, BMM-4-CXn-A, and BMM-8-CHn.

Table 3-81 BMM-4/BMM-8 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	2.00 inches / 50.80mm
	Depth	11.10 inches / 281.94mm
	Weight	10.5lb / 4.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Table 3-82 provides the mechanical and electrical specifications for all BMM2/BMM2Ps: BMM2-8-CXH2, BMM2-8-CH3, BMM2-8-CEH3, BMM2P-8-CH1, and BMM2P-8-CEH1.

Table 3-82 BMM2/BMM2P Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	2.00 inches / 50.80mm
	Depth	11.10 inches / 281.94mm
	Weight	11.3lb / 5.1kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Table 3-83 provides the mechanical and electrical specifications for the BMM1H-4-CX2, BMM2H-4-R3-MS, and BMM2H-4-B3.

Table 3-83 BMM1H/BMM2H Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	8.90 inches / 226.06mm
	Width	2.20 inches / 55.88mm
	Depth	11.10 inches / 281.94mm
	Weight	10.9lb / 4.9kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

The optical specification details for the BMM1H-4-CX2, BMM-4-Cn-A, BMM-4-Cn-B, and BMM-4-CXn-A are listed in Table 3-84.

Table 3-84 BMM1H-4-CX2, BMM-4-Cn-A, BMM-4-Cn-B, and BMM-4-CXn-A Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	100GHz
	Wavelength range	1530.725-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

The optical specification details for the BMM-8-CXH are listed in Table 3-85.

Table 3-85 BMM-8-CXH Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	50GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

The optical specification details for the BMM2-8-CXH2-MS are listed in Table 3-86.

Table 3-86 BMM2-8-CXH2-MS Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	50GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

The optical specification details for the BMM2-8-CH3-MS, BMM2-8-CEH3, BMM2P-8-CH1-MS, and BMM2P-8-CEH1 are listed in Table 3-87.

Table 3-87 BMM2/BMM2P (all except BMM2-8-CXH2-MS) Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	25GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

The optical specification details for the BMM2H-4-R3-MS and BMM2H-4-B3 are listed in Table 3-88.

Table 3-88 BMM2H-4-R3-MS and BMM2H-4-B3 Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	50GHz
	Wavelength range	1530.725-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

Channel Multiplexing Module (CMM)

The CMM which is supported on the DTC/MTC and provides multiplexing/demultiplexing of up to twenty separate Infinera (40Gbps or 20Gbps) wavelength optical channels (OCHs) onto two Optical Carrier Groups (OCGs). Each OCG can contain up to ten separate Infinera (40Gbps or 20Gbps) OCHs. The CMMs are optically connected between an ADLM-80/AXLM-80/SLM-80 (on the OCH side) and a BMM (on the OCG side).

CMMs can be installed in slots 3 through 6 of the DTC/MTC. There are two versions of the CMM, one for Red band OCGs and another for Blue band OCGs as listed in Table 3-89.

Table 3-89 CMM Product Details

Product Ordering Name (PON)	Description
CMM1D-20-CR	CMM, OCGs 1 - 4, 9 - 12 (default OCG 1), C-Band (Red: 1547.5-1563.75nm)
CMM1D-20-CB	CMM, OCGs 5 - 8, 13 - 16 (default OCG 5), C-Band (Blue: 1530.0-1545.92nm)

Functional Description

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The Channel Multiplexing Module, referred to as CMM, performs the following functions:

- Generates and receives up to twenty separate Infinera (40Gbps or 20Gbps) OCHs for multiplexing/demultiplexing onto two OCGs for transmission over the facility line side using the following modulation formats:
  - Polarization multiplexed-quadrature phase shift keying (PM-QPSK) for 40Gbps wavelengths (default)
  - Polarization multiplexed-binary phase shift keying (PM-BPSK) for 20Gbps wavelengths
- Configurable for Gen 1 or Gen 2 operating mode to interconnect with Gen 1/Gen 2/2P BMMs
- Supports wavelength spacing at 25GHz for a total channel count of 160 channels
- Contains a 1490nm laser to support Auto-discovery. Auto-discovery is supported between Infinera wavelengths and CMM OCGs, and between CMM OCGs and BMM OCGs

- Provides user-configurable target power offset from -3.0 to 0.0dB (default is 0.0dB) at OCH level in order to increase or decrease the ingress power levels to allow for the coexistence of different rate wavelengths (40Gbps, 20Gbps, or 10Gbps) on the OTS line side

Note: Do not configure the target power offset unless consulted to do so by an Infinera TAC resource.

- Provides 16.5dB of fixed EDFA gain

CMM Optical Power Specifications

The optical power specifications (per OCH/OCG port) for the different CMM types are listed in Table 3-90.

Table 3-90 CMM Optical Specifications

CMM1D-A Type	OCH Input Power (dBm)	OCH Output Power (dBm)	OCG Input Power (dBm)	OCG Output Power (dBm)
CMM1D-20-CR	-6.5 to +1.0	-22.0 to +1.0	-15.5 to +13.5	-6.0 to +8.0
CMM1D-20-CB				

CMM Optical Patch Cable Loss Specifications

The optical patch cable losses supported for Infinera wavelengths are listed as follows:

- 1.5dB between LM-80 OCH and CMM OCH (if the loss exceeds the threshold, an Optical Loss - Out of Range High alarm will be generated on the LM-80 OCH)
- 1.5dB between CMM OCG and BMM OCG (Gen 2/2P) (if the loss exceeds the threshold, an Optical Loss - Out of Range High alarm will be generated on the CMM OCG)
- 18.0dB (15.0dB attenuator pad + 3.0dB) between CMM OCG and BMM OCG (Gen 1) (if the loss exceeds the threshold, an Optical Loss - Out of Range High alarm will be generated on the CMM OCG)

Block Diagrams

This section provides the CMM control and data plane block diagrams as follows:

- CMM control plane block diagram as shown in Figure 3-52
- CMM1D-20-CR/CMM1D-20-CB data plane block diagram as shown in Figure 3-53 on page 3-144

Figure 3-52 CMM Control Plane Block Diagram

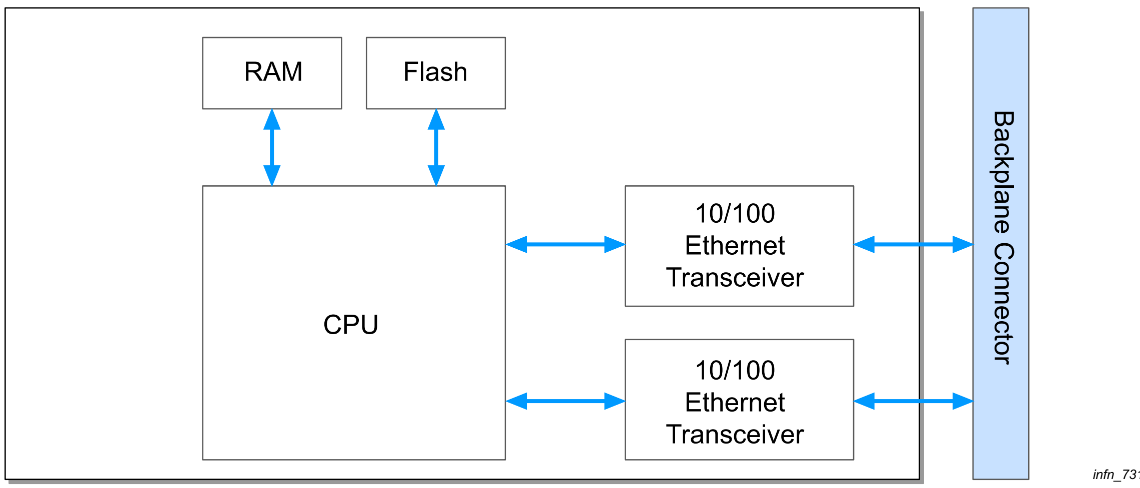
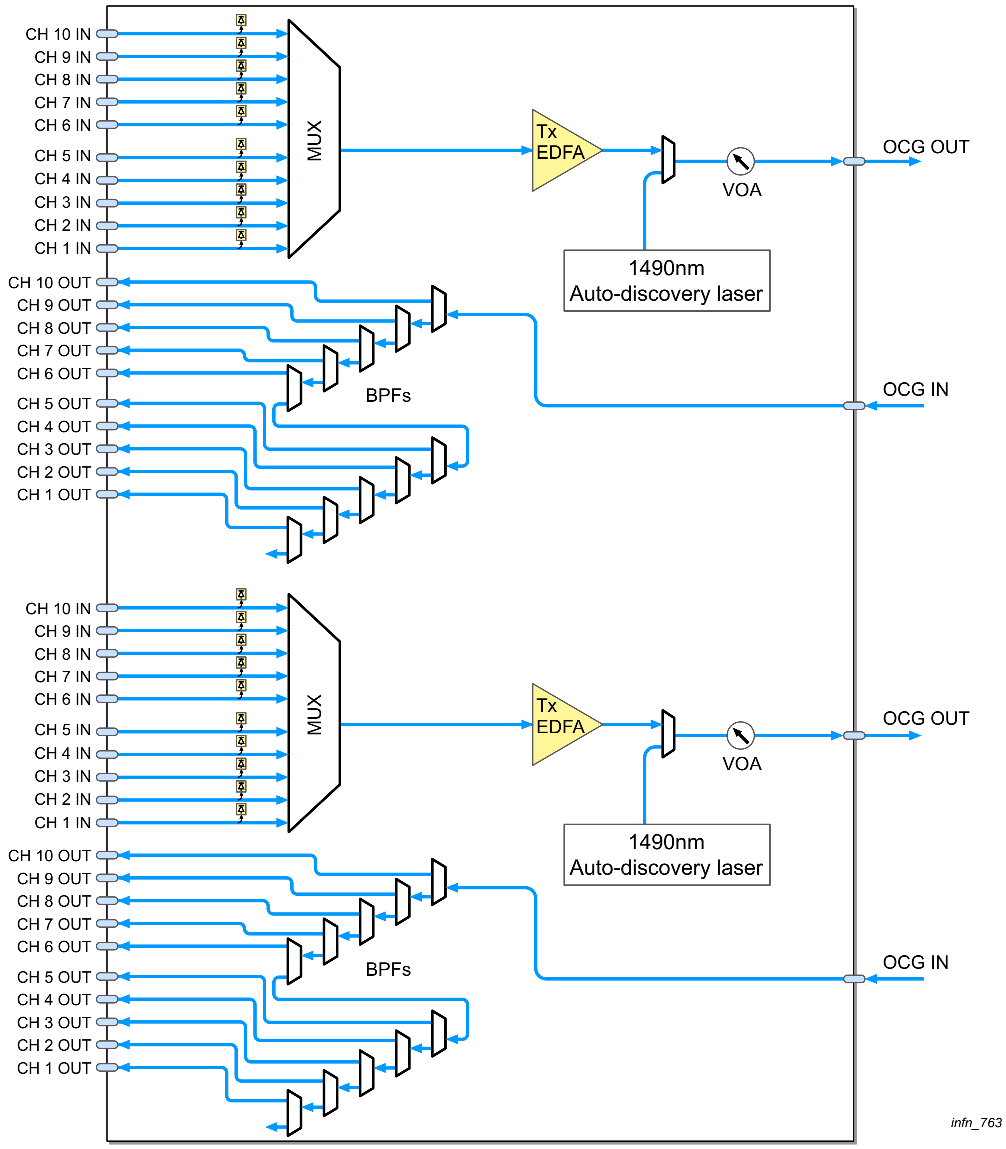


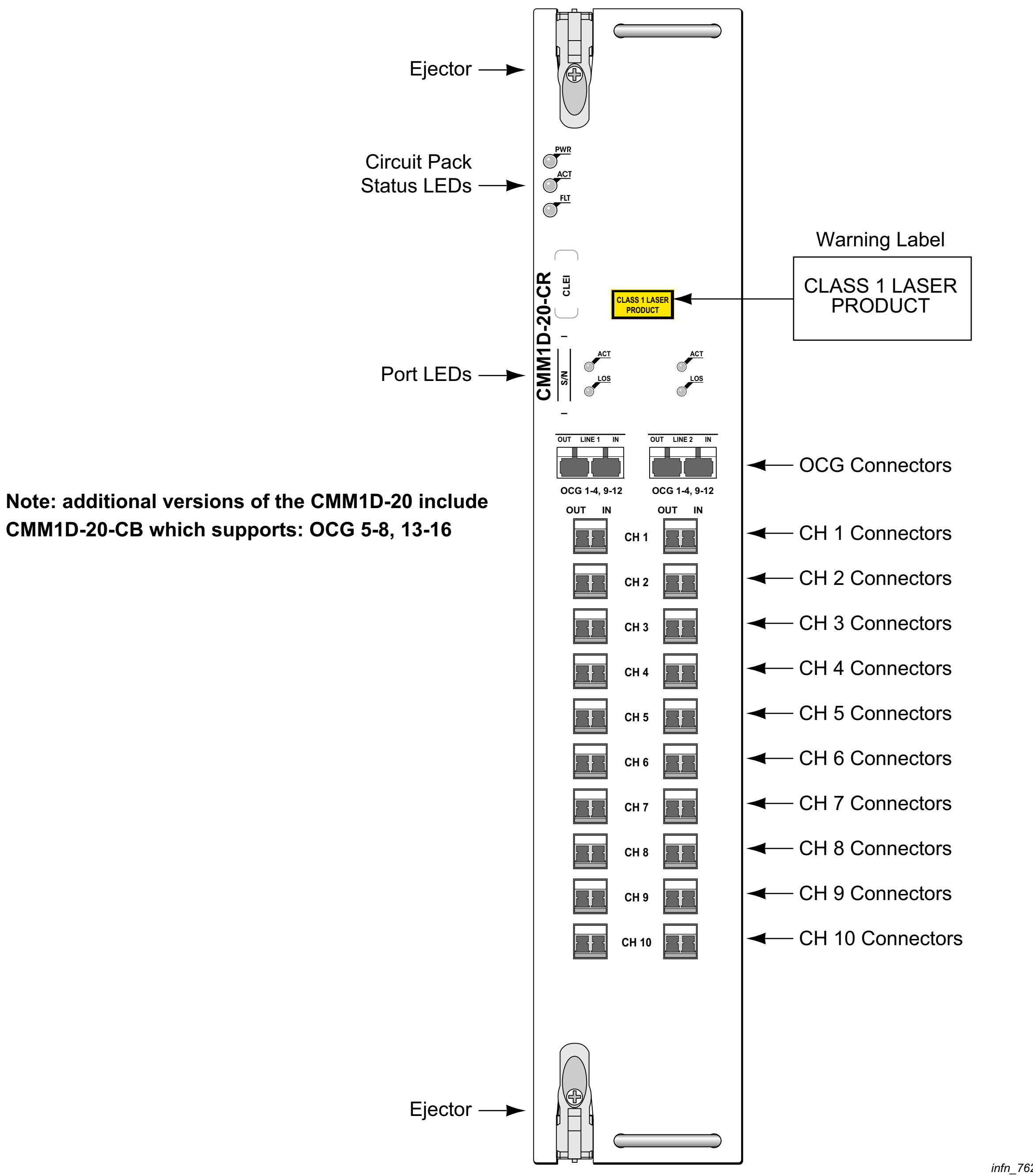
Figure 3-53 CMM1D-20-CR/CMM1D-20-CB Data Plane Block Diagram



External Indicators and Connectors

The CMM (Figure 3-54) provides circuit pack status/port LED indicators, and line/port connectors.

Figure 3-54 CMM1D-20-CR/CMM1D-20-CB Faceplate



Circuit Pack Level LEDs

The CMM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-91.

Table 3-91 CMM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the CMM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service) or flash-ing Yellow (In maintenance)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the CMM to indicate the line port status. The significance of an illuminated LED is described in Table 3-92.

Table 3-92 Port Visual Alarm Indicators on the CMM

LED	State	Description
ACT (Active)	Green / Dimmed	Indicates the line port administrative status: Solid Green (Active), flashing Green (Auto-discovery state), or dimmed (when Auto-discovery between CMM OCG and BMM OCG is timed out, card is Locked
LOS	Red / Dimmed	Indicates the status of the incoming signal. During an OTS LOS, C-Band LOS condition, or CMM OCG OLOS condition, this indicator will be lit. When dimmed, indicates that power is received by the CMM OCG

Connectors

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The CMM provides OCH (CH n IN/OUT) interfaces for fibering of the ADLM-80/AXLM-80/SLM-80 and OCG (Line n IN/OUT) interfaces for fibering to the corresponding BMM as shown in Table 3-93.

Table 3-93 CMM1D-20-CR/CMM1D-20-CB Connectors

Connector	Type	Purpose
Line 1 CH 1 IN Line 2 CH 1 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 1 OUT Line 2 CH 1 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 2 IN Line 2 CH 2 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 2 OUT Line 2 CH 2 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 3 IN Line 2 CH 3 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 3 OUT Line 2 CH 3 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 4 IN Line 2 CH 4 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 4 OUT Line 2 CH 4 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 5 IN Line 2 CH 5 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 5 OUT Line 2 CH 5 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 6 IN Line 2 CH 6 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 6 OUT Line 2 CH 6 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 7 IN Line 2 CH 7 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 7 OUT Line 2 CH 7 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80

Table 3-93 CMM1D-20-CR/CMM1D-20-CB Connectors

Connector	Type	Purpose
Line 1 CH 8 IN Line 2 CH 8 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 8 OUT Line 2 CH 8 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 9 IN Line 2 CH 9 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 9 OUT Line 2 CH 9 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 10 IN Line 2 CH 10 IN	LC, Front access	Connects from the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 CH 10 OUT Line 2 CH 10 OUT	LC, Front access	Connects to the OCH port on the ADLM-80/AXLM-80/SLM-80
Line 1 OCG n IN Line 2 OCG n IN • CMM1D-20-CR: n=1-4, 9-12 • CMM1D-20-CB: n=5-8, 13-16	SC, Front access	Connects from the corresponding OCG port on the BMM
Line 1 OCG n OUT Line 2 OCG n OUT • CMM1D-20-CR: n=1-4, 9-12 • CMM1D-20-CB: n=5-8, 13-16	SC, Front access	Connects to the corresponding OCG port on the BMM **Note**: If Gen 1 BMMs are used, ensure that a 15.0dB attenuator pad is plugged into the BMM OCG IN port to meet the power requirements for Auto-discovery.

Technical Specifications

Table 3-94 provides the mechanical and electrical specifications for the CMM1D-20-CR/CMM1D-20-CB.

Table 3-94 CMM1D-20-CR/CMM1D-20-CB Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	15.0lb / 6.8kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

The optical specification details for the CMM1D-20-CR/CMM1D-20-CB are listed in Table 3-95.

Table 3-95 CMM1D-20-CR/CMM1D-20-CB Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	25GHz
	Wavelength range	1530.725-1563.455nm ITU Grid

Digital Line Module (DLM)

The DLM transmits and receives ten 10Gbps DWDM signals, referred to as the Optical Carrier Group (OCG). DLMs are hard-wired to transmit and receive the specific optical channel group (OCG) that is represented by the "n" in the model number format "DLM-n-Cx". For example, the DLM-5-C2 type supports OCG 5 and must be connected to the OCG 5 port on the associated BMM.

DLMs can be installed in slots 3 through 6 of the DTC/MTC. There are twenty-four (24) versions of the DLM, with eight OCGs as listed in Table 3-96.

Table 3-96 DLM Product Details

Product Ordering Name (PON)	Description
DLM-1-C1-A[a] DLM-1-C1-B DLM-1-C2 DLM-1-C3	DLM, OCG 1, C-Band
DLM-2-C2 DLM-2-C3	DLM, OCG 2, C-Band
DLM-3-C1-A[a] DLM-3-C1-B DLM-3-C2 DLM-3-C3	DLM, OCG 3, C-Band
DLM-4-C2 DLM-4-C3	DLM, OCG 4, C-Band
DLM-5-C1-A[a] DLM-5-C1-B DLM-5-C2 DLM-5-C3	DLM, OCG 5, C-Band
DLM-6-C2 DLM-6-C3	DLM, OCG 6, C-Band
DLM-7-C1-A[a] DLM-7-C1-B DLM-7-C2 DLM-7-C3	DLM, OCG 7, C-Band
DLM-8-C2 DLM-8-C3	DLM, OCG 8, C-Band

a. DLM-n-C1-A is generally no longer available but is still supported.

Functional Description

Note: The DLM-n-C1-A is generally no longer available but is still supported and has been replaced by the DLM-n-C1-B.

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The Digital Line Module, referred to as DLM, performs the following functions:

- Provides add/drop or switching of 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the back-plane

  Note: 40Gbps signals are not supported on the DLM-n-C1-A.

  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode

  Note: DLMs are not supported in a chassis that is set to Mesh switching mode. If a DLM is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the DLM.

- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
  - GAM-1

- GAM-2

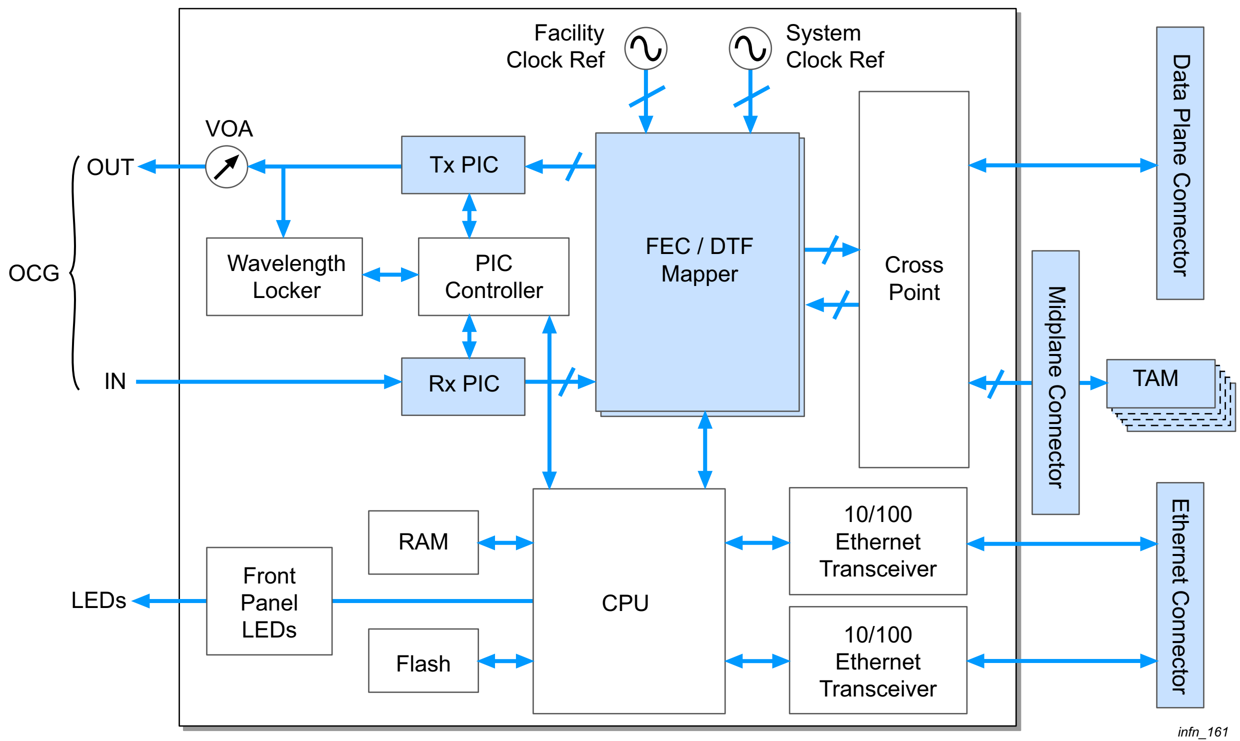
Note: In the case of a DLM-n-C1-A, contact Infinera Technical Assistance Center (TAC) prior to installing a TAM-8-2.5GM. Also, the TAM-1-40G-VSR, TAM-1-40GE, TAM-1-40GR, and TAM-2-10GT are not supported on the DLM-n-C1-A.

Note: When a DLM/XLM is connected to a BMM2/BMM2H, it must be connected via a GAM-1 due to the increased launch power required on the BMM2/BMM2H. See "Gain Adapter Module (GAM)" on page 3-170 for more information.

- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCG OUT and OCG IN links on each DLM
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx Photonic Integrated Circuits (PICs)
- Multiplexes the 10 individual wavelengths into an OCG through the Tx PIC
- De-multiplexes the OCG into 10 individual wavelengths through the Rx PIC
- Optically connects to the appropriate BMM or GAM-1 for transmission over the facility line side
- Allows for wider dispersion in order to increase distance between regeneration. The following ranges are supported:
  - DLM-n-C1-A/B: -300 to +500ps/nm
  - DLM-n-C2/C3: -700 to +800ps/nm
- The DLM-n-C3 provides an improved Rx dynamic gain range specification compared to the DLM-n-C2

Block Diagram

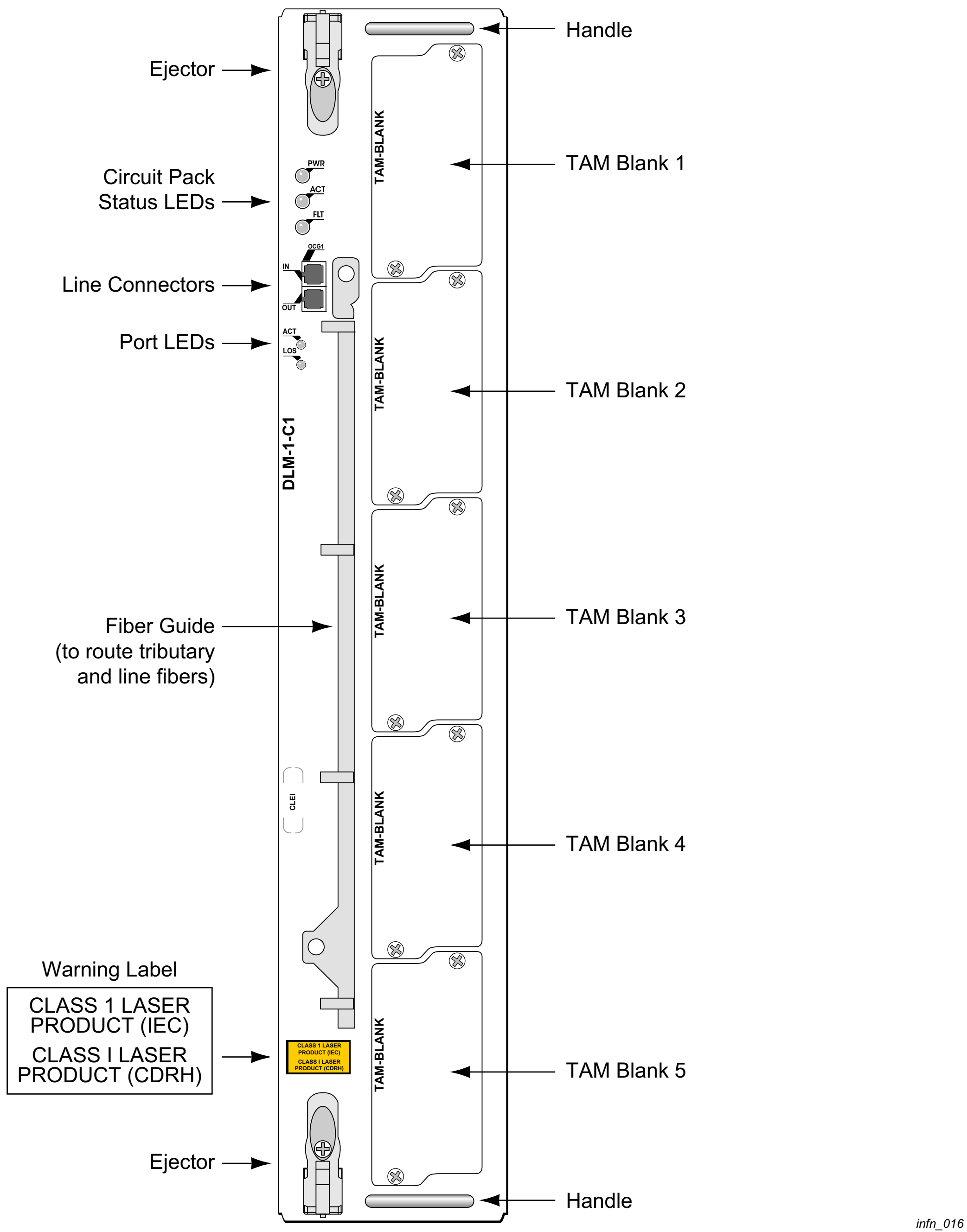
Figure 3-55 DLM Functional Block Diagram



External Indicators and Connectors

The DLM (Figure 3-56) provides circuit pack status/port LED indicators and line connectors.

Figure 3-56 DLM Faceplate



Circuit Pack Level LEDs

The DLM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-97.

Table 3-97 DLM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the DLM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the DLM OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-98.

Table 3-98 Port Visual Alarm Indicators on the DLM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of BMM OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During a Loss of Signal (LOS) condition, this indicator will be lit

Connectors

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The DLM provides IN and OUT interfaces to the BMM or GAM-1 as shown in Table 3-99.

Table 3-99 DLM Connectors

Connector	Type	Purpose
Line IN	SC	Connects from the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to a DLM, this connects from the GAM-1 SYSTEM OUT connector.
Line OUT	SC	Connects to the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to a DLM, this connects to the GAM-1 SYSTEM IN connector.

Technical Specifications

Table 3-100 provides the mechanical and electrical specifications for the DLM.

Table 3-100 DLM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	16.5lb / 7.4kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-101 provides the OCG optical power specifications (per OCG port) for the DLM.

Table 3-101 DLM OCG Optical Power Range

Type	Parameter	Specification
DLM-n (n=1-8)	Input power level (no GAM)	6.5 to 8.5dBm - (patch cable loss)[a]
	Input power level (with GAM-1)	0 to 9.0dBM - (patch cable losses)[b]
	Output power level	-14.0 to -12.5dBm

a. Patch cable loss from BMM OCG to DLM OCG.
b. Patch cable losses = (patch cable loss from BMM2 transmit OCG to GAM-1 LINE receive OCG) + (patch cable loss from GAM-1 SYSTEM transmit OCG to DLM receive OCG).

Table 3-102 provides the wavelength operating range for the DLM per the DTN C-Band optical channel plan.

Table 3-102 DLM Wavelength Operating Range

Type	Parameter	Specification
DLM-1	Wavelength range OCG 1	1548.915nm to 1563.455nm
DLM-2	Wavelength range OCG 2	1548.515nm to 1563.047nm
DLM-3	Wavelength range OCG 3	1548.115nm to 1562.640nm
DLM-4	Wavelength range OCG 4	1547.715nm to 1562.233nm
DLM-5	Wavelength range OCG 5	1531.507nm to 1545.720nm
DLM-6	Wavelength range OCG 6	1531.116nm to 1545.322nm
DLM-7	Wavelength range OCG 7	1530.725nm to 1544.924nm
DLM-8	Wavelength range OCG 8	1530.334nm to 1544.526nm

Switching Line Module (XLM)

The XLM transmits and receives ten 10Gbps DWDM signals, referred to as the Optical Carrier Group (OCG). XLMs are hard-wired to transmit and receive the specific optical channel group (OCG) that is represented by the "n" in the model number format "XLM-n-Cx". For example, the XLM-5-C3 type supports OCG 5 and must be connected to the OCG 5 port on the associated BMM.

The XLM can be installed in slots 3 through 6 of the DTC/MTC. The supported XLM types are listed in Table 3-103.

Table 3-103 XLM Product Details

Product Ordering Name (PON)	Description
XLM-1-C3	XLM, OCG 1, C-Band
XLM-2-C3	XLM, OCG 2, C-Band
XLM-3-C3	XLM, OCG 3, C-Band
XLM-4-C3	XLM, OCG 4, C-Band
XLM-5-C3	XLM, OCG 5, C-Band
XLM-6-C3	XLM, OCG 6, C-Band
XLM-7-C3	XLM, OCG 7, C-Band
XLM-8-C3	XLM, OCG 8, C-Band

Functional Description

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The Switching Line Module, referred to as XLM, performs the following functions:

- Provides add/drop and/or unrestricted non-blocking line-to-line switching of 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode
  - Provides 100Gbps of switching between any slot pairs (slots 3 to 4, 3 to 5, 3 to 6, 4 to 5, 4 to 6, and 5 to 6) in Mesh switching mode

Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B/MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s in each slot (slots 3, 4, 5, and 6).

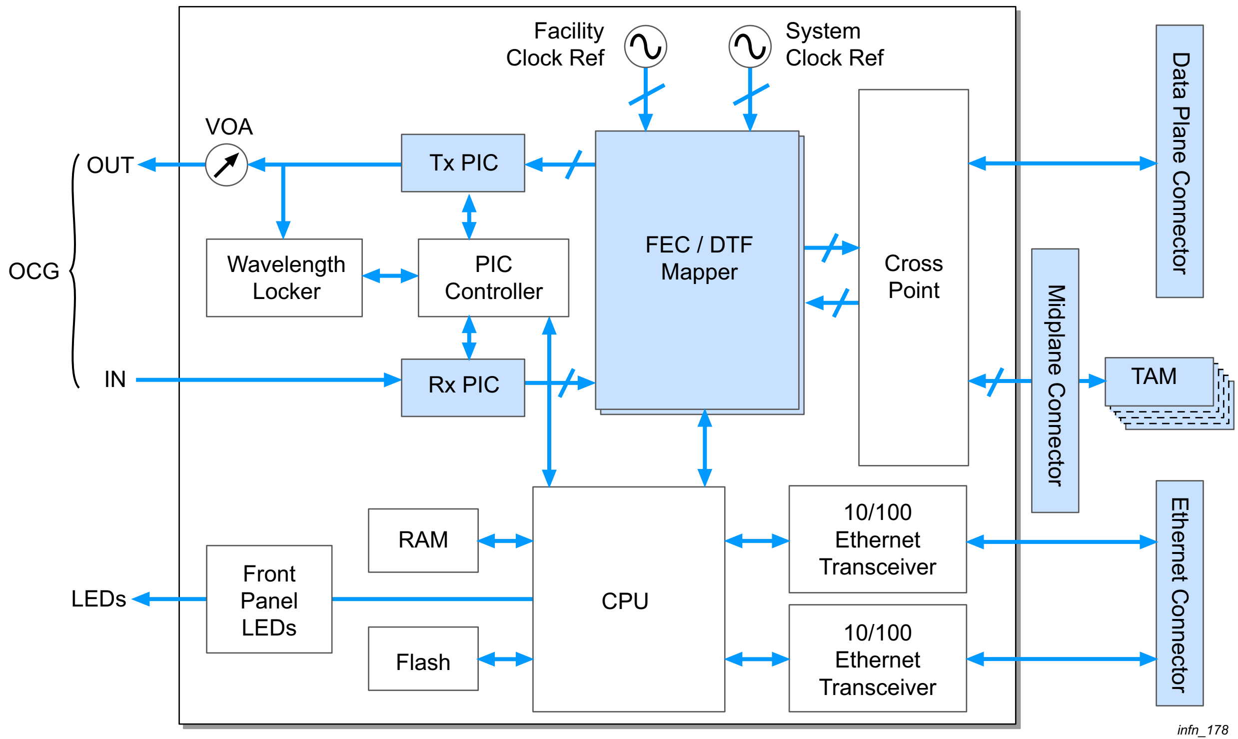
- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
  - GAM-1
  - GAM-2

Note: When a DLM/XLM is connected to a BMM2/BMM2H, it must be connected via a GAM-1 due to the increased launch power required on the BMM2/BMM2H. See "Gain Adapter Module (GAM)" on page 3-170 for more information.

- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCG OUT and OCG IN links on each XLM
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx Photonic Integrated Circuits (PICs)
- Multiplexes the 10 individual wavelengths into an OCG through the Tx PIC
- De-multiplexes the OCG into 10 individual wavelengths through the Rx PIC
- Optically connects to the appropriate BMM or GAM-1 for transmission over the facility line side
- Allows for wider dispersion in order to increase distance between regeneration. The following range is supported:
  - -700 to +800ps/nm

Block Diagram

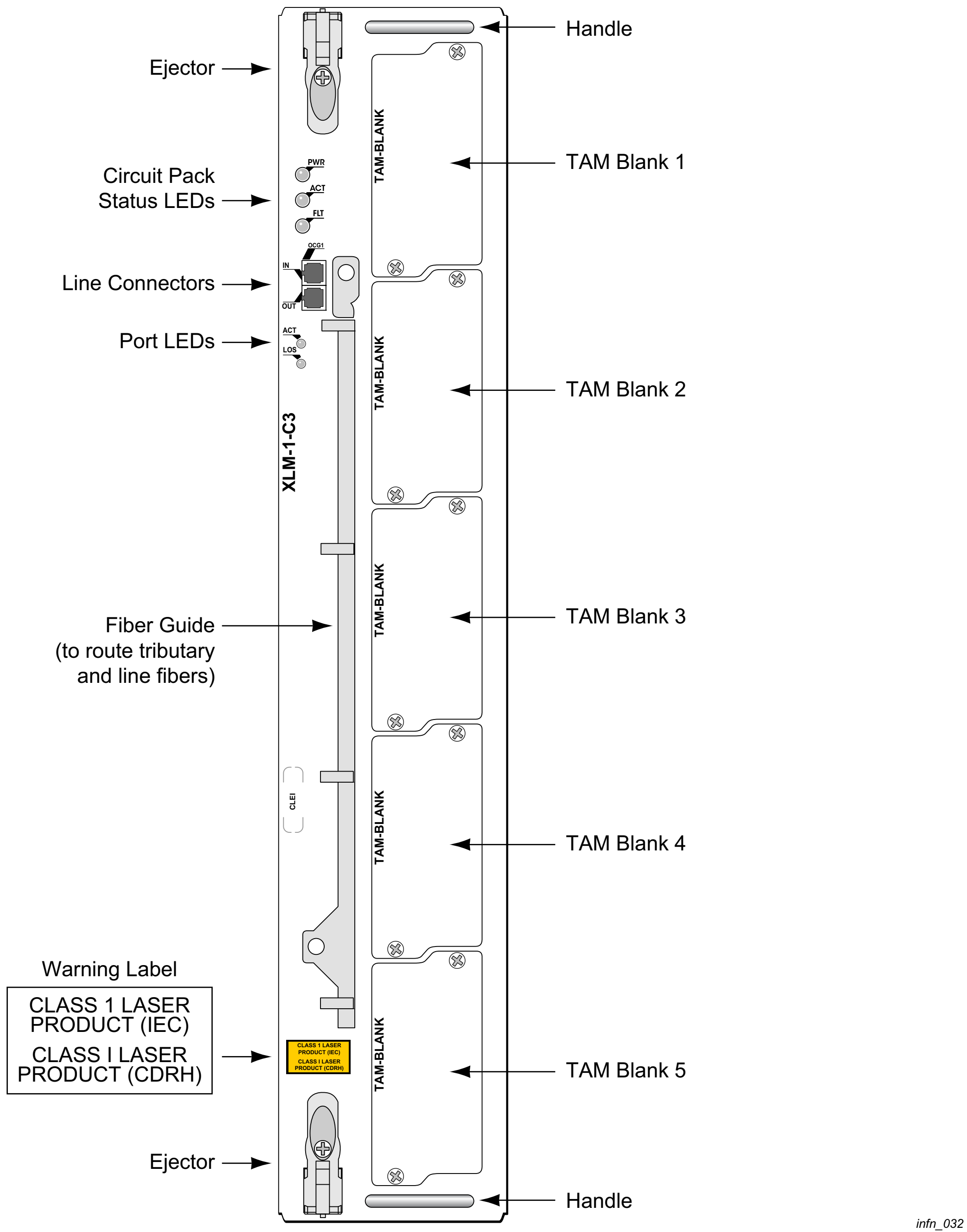
Figure 3-57 XLM Functional Block Diagram



External Indicators and Connectors

The XLM (Figure 3-58) provides circuit pack status/port LED indicators and line connectors.

Figure 3-58 XLM Faceplate



Circuit Pack Level LEDs

The XLM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-104.

Table 3-104 XLM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the XLM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the XLM OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-105.

Table 3-105 Port Visual Alarm Indicators on the XLM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of BMM OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During a Loss of Signal (LOS) condition, this indicator will be lit

Connectors

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

The XLM provides IN and OUT interfaces to the BMM or GAM-1 as shown in Table 3-106.

Table 3-106 XLM Connectors

Connector	Type	Purpose
Line IN	SC	Connects from the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an XLM, this connects from the GAM-1 SYSTEM OUT connector.
Line OUT	SC	Connects to the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an XLM, this connects to the GAM-1 SYSTEM IN connector.

Technical Specifications

Table 3-107 provides the mechanical and electrical specifications for the XLM.

Table 3-107 XLM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	16.5lb / 7.4kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-108 provides the OCG optical power specifications (per OCG port) for the XLM.

Table 3-108 XLM OCG Optical Power Range

Type	Parameter	Specification
XLM-n (n=1-8)	Input power level (no GAM)	6.5 to 8.5dBm - (patch cable loss)[a]
	Input power level (with GAM-1)	0 to 9.0dBM - (patch cable losses)[b]
	Output power level	-14.0 to -12.5dBm

a. Patch cable loss from BMM OCG to XLM OCG.

b. Patch cable losses = (patch cable loss from BMM2 transmit OCG to GAM-1 LINE receive OCG) + (patch cable loss from GAM-1 SYSTEM transmit OCG to XLM receive OCG).

Table 3-109 provides the wavelength operating range for the XLM per the DTN C-Band optical channel plan.

Table 3-109 XLM Wavelength Operating Range

Type	Parameter	Specification
XLM-1	Wavelength range OCG 1	1548.915nm to 1563.455nm
XLM-2	Wavelength range OCG 2	1548.515nm to 1563.047nm
XLM-3	Wavelength range OCG 3	1548.115nm to 1562.640nm
XLM-4	Wavelength range OCG 4	1547.715nm to 1562.233nm
XLM-5	Wavelength range OCG 5	1531.507nm to 1545.720nm
XLM-6	Wavelength range OCG 6	1531.116nm to 1545.322nm
XLM-7	Wavelength range OCG 7	1530.725nm to 1544.924nm
XLM-8	Wavelength range OCG 8	1530.334nm to 1544.526nm

TAM Extender Module (TEM)

Table 3-110 TEM Product Details

Product Ordering Name (PON)	Description
TEM	TAM extender module

Functional Description

The Tributary Adapter Module (TAM) Extender Module, referred to as TEM, provides additional TAM sub-slots for a line module so that the bandwidth of the line module may be fully utilized. See Table 3-111 on page 3-166 for valid slots. The application of a TEM is more visible for lower rate, lower density TAMs such as the TAM-4-2.5G and TAM-8-1G. A line module populated with either TAM-4-2.5G(s) or TAM-8-1G(s) will not be able to utilize the complete OCG bandwidth of 100G for add/drop traffic.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Each TEM provides an additional five sub-slots for TAMs which will enable:

- Up to 100% add/drop of 2.5G traffic using TAM-4-2.5G per OCG
- Up to 100% add/drop of 1GbE traffic using TAM-8-1G per OCG

In addition, each TEM provides the following:

- Add/drop or cross-connecting of 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, and corresponding line modules across the backplane
- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM

- TAM-8-1G
- GAM-1
- GAM-2

A TEM can be equipped in slots 3 through 6 and is designed to work with line modules in corresponding slots. Valid slot combinations are listed in Table 3-111.

Table 3-111 Line Module and TEM Valid Slot Combinations

Line Module Slot	Valid TEM Slot
3	4, 5, **6**[a]
4	3, **5**, 6
5	3, **4**, 6
6	**3**, 4, 5

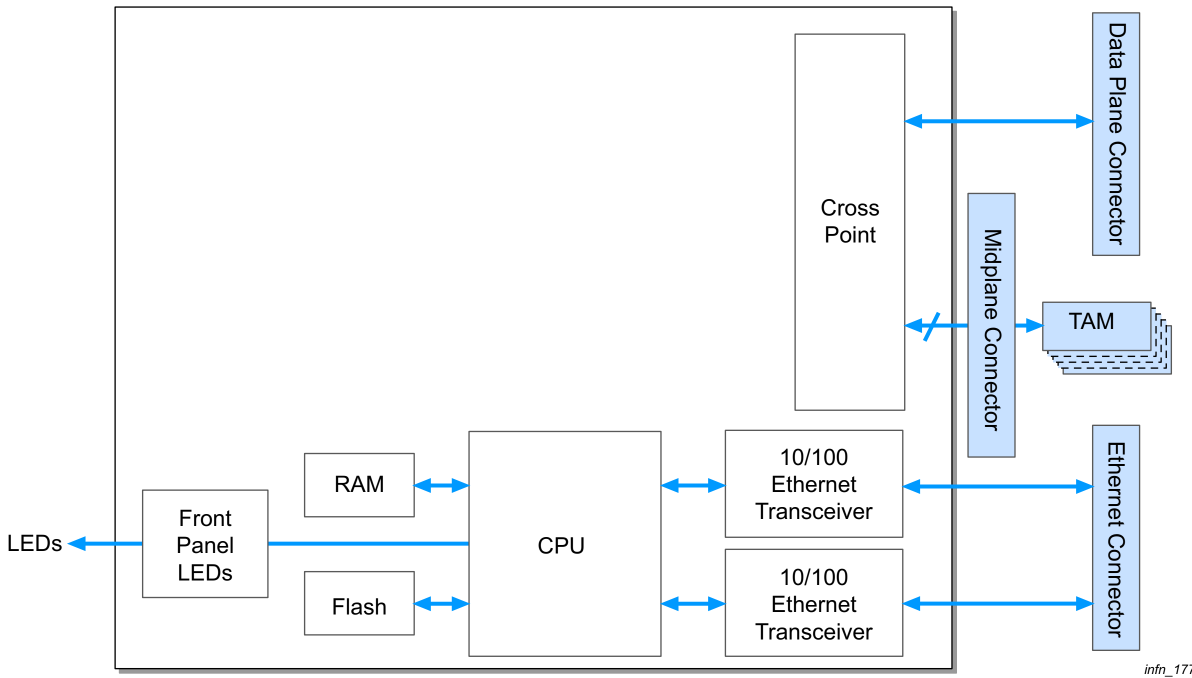
a. TEM slots in bold are indirect slot configurations where a cross-connect takes two hops between line module and TEM.

Note: When TEMs are deployed in a chassis configured for Mesh switching mode, the switching capacity for the particular slot pair is reduced to 60Gbps. Only one TEM can be used in slots 3 and 5, and slots 4 and 6 (the other slot must contain an XLM/AXLM/SLM/ADLM-80/AXLM-80/SLM-80 to provide access to the virtual fabric).

Note: Any attempt to provision a TEM in a chassis configured for Mesh switching mode in *both* slot 3 and slot 5 will be denied by the management interfaces, as will any attempt to provision a TEM in *both* slot 4 and slot 6.

Block Diagram

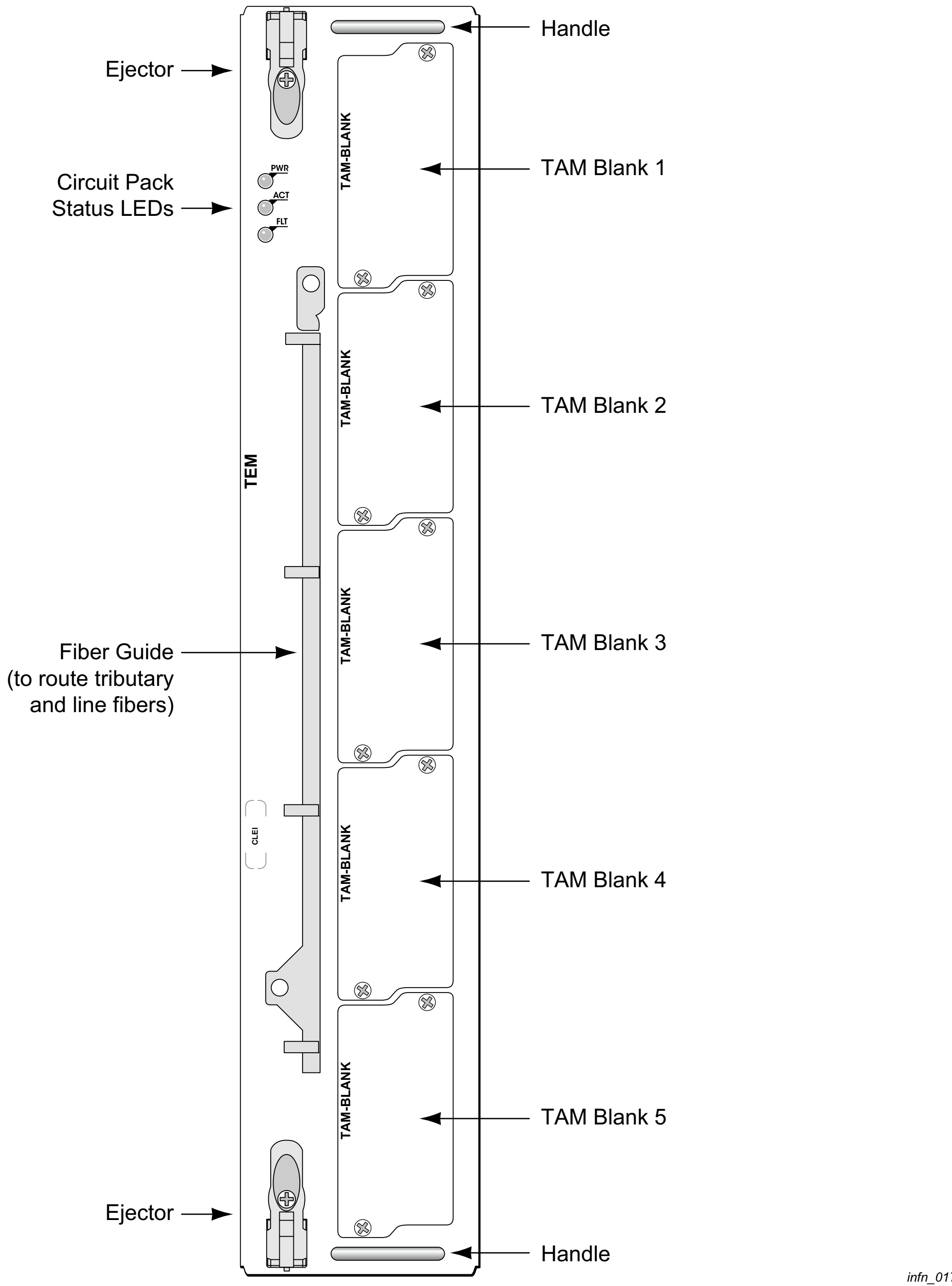
Figure 3-59 TEM Functional Block Diagram



External Indicators

The TEM (Figure 3-60) provides circuit pack status LED indicators.

Figure 3-60 TEM Faceplate



Circuit Pack Level LEDs

The TEM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-112.

Table 3-112 TEM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TEM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack LED functions.

TEM Port LEDs

The TEM has no port LEDs.

Technical Specifications

Table 3-113 provides the mechanical and electrical specifications for the TEM.

Table 3-113 TEM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	13.5lb / 6.1kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Gain Adapter Module (GAM)

Note: Unless specifically noted otherwise, all references to the GAM will refer to either the GAM-1 and/or GAM-2 interchangeably.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Table 3-114 GAM Product Details

Product Ordering Name (PON)	Description
GAM-1	Gain Adapter Module. Provides 14.0 +/-0.5dB of EDFA gain.
GAM-2	Gain Adapter Module. Provides 16.0 +/-0.5dB of EDFA gain.

Functional Description

The Gain Adapter Module, referred to as GAM, is an inline optical amplifier providing additional gain between line modules and BMM2/BMM2P/BMM2Hs. The GAM allows for a line module to interoperate with a BMM2/BMM2P/BMM2H to provide a longer reach; a GAM occupies an available single-height sub-slot on any line module or TEM.

- See “GAM-1 Interconnection Diagram” on page 3-172 for interconnections involving GAM-1s
- See “GAM-2 Interconnection Diagram” on page 3-173 for interconnection involving GAM-2s

Note: The GAM does not have to reside in the same chassis as the DLM/XLM or ADLM/AXLM that it is amplifying.

Note: GAMs are not required for interconnections between LM-80s, CMMs, and BMMs.

GAM/BMM/Line Module Supported Combinations

Table 3-115 lists the combinations of GAMs, BMM, and line modules that are supported including the required operating mode (Gen 1 or Gen 2) to which the line module must be configured in order to work with each type of GAM/BMM combination.

Note: A single DTN can employ any combination of these GAM/BMM/line module configurations.

Note: For GAM connections, Auto-discovery is supported only in the multiplex direction (from the line module to the GAM to the BMM2/BMM2P).

Table 3-115 GAM, BMM, and Line Module Supported Combinations

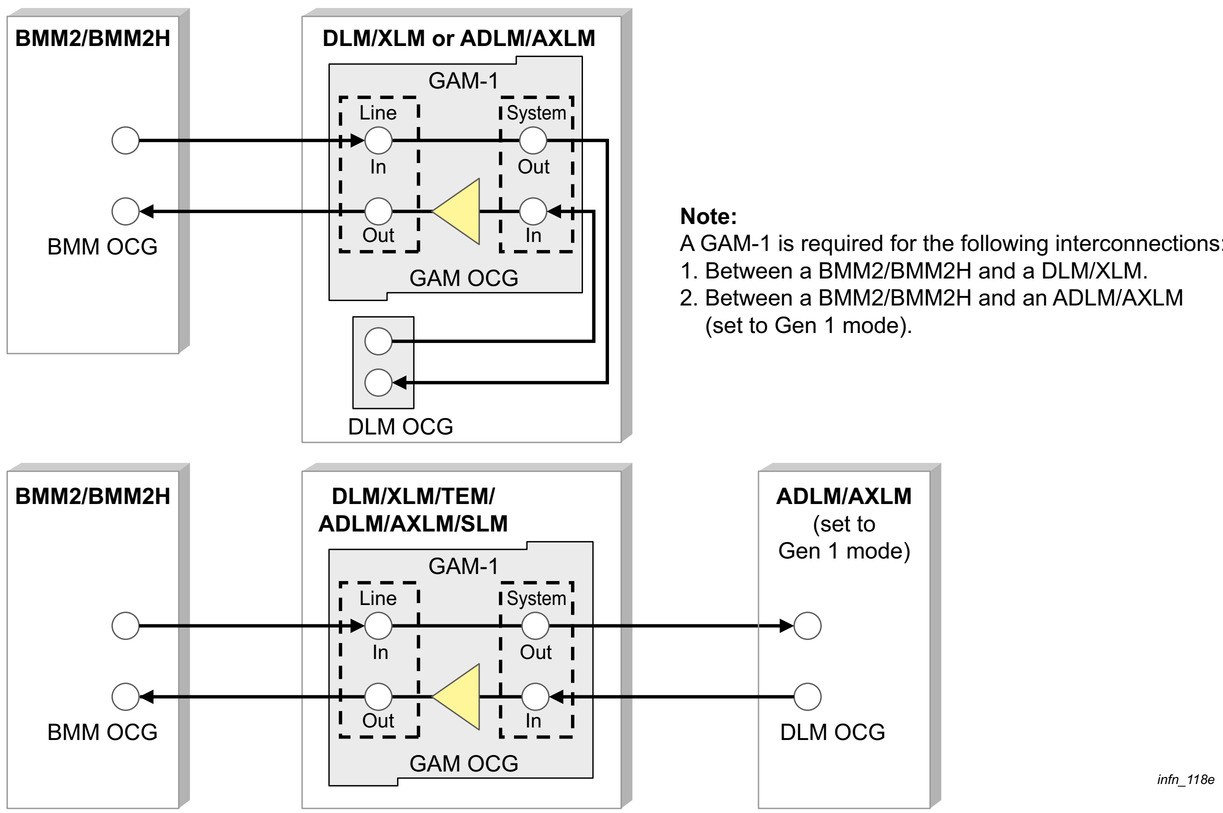
GAM Type	BMM Type[a]	Line Module Type	Line Module Operating Mode
(no GAM)	BMM	DLM/XLM	Gen 1
		ADLM/AXLM	
GAM-1	BMM2/BMM2H	DLM/XLM	
		ADLM/AXLM	
GAM-2	BMM2P	ADLM/AXLM	Gen 2

a. Except where indicated otherwise, all BMM types must be set to Native Automated mode (as opposed to SLTE Mode 1) in order to interoperate with a GAM.

GAM-1 Interconnection Diagram

Figure 3-61 (top part of figure) shows how the GAM-1 is interconnected between a DLM/XLM (or ADLM/AXLM) and a BMM2/BMM2H on the same chassis. Note that the GAM-1 does not have to reside in the same chassis as the DLM/XLM (or ADLM/AXLM) that it is amplifying (refer to bottom part of figure).

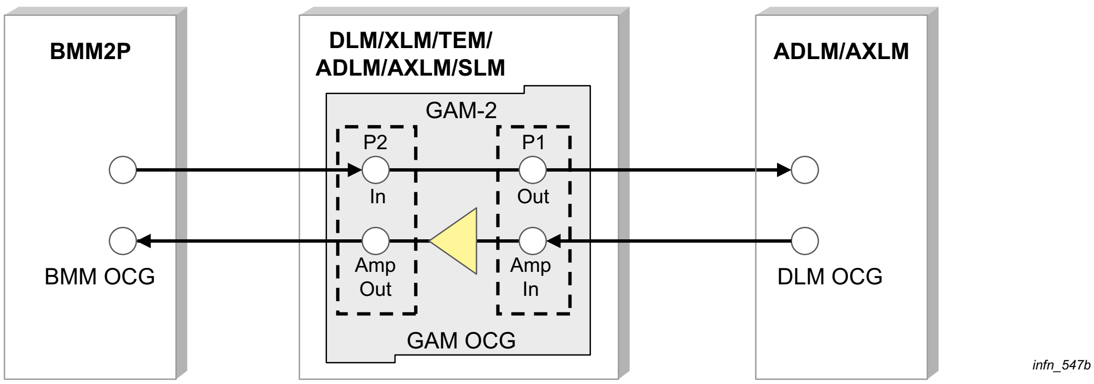
Figure 3-61 Interconnecting the GAM-1 with BMM2/BMM2Hs and DLM/XLM/ADLM/AXLMs



GAM-2 Interconnection Diagram

When connecting BMM2Ps with ADLM/AXLMs (Figure 3-62), an intermediary GAM-2 is required (similar to interconnections between BMM2/BMM2Hs and DLM/XLMs which require GAM-1s). Note that the GAM-2 does not have to reside in the same chassis as the ADLM/AXLM that it is amplifying.

Figure 3-62 Interconnecting the GAM-2 with BMM2Ps and ADLM/AXLMs



External Indicators and Connectors

The GAM (Figure 3-63 and Figure 3-64) provides circuit pack status/port LED indicators and SYSTEM/LINE (GAM-1) connectors or P1/P2 (GAM-2) connectors.

Figure 3-63 GAM-1 Faceplate

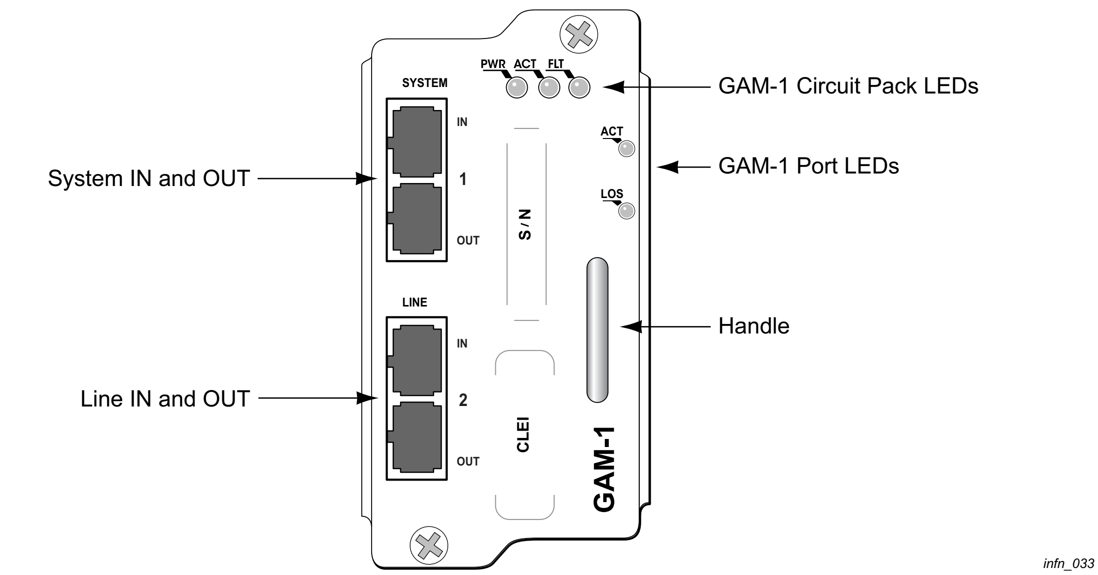
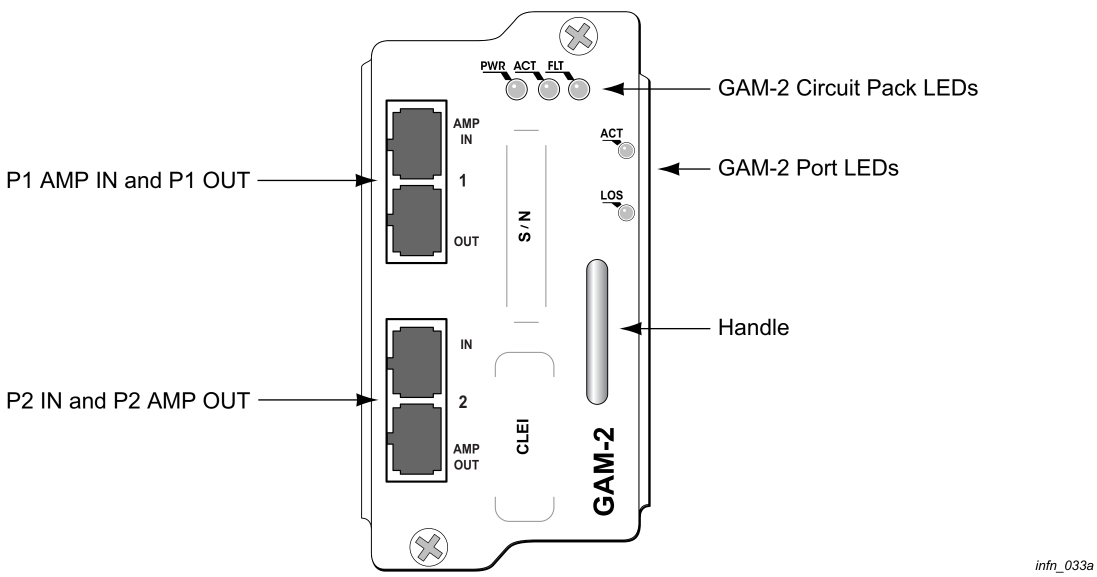


Figure 3-64 GAM-2 Faceplate



Circuit Pack Level LEDs

The GAM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-116.

Table 3-116 GAM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the GAM
ACT (Active)	Green / Yellow	Indicates the GAM status: Solid Green (Active, In-service) or flashing Yellow (In maintenance)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the GAM: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

GAM Port LEDs

There are two LEDs: ACTIVE and LOS for the GAM to indicate the line port status. The significance of a lit LED is described in Table 3-117.

Table 3-117 Port Visual Alarm Indicators on the GAM

LED	State	Description
ACT (Active)	Green / Yellow / Off	Indicates the line port administrative status: Solid Green (Active, In-service), flashing Yellow (port is in maintenance), or Off (card is Locked/ EDFA is shutdown)
LOS	Red	Indicates the status of the incoming signal. During a Loss of Signal (LOS) condition, this indicator will be lit

Connectors

Table 3-118 lists the connector information for the GAM-1.

Table 3-118 GAM-1 Connectors

Connector	Type	Purpose
SYSTEM IN	SC, Front access	Connects from the DLM/XLM/ADLM/AXLM OCG n (n=1-16) OUT
SYSTEM OUT	SC, Front access	Connects to the DLM/XLM/ADLM/AXLM OCG n (n=1-16) IN
LINE IN	SC, Front access	Connects from the BMM2/BMM2H OCG n (n=1-16) OUT
LINE OUT	SC, Front access	Connects to the BMM2/BMM2H OCG n (n=1-16) IN

Table 3-119 lists the connector for the GAM-2.

Table 3-119 GAM-2 Connectors

Connector	Type	Purpose
P1 AMP IN	SC, Front access	Connects from the ADLM/AXLM OCG n (n=1-16) OUT
P1 OUT	SC, Front access	Connects to the ADLM/AXLM OCG n (n=1-16) IN
P2 IN	SC, Front access	Connects from the BMM2P OCG n (n=1-16) OUT
P2 AMP OUT	SC, Front access	Connects to the BMM2P OCG n (n=1-16) IN

Technical Specifications

Table 3-120 provides the mechanical and electrical specifications for the GAM.

Table 3-120 GAM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.4lb / 0.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-121 provides the optical specifications for the GAM-1.

Table 3-121 GAM-1 Port IN/OUT Optical Specifications

Type	Specification
SYSTEM IN connector	-15.0 to -13.0dBm
SYSTEM OUT connector	-0.5 to 9.0dBm
LINE IN connector	0.0 to 9.0dBm
LINE OUT connector	-1.5 to 1.0dBm
EDFA Gain	14.0+/-0.5dB

Table 3-122 provides the optical specifications for the GAM-2.

Table 3-122 GAM-2 Port IN/OUT Optical Specifications

Type	Specification
P1 AMP IN connector	-16.5 to -10.0dBm
P1 OUT connector	-2.0 to 5.5dBm
P2 IN connector	0.0 to 5.5dBm
P2 AMP OUT connector	0.0 to 5.5dBm
EDFA Gain	16.0 +/-0.5dB

Amplified Digital Line Module (ADLM)

The ADLM transmits and receives ten 10Gbps DWDM signals, referred to as the Optical Carrier Group (OCG). ADLMs are tunable line modules that can be configured for one of four OCGs in a 160-channel system, or one of two OCGs in an 80-channel system. For example, the ADLM-T4-1-C4 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

ADLMs can be installed in slots 3 through 6 of the DTC/MTC. The supported ADLM types are listed in Table 3-123.

Table 3-123 ADLM Product Details

Product Ordering Name (PON)	Description
ADLM-T4-1-C4	ADLM, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
ADLM-T4-1-C5[a]	
ADLM-T4-3-C4	ADLM, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
ADLM-T4-3-C5[a]	
ADLM-T4-5-C4	ADLM, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
ADLM-T4-5-C5[a]	
ADLM-T4-7-C4	ADLM, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16
ADLM-T4-7-C5[a]	

a. The ADLM-T4-n-C5 (n=1,3,5,7) provides higher performance and longer reach capabilities (compared to the C4 type).

Functional Description

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

Note: When connecting an ADLM to any BMM, the total number of tunable OCGs for carrying traffic will be determined by the BMM type. For example, a 40-channel BMM1H only supports OCGs 1, 3, 5, and 7. Refer to Table 3-60 on page 3-87 for further details.

The Amplified Digital Line Module, referred to as ADLM, performs the following functions:

- Contains additional amplifiers to improve the output power (compared to the first generation DLM) which enables longer reach
- Reduction of wavelength spacing from 50GHz to 25GHz to increase total channel count from 80 to 160 channels with optical tunability over four OCGs
- Operates in one of two operating modes (selectable through the management interfaces):
  - Gen 1—operating mode when connected directly to a BMM/BMM1H (an intermediary GAM-1 is not required) or to a BMM2/BMM2H (an intermediary GAM-1 is required)
  - Gen 2—operating mode when connected directly to a BMM2/BMM2H (an intermediary GAM-1 is not required) or to a BMM2P (an intermediary GAM-2 is required)
- Provides add/drop and/or unrestricted non-blocking line-to-line switching of 100Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode

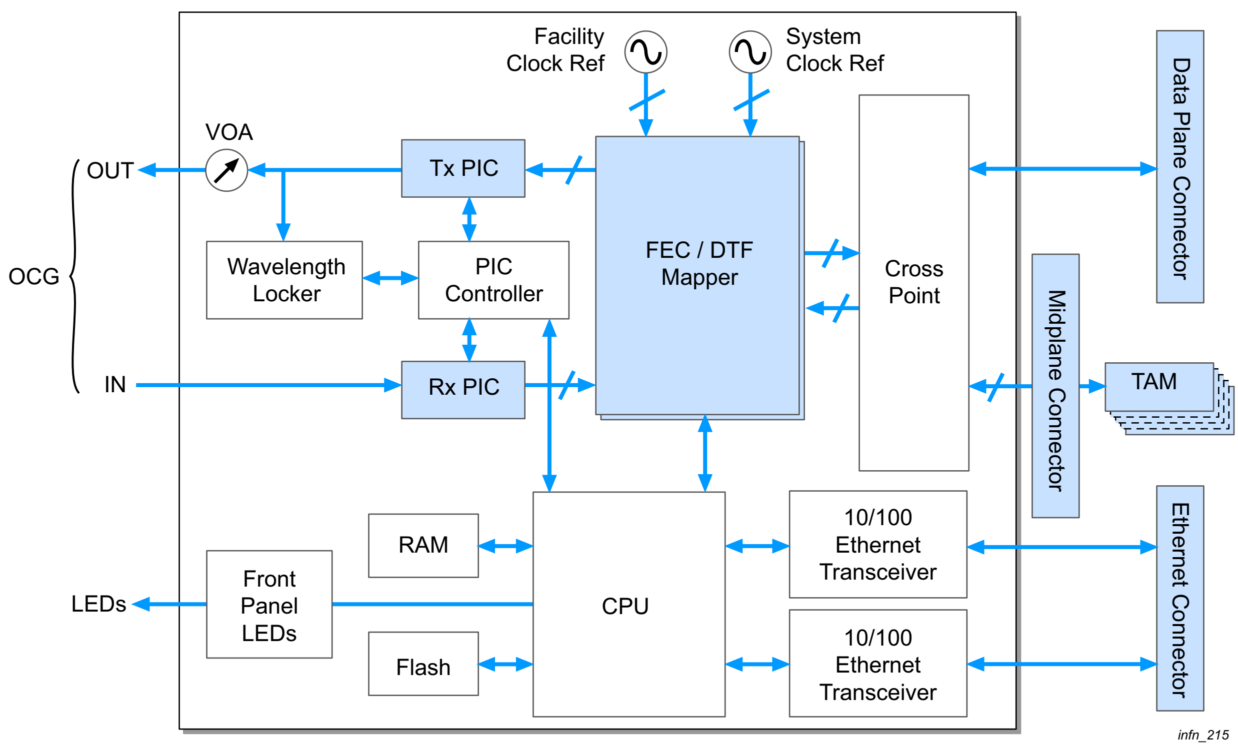
Note: ADLMs are not supported in a chassis that is set to Mesh switching mode. If a ADLM is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the ADLM.

- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
  - GAM-1

- GAM-2
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCG OUT and OCG IN links on each ADLM
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx Photonic Integrated Circuits (PICs)
- Multiplexes the 10 individual wavelengths into an OCG through the Tx PIC
- De-multiplexes the OCG into 10 individual wavelengths through the Rx PIC
- Optically connects to the appropriate BMM for transmission over the facility line side
- Allows for wider dispersion in order to increase distance between regeneration. The following range is supported:
  - -700 to +1200ps/nm

Block Diagram

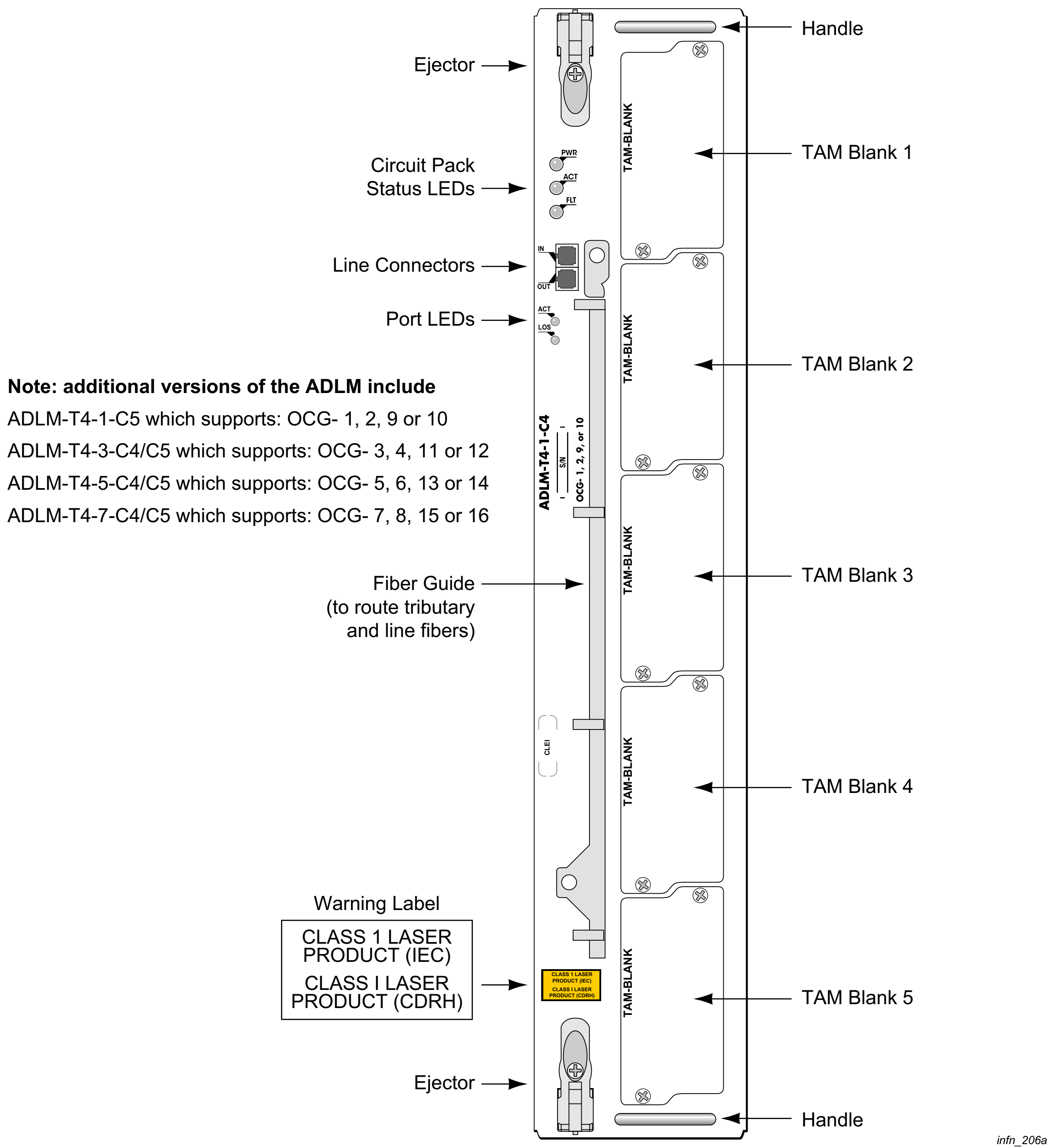
Figure 3-65 ADLM Functional Block Diagram



External Indicators and Connectors

The ADLM (Figure 3-66) provides circuit pack status/port LED indicators and line connectors.

Figure 3-66 ADLM Faceplate



Circuit Pack Level LEDs

The ADLM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-124.

Table 3-124 ADLM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the ADLM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the ADLM OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-125.

Table 3-125 Port Visual Alarm Indicators on the ADLM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of BMM OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The ADLM provides IN and OUT interfaces to the BMM as shown in Table 3-126.

Table 3-126 ADLM Connectors

Connector	Type	Purpose
Line IN	SC	Connects from the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an ADLM set to Gen 1 mode, this connects from the GAM-1 SYSTEM OUT connector. When connecting a BMM2P to an ADLM set to Gen 2 mode, this connects from the GAM-2 P1 OUT connector.
Line OUT	SC	Connects to the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an ADLM set to Gen 1 mode, this connects to the GAM-1 SYSTEM IN connector. When connecting a BMM2P to an ADLM set to Gen 2 mode, this connects to the GAM-2 P1 IN connector.

Technical Specifications

Table 3-127 provides the mechanical and electrical specifications for the ADLM.

Table 3-127 ADLM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	17.0lb / 7.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-128 provides the OCG optical power specifications (per OCG port) for the ADLM.

Table 3-128 ADLM OCG Optical Power Range

Type	Parameter	Specification
ADLM-T4-n-C4/C5 (n=1,3,5,7)	Input power level (with GAM-1, ADLM set to Gen 1 mode)	6.5 to 8.5dBm - (patch cable losses)[a]
	Input power level (no GAM, ADLM set to Gen 2 mode)	0 to 9.0dBM - (patch cable loss)[b]
	Input power level (with GAM-2, ADLM set to Gen 2 mode)	2.5 to 10.5dBM - (patch cable losses)[c]
	Output power level	-0.75 to 0.75dBm

a. Patch cable losses = (patch cable loss from BMM OCG to GAM-1 LINE receive OCG) + (patch cable loss from GAM-1 SYSTEM transmit OCG to ADLM OCG).

b. Patch cable loss = patch cable loss from BMM2 OCG to ADLM OCG.

c. Patch cable losses = (patch cable loss from BMM2P OCG to GAM-2 P2 receive OCG) + (patch cable loss from GAM-2 P1 transmit OCG to ADLM OCG).

Table 3-129 provides the wavelength operating range for the ADLM per the DTN C-Band optical channel plan.

Table 3-129 ADLM Wavelength Operating Range

Type	Parameter	Specification
ADLM-T4-1-C4/C5	Wavelength range OCG 1	1548.915nm to 1563.455nm
ADLM-T4-1-C4/C5 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
ADLM-T4-3-C4/C5	Wavelength range OCG 3	1548.115nm to 1562.640nm
ADLM-T4-3-C4/C5 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
ADLM-T4-5-C4/C5	Wavelength range OCG 5	1531.507nm to 1545.720nm
ADLM-T4-5-C4/C5 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
ADLM-T4-7-C4/C5	Wavelength range OCG 7	1530.725nm to 1544.924nm
ADLM-T4-7-C4/C5 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
ADLM-T4-1-C4/C5 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
ADLM-T4-1-C4/C5 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm

Table 3-129 ADLM Wavelength Operating Range

Type	Parameter	Specification
ADLM-T4-3-C4/C5 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
ADLM-T4-3-C4/C5 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
ADLM-T4-5-C4/C5 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
ADLM-T4-5-C4/C5 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
ADLM-T4-7-C4/C5 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
ADLM-T4-7-C4/C5 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Amplified Switching Line Module (AXLM)

The AXLM transmits and receives ten 10Gbps DWDM signals, referred to as the Optical Carrier Group (OCG). AXLMs are tunable line modules that can be configured for one of four OCGs in a 160-channel system, or one of two OCGs in an 80-channel system. For example, the AXLM-T4-1-C4 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The AXLM can be installed in slots 3 through 6 of the DTC/MTC. The supported AXLM types are listed in Table 3-130.

Table 3-130 AXLM Product Details

Product Ordering Name (PON)	Description
AXLM-T4-1-C4	AXLM, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
AXLM-T4-1-C5[a]	
AXLM-T4-3-C4	AXLM, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
AXLM-T4-3-C5[a]	
AXLM-T4-5-C4	AXLM, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
AXLM-T4-5-C5[a]	
AXLM-T4-7-C4	AXLM, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16
AXLM-T4-7-C5[a]	

a. The AXLM-T4-n-C5 (n=1,3,5,7) provides higher performance and longer reach capabilities (compared to the C4 type).

Functional Description

Note: Unless specifically noted otherwise, all references to the BMM will refer to either the BMM, BMM2, BMM2P, BMM1H, and/or BMM2H interchangeably.

Note: When connecting an AXLM to any BMM, the total number of tunable OCGs for carrying traffic will be determined by the BMM type. For example, a 40-channel BMM1H only supports OCGs 1, 3, 5, and 7. Refer to Table 3-60 on page 3-87 for further details.

The Amplified Switching Line Module, referred to as AXLM, performs the following functions:

- Contains additional amplifiers to improve the output power (compared to the first generation XLM) which enables longer reach
- Reduction of wavelength spacing from 50GHz to 25GHz to increase total channel count from 80 to 160 channels with optical tunability over four OCGs
- Operates in one of two operating modes (selectable through the management interfaces):
  - Gen 1—operating mode when connected directly to a BMM/BMM1H (an intermediary GAM-1 is not required) or to a BMM2/BMM2H (an intermediary GAM-1 is required)
  - Gen 2—operating mode when connected directly to a BMM2/BMM2H (an intermediary GAM-1 is not required) or to a BMM2P (an intermediary GAM-2 is required)
- Provides add/drop and/or unrestricted non-blocking line-to-line switching of 100Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode
  - Provides 100Gbps of switching between any slot pairs (slots 3 to 4, 3 to 5, 3 to 6, 4 to 5, 4 to 6, and 5 to 6) in Mesh switching mode

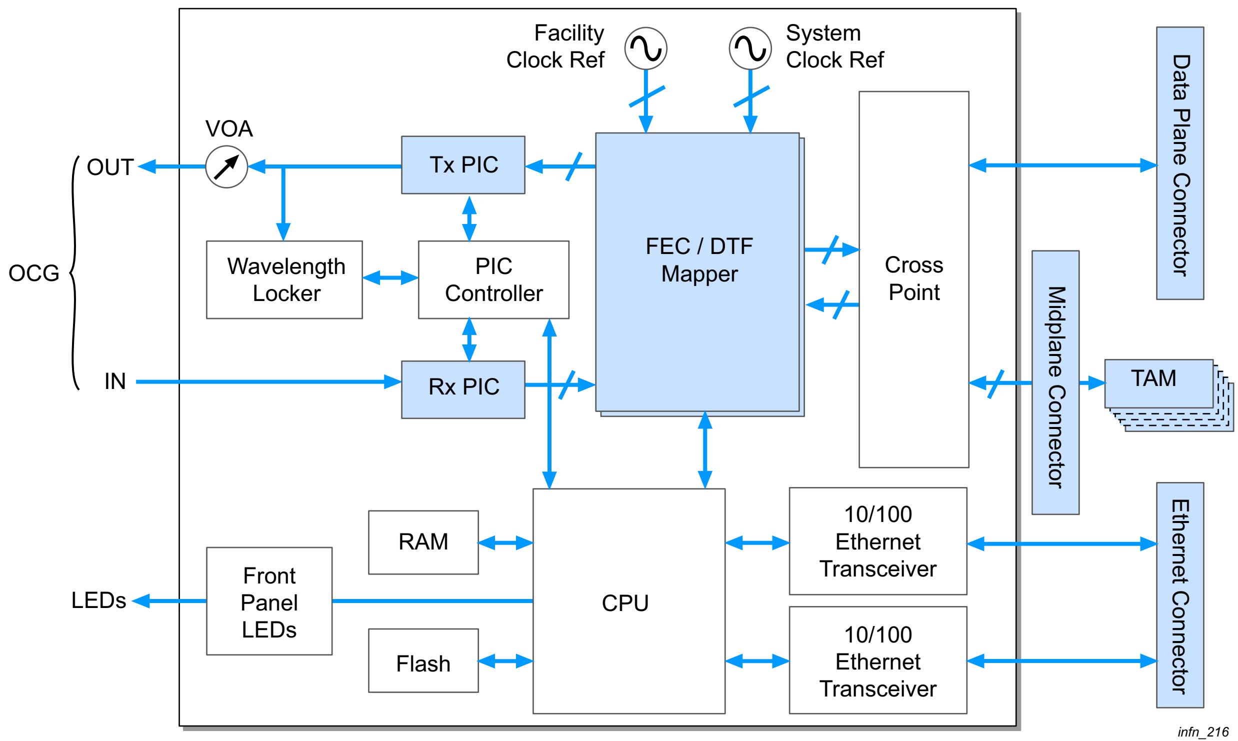
Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B/MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s in each slot (slots 3, 4, 5, and 6).

- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM

    - TAM-8-1G
    - GAM-1
    - GAM-2
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCG OUT and OCG IN links on each AXLM
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx Photonic Integrated Circuits (PICs)
- Multiplexes the 10 individual wavelengths into an OCG through the Tx PIC
- De-multiplexes the OCG into 10 individual wavelengths through the Rx PIC
- Optically connects to the appropriate BMM for transmission over the facility line side
- Allows for wider dispersion in order to increase distance between regeneration. The following range is supported:
    - -700 to +1200ps/nm

Block Diagram

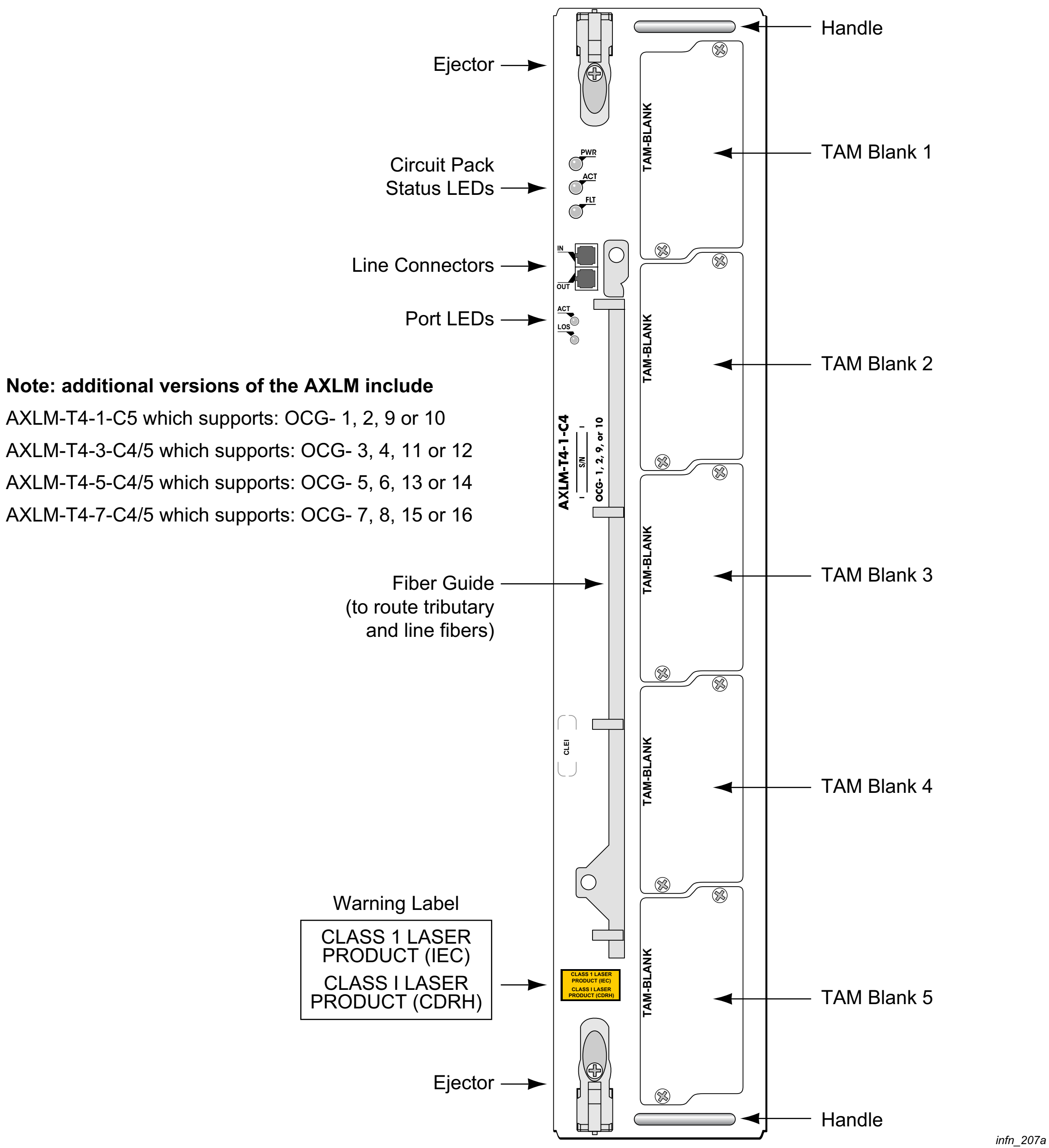
Figure 3-67 AXLM Functional Block Diagram



External Indicators and Connectors

The AXLM (Figure 3-68) provides circuit pack status/port LED indicators and line connectors.

Figure 3-68 AXLM Faceplate



Circuit Pack Level LEDs

The AXLM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-131.

Table 3-131 AXLM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the AXLM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the AXLM OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-132.

Table 3-132 Port Visual Alarm Indicators on the AXLM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of BMM OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The AXLM provides IN and OUT interfaces to the BMM as shown in Table 3-133.

Table 3-133 AXLM Connectors

Connector	Type	Purpose
Line IN	SC	Connects from the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an AXLM set to Gen 1 mode, this connects from the GAM-1 SYSTEM OUT connector. When connecting a BMM2P to an AXLM set to Gen 2 mode, this connects from the GAM-2 P1 OUT connector.
Line OUT	SC	Connects to the corresponding OCG port on the BMM **NOTE**: When connecting a BMM2/BMM2H to an AXLM set to Gen 1 mode, this connects to the GAM-1 P1 IN connector. When connecting a BMM2P to an AXLM set to Gen 2 mode, this connects to the GAM-2 P1 IN connector.

Technical Specifications

Table 3-134 provides the mechanical and electrical specifications for the AXLM.

Table 3-134 AXLM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	17.0lb / 7.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-135 provides the OCG optical power specifications (per OCG port) for the AXLM.

Table 3-135 AXLM OCG Optical Power Range

Type	Parameter	Specification
AXLM-T4-n-C4/C5 (n=1,3,5,7)	Input power level (with GAM-1, AXLM set to Gen 1 mode)	6.5 to 8.5dBm - (patch cable losses)[a]
	Input power level (no GAM, AXLM set to Gen 2 mode)	0 to 9.0dBM - (patch cable loss)[b]
	Input power level (with GAM-2, AXLM set to Gen 2 mode)	2.5 to 10.5dBM - (patch cable losses)[c]
	Output power level	-0.75 to 0.75dBm

a. Patch cable losses = (patch cable loss from BMM OCG to GAM-1 LINE receive OCG) + (patch cable loss from GAM-1 SYSTEM transmit OCG to AXLM OCG).

b. Patch cable loss = patch cable loss from BMM2 OCG to AXLM OCG.

c. Patch cable losses = (patch cable loss from BMM2P OCG to GAM-2 P2 receive OCG) + (patch cable loss from GAM-2 P1 transmit OCG to AXLM OCG).

Table 3-136 provides the wavelength operating range for the AXLM per the DTN C-Band optical channel plan.

Table 3-136 AXLM Wavelength Operating Range

Type	Parameter	Specification
AXLM-T4-1-C4/C5	Wavelength range OCG 1	1548.915nm to 1563.455nm
AXLM-T4-1-C4/C5 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
AXLM-T4-3-C4/C5	Wavelength range OCG 3	1548.115nm to 1562.640nm
AXLM-T4-3-C4/C5 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
AXLM-T4-5-C4/C5	Wavelength range OCG 5	1531.507nm to 1545.720nm
AXLM-T4-5-C4/C5 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
AXLM-T4-7-C4/C5	Wavelength range OCG 7	1530.725nm to 1544.924nm
AXLM-T4-7-C4/C5 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
AXLM-T4-1-C4/C5 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
AXLM-T4-1-C4/C5 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm

Table 3-136 AXLM Wavelength Operating Range

Type	Parameter	Specification
AXLM-T4-3-C4/C5 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
AXLM-T4-3-C4/C5 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
AXLM-T4-5-C4/C5 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
AXLM-T4-5-C4/C5 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
AXLM-T4-7-C4/C5 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
AXLM-T4-7-C4/C5 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Submarine Line Module (SLM)

The SLM transmits and receives ten 10Gbps DWDM signals, referred to as the Optical Carrier Group (OCG). SLMs are tunable line modules that can be configured for one of four OCGs in a 160-channel system, or one of two OCGs in an 80-channel system. For example, the SLM-T4-1-C4 is set to OCG 1 by default but can be tuned via the management interfaces to carry signals on OCG 1, 2, 9, or 10.

The SLM can be installed in slots 3 through 6 of the DTC/MTC. The supported SLM types are listed in Table 3-137.

Table 3-137 SLM Product Details

Product Ordering Name (PON)	Description
SLM-T4-1-C4	SLM, OCG 1 (default OCG), C-Band, Tunable OCGs: 1, 2, 9, 10
SLM-T4-1-C5	
SLM-T4-3-C4	SLM, OCG 3 (default OCG), C-Band, Tunable OCGs: 3, 4, 11, 12
SLM-T4-3-C5	
SLM-T4-5-C4	SLM, OCG 5 (default OCG), C-Band, Tunable OCGs: 5, 6, 13, 14
SLM-T4-5-C5	
SLM-T4-7-C4	SLM, OCG 7 (default OCG), C-Band, Tunable OCGs: 7, 8, 15, 16
SLM-T4-7-C5	

Functional Description

The Submarine Line Module, referred to as SLM, performs the following functions:

- Used exclusively for DTN links operating in submarine line terminating equipment (SLTE) mode 1
- Interoperates with full-height BMM2s (BMM2-8-CXH2-MS, BMM2-8-CH3-MS and/or BMM2-8-CEH3)

Note: The SLM is not interoperable with BMMs, BMM2Ps, BMM1Hs, and/or BMM2Hs.

- Operates in one of two operating modes (selectable through the management interfaces):
  - Gen 1—not supported in Release 8.0
  - Gen 2—operating mode when connected directly to a full-height BMM2 (an intermediary GAM-1 is not required)
- Wavelength spacing of 25GHz to increase total channel count from 80 to 160 channels with optical tunability over four OCGs

- Provides add/drop and/or unrestricted non-blocking line-to-line switching of 100Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode
  - Provides 100Gbps of switching between any slot pairs (slots 3 to 4, 3 to 5, 3 to 6, 4 to 5, 4 to 6, and 5 to 6) in Mesh switching mode

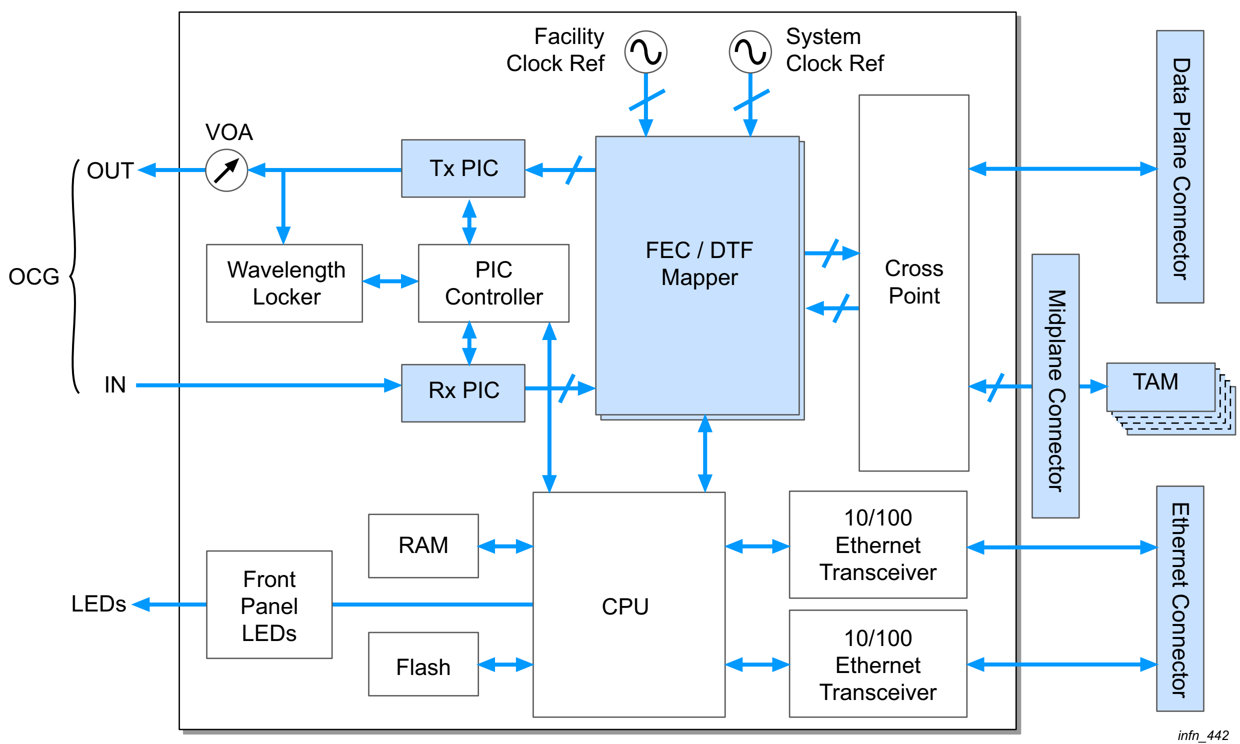
Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B/MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s in each slot (slots 3, 4, 5, and 6).

- Contains five sub-slots to house TAM/GAMs; the following TAM/GAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
  - GAM-1
  - GAM-2
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCG OUT and OCG IN links on each SLM
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength of the OCG transmitted through the Tx and Rx Photonic Integrated Circuits (PICs)
- Multiplexes the 10 individual wavelengths into an OCG through the Tx PIC
- De-multiplexes the OCG into 10 individual wavelengths through the Rx PIC

- Optically connects to the appropriate full-height BMM2 for transmission over the facility line side
- Allows for wider dispersion in order to increase distance between regeneration. The following range is supported:
  - -700 to +1200ps/nm

Block Diagram

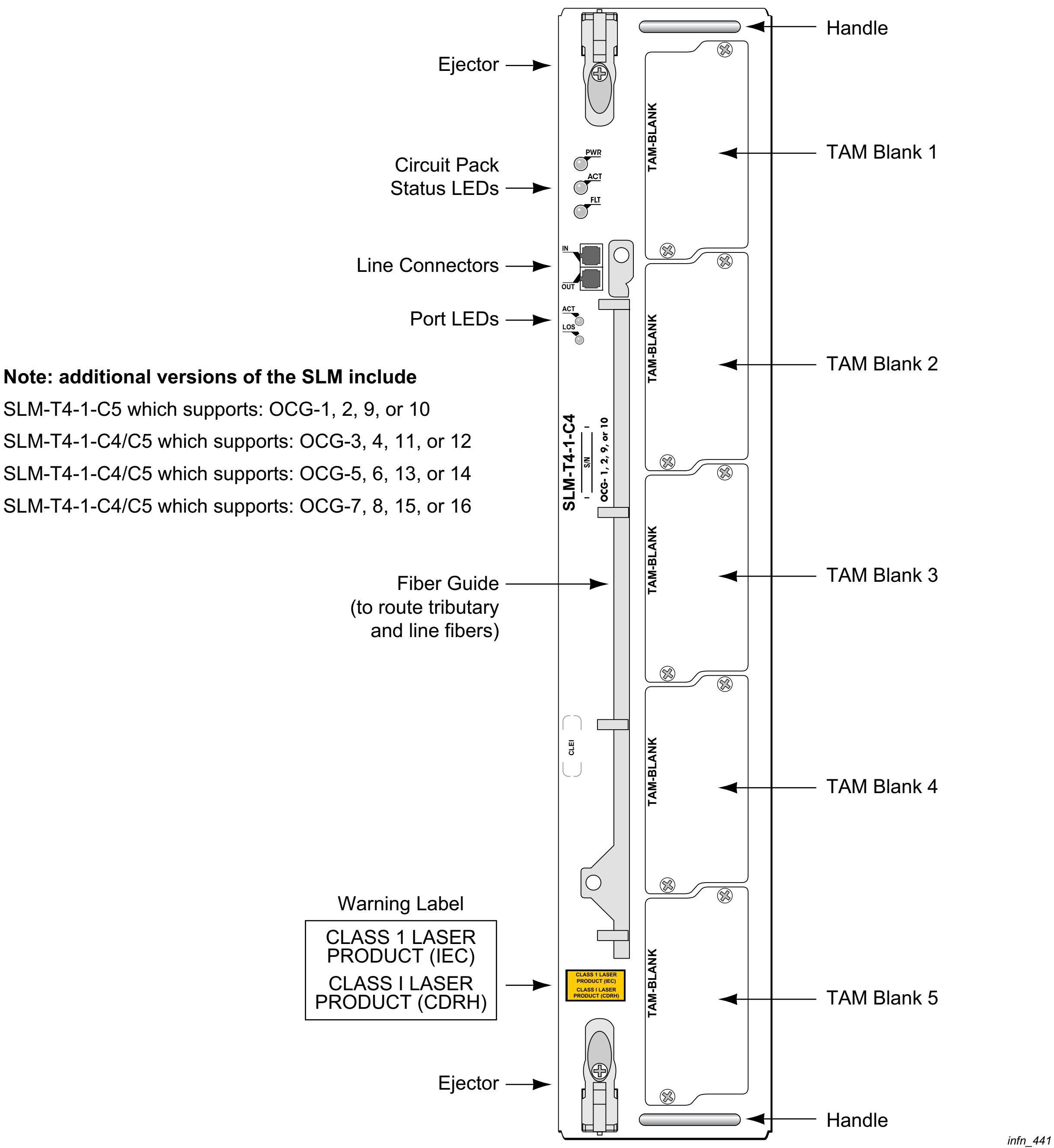
Figure 3-69 SLM Functional Block Diagram



External Indicators and Connectors

The SLM (Figure 3-70) provides circuit pack status/port LED indicators and line connectors.

Figure 3-70 SLM Faceplate



Circuit Pack Level LEDs

The SLM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-138.

Table 3-138 SLM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the SLM
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the SLM OCG port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-139.

Table 3-139 Port Visual Alarm Indicators on the SLM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal), or dimmed (Locked or Auto-discovery of BMM OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCG Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCG signal

Connectors

The SLM provides IN and OUT interfaces to the BMM2 as shown in Table 3-140.

Table 3-140 SLM Connectors

Connector	Type	Purpose
Line IN	SC	Connects from the corresponding OCG port on the full-height BMM2
Line OUT	SC	Connects to the corresponding OCG port on the full-height BMM2

Technical Specifications

Table 3-141 provides the mechanical and electrical specifications for the SLM.

Table 3-141 SLM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	17.0lb / 7.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-142 provides the OCG optical power specifications (per OCG port) for the SLM.

Table 3-142 SLM OCG Optical Power Range

Type	Parameter	Specification
SLM-T4-n-C4/C5 (n=1,3,5,7)	Input power level (no GAM, SLM set to Gen 2 mode)	0 to 9.0dBm - (patch cable loss)[a]
	Input power level (with GAM-2, SLM set to Gen 2 mode)	2.5 to 10.5dBM - (patch cable losses)[b]
	Output power level	-0.75 to 0.75dBm

a. Patch cable loss from BMM2 OCG to SLM OCG.

b. Patch cable losses = (patch cable loss from BMM2 OCG to GAM-2 P2 receive OCG) + (patch cable loss from GAM-2 P1 transmit OCG to SLM OCG).

Table 3-143 provides the wavelength operating range for the SLM per the DTN C-Band optical channel plan.

Table 3-143 SLM Wavelength Operating Range

Type	Parameter	Specification
SLM-T4-1-C4/C5	Wavelength range OCG 1	1548.915nm to 1563.455nm
SLM-T4-1-C4/C5 (tuned as OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
SLM-T4-3-C4/C5	Wavelength range OCG 3	1548.115nm to 1562.640nm
SLM-T4-3-C4/C5 (tuned as OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
SLM-T4-5-C4/C5	Wavelength range OCG 5	1531.507nm to 1545.720nm
SLM-T4-5-C4/C5 (tuned as OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
SLM-T4-7-C4/C5	Wavelength range OCG 7	1530.725nm to 1544.924nm
SLM-T4-7-C4/C5 (tuned as OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
SLM-T4-1-C4/C5 (tuned as OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
SLM-T4-1-C4/C5 (tuned as OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
SLM-T4-3-C4/C5 (tuned as OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
SLM-T4-3-C4/C5 (tuned as OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
SLM-T4-5-C4/C5 (tuned as OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
SLM-T4-5-C4/C5 (tuned as OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
SLM-T4-7-C4/C5 (tuned as OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
SLM-T4-7-C4/C5 (tuned as OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Amplified Digital Line Module 80G (ADLM-80)

The ADLM-80 is a C-Band tunable line module that contains two ports (for transmitting and receiving two single 40Gbps or 20Gbps DWDM wavelengths) and supports any of the wavelengths within Optical Carrier Groups (OCGs) 1 - 16 in a 160-channel system.

The ADLM-80 is optically connected to a CMM. ADLM-80s can be installed in slots 3 through 6 of the DTC/MTC. The supported ADLM-80 types are listed in Table 3-144.

Table 3-144 ADLM-80 Product Details

Product Ordering Name (PON)	Description
ADLM-80-T1-C5	ADLM-80, C-Band tunable supporting any of the ten wavelengths within OCGs: 1 - 16

Functional Description

The Amplified Digital Line Module 80G, referred to as ADLM-80, performs the following functions:

- Contains two industry-standard, multi-source agreement (MSA) 40G transponders that provide 40Gbps optical functions in place of Photonic Integrated Circuits (PICs) and the associated PIC controller circuitry
- Generates and receives two single 40Gbps or 20Gbps Infinera wavelengths (with coherent detection) using the following modulation formats:
  - Polarization multiplexed-quadrature phase shift keying (PM-QPSK) for 40Gbps Infinera wavelengths
  - Polarization multiplexed-binary phase shift keying (PM-BPSK) for 20Gbps Infinera wavelengths

Note: For 40GbE and 100GbE signals (which are transported via separate channels), all of the channels carrying the signal must be 10G channels, or channels that use the same modulation format, either BPSK modulation or QPSK. If 40GbE or 100GbE signals are transported over channels with a mix of 10G, BPSK, and QPSK, a Loss of Alignment (LOA) alarm is raised and service is affected.

- Supports wavelength spacing at 25GHz for a total channel count of 160 channels
- Provides add/drop and/or line side switching of 80Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane

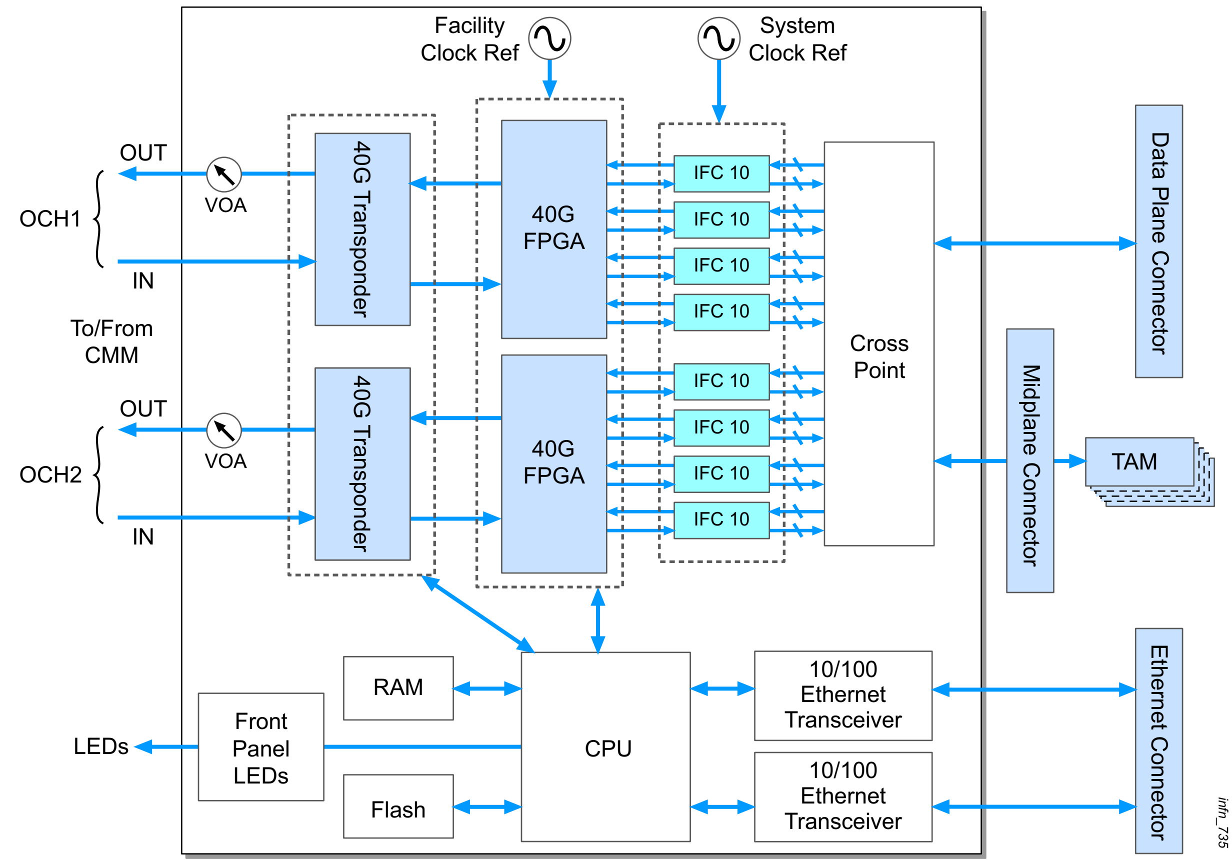
- Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
- Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode

Note: ADLM-80s are not supported in a chassis that is set to Mesh switching mode. If a ADLM-80 is installed in a chassis configured for Mesh switching mode, the system will generate an equipment mismatch (EQPTMSMT) alarm and will not initialize the ADLM-80.

- Contains five sub-slots to house TAMs; the following TAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCH n OUT (n = 1 or 2) and OCH n IN (n = 1 or 2) links on each ADLM-80
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength transmitted through the 40G transponders
- Optically connects to the appropriate Channel Multiplexing Module (CMM) for transmission over the facility line side
- Allows for wider dispersion in order to support more distance between regenerator sites. The supported dispersion compensation is:
  - +/-55000 ps/nm

Block Diagram

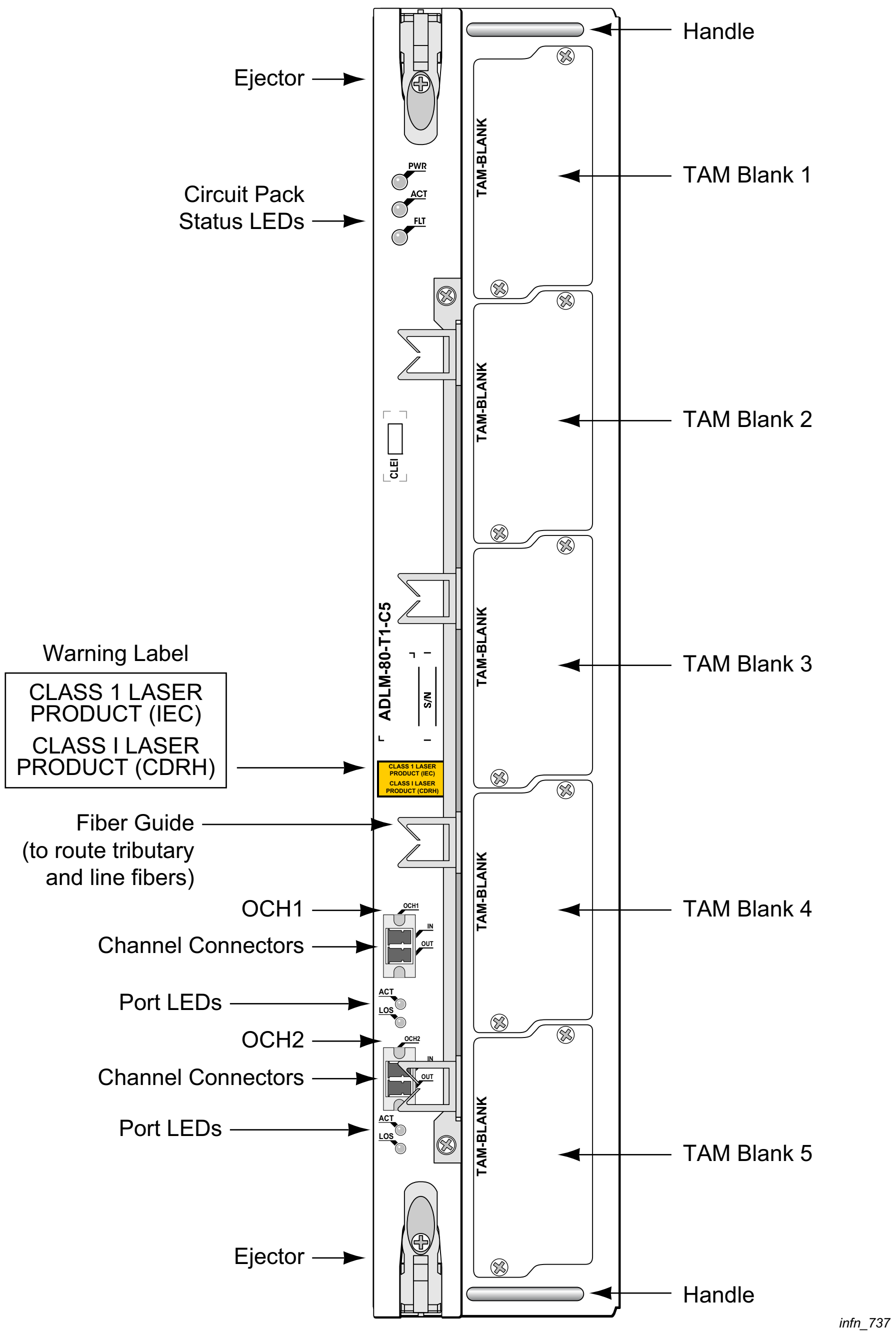
Figure 3-71 ADLM-80 Functional Block Diagram



External Indicators and Connectors

The ADLM-80 (Figure 3-72) provides circuit pack status/port LED indicators and line connectors.

Figure 3-72 ADLM-80 Faceplate



Circuit Pack Level LEDs

The ADLM-80 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-145.

Table 3-145 ADLM-80 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the ADLM-80
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the ADLM-80 OCH port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-146.

Table 3-146 Port Visual Alarm Indicators on the ADLM-80

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal for Auto-discovery), or dimmed (Locked or Auto-discovery of LM-80 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCH Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCH signal

Connectors

The ADLM-80 provides OCH n IN/OUT interfaces to the CMM as shown in Table 3-147.

Table 3-147 ADLM-80 Connectors

Connector	Type	Purpose
OCH 1/OCH 2 IN	LC, Front access	Connects from the corresponding OCH OUT port on the CMM
OCH 1/OCH 2 OUT	LC, Front access	Connects to the corresponding OCH IN port on the CMM

Technical Specifications

Table 3-148 provides the mechanical and electrical specifications for the ADLM-80.

Table 3-148 ADLM-80 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	20.1lb / 9.1kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-149 provides the optical power specifications for the ADLM-80.

Table 3-149 ADLM-80 Optical Power Range

Type	Parameter	Specification
ADLM-80-T1-C5	Input power level	-19.7 to 0.0dBm
	Output power level	-6.0 to -2.3dBm

Table 3-150 provides the wavelength operating range for the ADLM-80 per the DTN C-Band optical channel plan.

Table 3-150 ADLM-80 Wavelength Operating Range

Type	Parameter	Specification
ADLM-80-T1-C5 (configured for OCG 1)	Wavelength range OCG 1	1548.915nm to 1563.455nm
ADLM-80-T1-C5 (configured for OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
ADLM-80-T1-C5 (configured for OCG 3)	Wavelength range OCG 3	1548.115nm to 1562.640nm
ADLM-80-T1-C5 (configured for OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
ADLM-80-T1-C5 (configured for OCG 5)	Wavelength range OCG 5	1531.507nm to 1545.720nm
ADLM-80-T1-C5 (configured for OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
ADLM-80-T1-C5 (configured for OCG 7)	Wavelength range OCG 7	1530.725nm to 1544.924nm
ADLM-80-T1-C5 (configured for OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
ADLM-80-T1-C5 (configured for OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
ADLM-80-T1-C5 (configured for OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
ADLM-80-T1-C5 (configured for OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
ADLM-80-T1-C5 (configured for OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
ADLM-80-T1-C5 (configured for OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
ADLM-80-T1-C5 (configured for OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
ADLM-80-T1-C5 (configured for OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
ADLM-80-T1-C5 (configured for OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Amplified Switching Line Module 80G (AXLM-80)

The AXLM-80 is a C-Band tunable line module that contains two ports (for transmitting and receiving two single 40Gbps or 20Gbps DWDM wavelengths) and supports any of the wavelengths within Optical Carrier Groups (OCGs) 1 - 16 in a 160-channel system.

The AXLM-80 is optically connected to a CMM. AXLM-80s can be installed in slots 3 through 6 of the DTC/MTC. The supported AXLM-80 types are listed in Table 3-151.

Table 3-151 AXLM-80 Product Details

Product Ordering Name (PON)	Description
AXLM-80-T1-C5	AXLM-80, C-Band tunable supporting any of the ten wavelengths within OCGs: 1 - 16

Functional Description

The Amplified Switching Line Module 80G, referred to as AXLM-80, performs the following functions:

- Contains two industry-standard, multi-source agreement (MSA) 40G transponders that provide 40Gbps optical functions in place of Photonic Integrated Circuits (PICs) and the associated PIC controller circuitry
- Generates and receives two single 40Gbps or 20Gbps Infinera wavelengths (with coherent detection) using the following modulation formats:
    - Polarization multiplexed-quadrature phase shift keying (PM-QPSK) for 40Gbps Infinera wavelengths
    - Polarization multiplexed-binary phase shift keying (PM-BPSK) for 20Gbps Infinera wavelengths

Note: For 40GbE and 100GbE signals (which are transported via separate channels), all of the channels carrying the signal must be 10G channels, or channels that use the same modulation format, either BPSK modulation or QPSK. If 40GbE or 100GbE signals are transported over channels with a mix of 10G, BPSK, and QPSK, a Loss of Alignment (LOA) alarm is raised and service is affected.

- Supports wavelength spacing at 25GHz for a total channel count of 160 channels
- Provides add/drop and/or line side switching of 80Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
    - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode

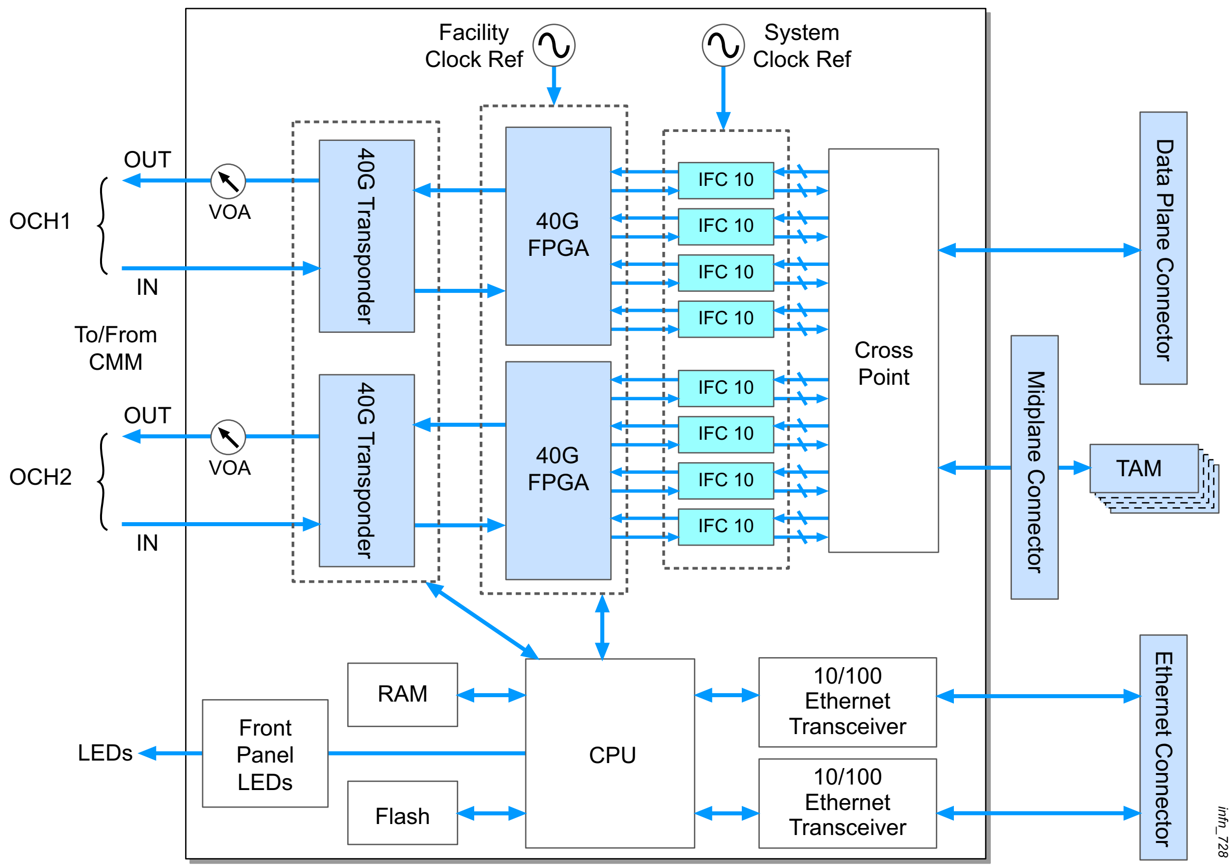
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode
  - Provides 100Gbps of switching between any slot pairs (slots 3 to 4, 3 to 5, 3 to 6, 4 to 5, 4 to 6, and 5 to 6) in Mesh switching mode

Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B/MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/AXLM-80/SLM-80s in each slot (slots 3, 4, 5, and 6).

- Contains five sub-slots to house TAMs; the following TAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCH n OUT (n = 1 or 2) and OCH n IN (n = 1 or 2) links on each AXLM-80
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength transmitted through the 40G transponders
- Optically connects to the appropriate Channel Multiplexing Module (CMM) for transmission over the facility line side
- Allows for wider dispersion in order to support more distance between regenerator sites. The supported dispersion compensation is:
  - +/-55000 ps/nm

Block Diagram

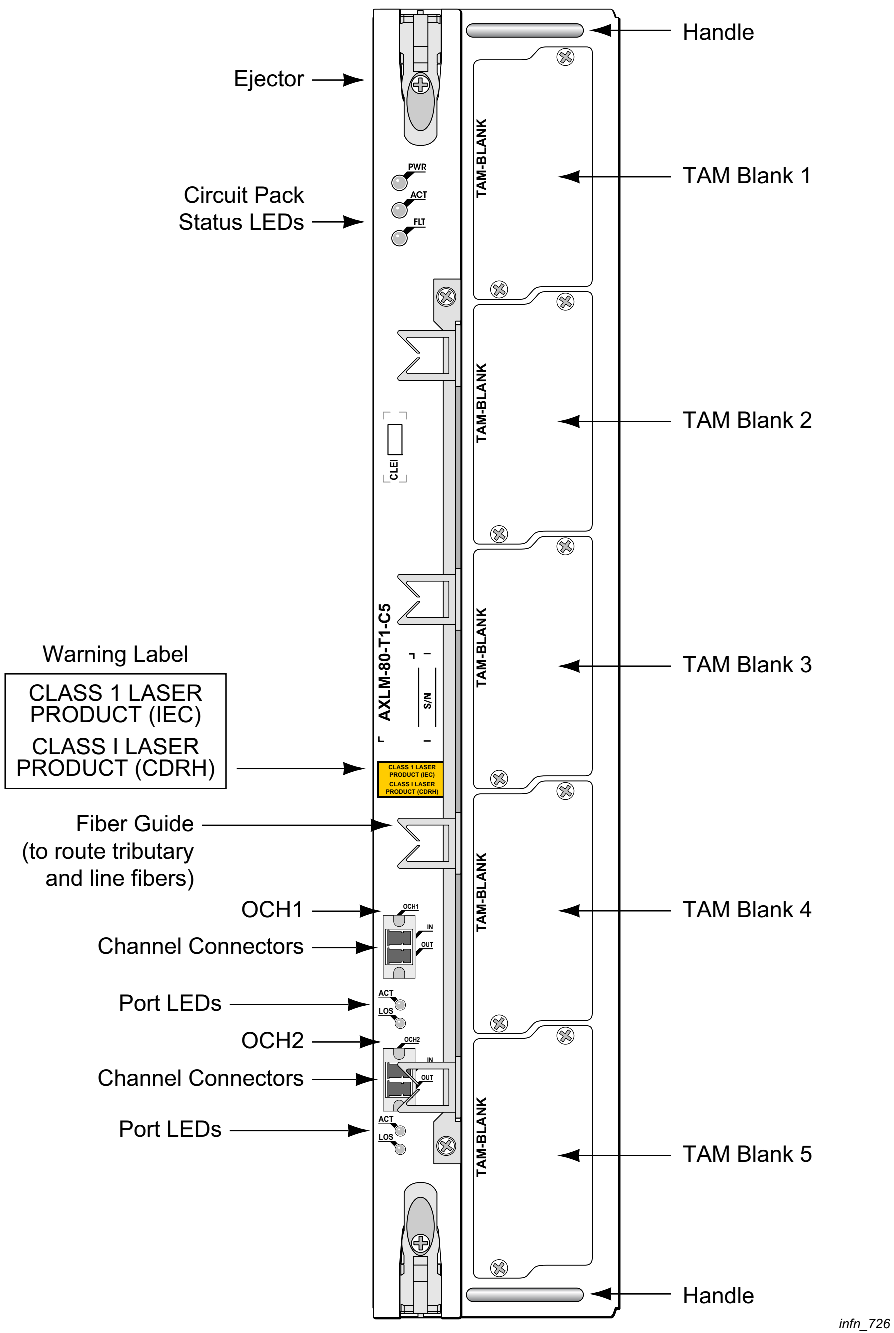
Figure 3-73 AXLM-80 Functional Block Diagram



External Indicators and Connectors

The AXLM-80 (Figure 3-74) provides circuit pack status/port LED indicators and line connectors.

Figure 3-74 AXLM-80 Faceplate



Circuit Pack Level LEDs

The AXLM-80 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-152.

Table 3-152 AXLM-80 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the AXLM-80
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the AXLM-80 OCH port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-153.

Table 3-153 Port Visual Alarm Indicators on the AXLM-80

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal for Auto-discovery), or dimmed (Locked or Auto-discovery of LM-80 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCH Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCH signal

Connectors

The AXLM-80 provides OCH n IN/OUT interfaces to the CMM as shown in Table 3-154.

Table 3-154 AXLM-80 Connectors

Connector	Type	Purpose
OCH 1/OCH 2 IN	LC, Front access	Connects from the corresponding OCH OUT port on the CMM
OCH 1/OCH 2 OUT	LC, Front access	Connects to the corresponding OCH IN port on the CMM

Technical Specifications

Table 3-155 provides the mechanical and electrical specifications for the AXLM-80.

Table 3-155 AXLM-80 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	20.1lb / 9.1kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-156 provides the optical power specifications for the AXLM-80.

Table 3-156 AXLM-80 Optical Power Range

Type	Parameter	Specification
AXLM-80-T1-C5	Input power level	-19.7 to 0.0 dBm
	Output power level	-6.0 to -2.3 dBm

Table 3-157 provides the wavelength operating range for the AXLM-80 per the DTN C-Band optical channel plan.

Table 3-157 AXLM-80 Wavelength Operating Range

Type	Parameter	Specification
AXLM-80-T1-C5 (configured for OCG 1)	Wavelength range OCG 1	1548.915nm to 1563.455nm
AXLM-80-T1-C5 (configured for OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
AXLM-80-T1-C5 (configured for OCG 3)	Wavelength range OCG 3	1548.115nm to 1562.640nm
AXLM-80-T1-C5 (configured for OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
AXLM-80-T1-C5 (configured for OCG 5)	Wavelength range OCG 5	1531.507nm to 1545.720nm
AXLM-80-T1-C5 (configured for OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
AXLM-80-T1-C5 (configured for OCG 7)	Wavelength range OCG 7	1530.725nm to 1544.924nm
AXLM-80-T1-C5 (configured for OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
AXLM-80-T1-C5 (configured for OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
AXLM-80-T1-C5 (configured for OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
AXLM-80-T1-C5 (configured for OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
AXLM-80-T1-C5 (configured for OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
AXLM-80-T1-C5 (configured for OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
AXLM-80-T1-C5 (configured for OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
AXLM-80-T1-C5 (configured for OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
AXLM-80-T1-C5 (configured for OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Submarine Line Module 80G (SLM-80)

The SLM-80 is a C-Band tunable line module that contains two ports (for transmitting and receiving two single 40Gbps or 20Gbps DWDM wavelengths) and supports any of the wavelengths within Optical Carrier Groups (OCGs) 1 - 16 in a 160-channel system.

The SLM-80 is optically connected to a CMM. SLM-80s can be installed in slots 3 through 6 of the DTC/MTC. The supported SLM-80 types are listed in Table 3-158.

Table 3-158 SLM-80 Product Details

Product Ordering Name (PON)	Description
SLM-80-T1-C5	SLM-80, C-Band tunable supporting any of the ten wavelengths within OCGs: 1 - 16

Functional Description

The Submarine Line Module 80G, referred to as SLM-80, performs the following functions:

- Used exclusively for DTN links operating in submarine line terminating equipment (SLTE) mode 1

  Note: Auto-discovery will complete only with BMM2s operating in SLTE Mode 1.

- Contains two industry-standard, multi-source agreement (MSA) 40G transponders that provide 40Gbps optical functions in place of Photonic Integrated Circuits (PICs) and the associated PIC controller circuitry
- Generates and receives two single 40Gbps or 20Gbps Infinera wavelengths (with coherent detection) using the following modulation formats:
  - Polarization multiplexed-quadrature phase shift keying (PM-QPSK) for 40Gbps Infinera wavelengths
  - Polarization multiplexed-binary phase shift keying (PM-BPSK) for 20Gbps Infinera wavelengths

  Note: For 40GbE and 100GbE signals (which are transported via separate channels), all of the channels carrying the signal must be 10G channels, or channels that use the same modulation format, either BPSK modulation or QPSK. If 40GbE or 100GbE signals are transported over channels with a mix of 10G, BPSK, and QPSK, a Loss of Alignment (LOA) alarm is raised and service is affected.

- Supports wavelength spacing at 25GHz for a total channel count of 160 channels

- Provides add/drop and/or line side switching of 80Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps signals between TAMs, wavelengths on the OCG uplink, and peered line modules across the backplane
  - Provides 100Gbps of switching between adjacent slot pairs (slots 3 to 4 and slots 5 to 6) in Ring switching mode
  - Provides 60Gbps of switching between non-adjacent slot pairs (slots 3 to 5 and slots 4 to 6) in Ring switching mode
  - Provides 100Gbps of switching between any slot pairs (slots 3 to 4, 3 to 5, 3 to 6, 4 to 5, 4 to 6, and 5 to 6) in Mesh switching mode

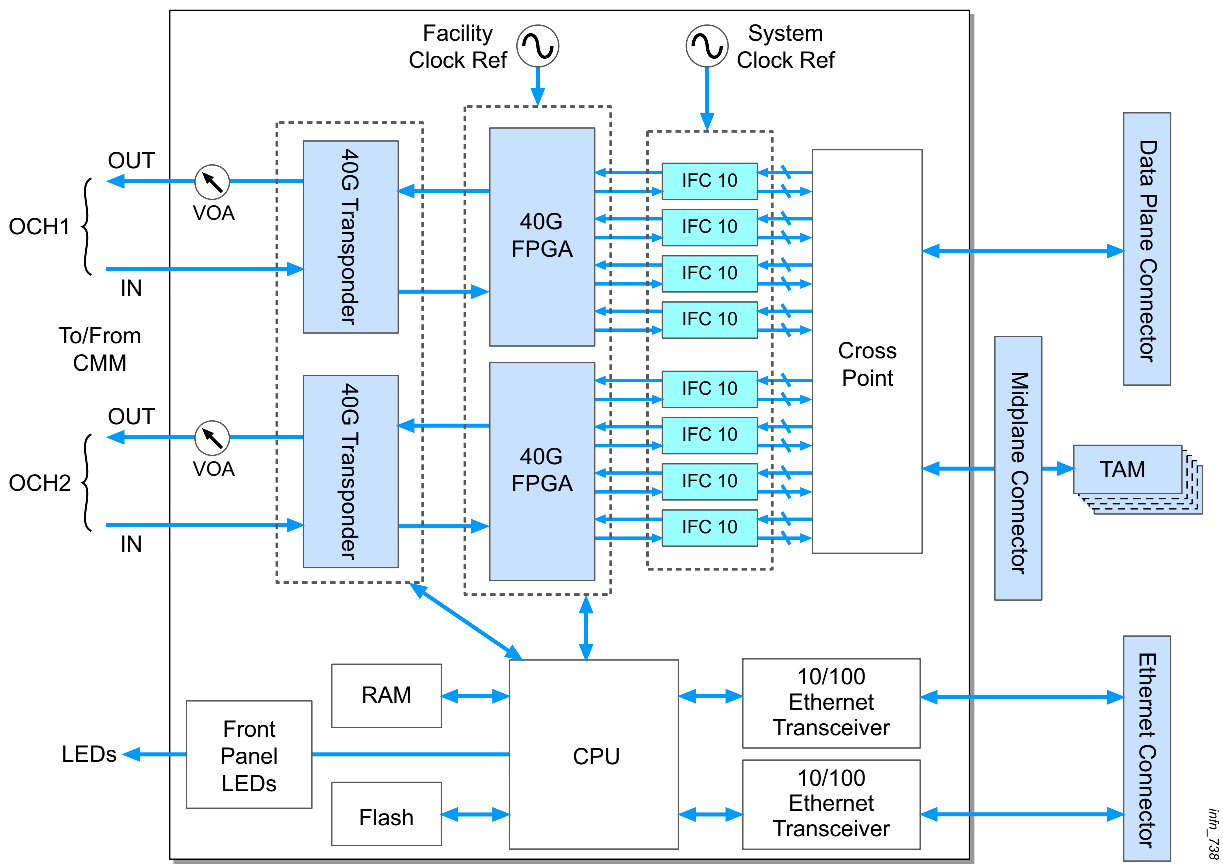
Note: The full 100Gbps switching capacity between all four slots and the virtual fabric is only available when the DTC-B/MTC is configured for Mesh switching mode and provisioned with XLM/AXLM/SLM/SLM-80s in each slot (slots 3, 4, 5, and 6).

- Contains five sub-slots to house TAMs; the following TAM types are supported:
  - TAM-1-100GE
  - TAM-1-100GR
  - TAM-1-40G-VSR
  - TAM-1-40GE
  - TAM-1-40GR
  - TAM-2-10G
  - TAM-2-10GR
  - TAM-2-10GT
  - TAM-2-10GM
  - TAM-4-2.5G
  - TAM-8-2.5GM
  - TAM-8-1G
- Creates and terminates the line Digital Transport Frame (DTF)
- Maps the client signals from the TAMs (Trib DTF) into the line DTF that are transmitted and received from the OCH n OUT (n = 1 or 2) and OCH n IN (n = 1 or 2) links on each SLM-80
- Codes and decodes the Forward Error Correction (FEC) signal for each wavelength transmitted through the 40G transponders
- Optically connects to the appropriate Channel Multiplexing Module (CMM) for transmission over the facility line side
- Allows for wider dispersion in order to support more distance between regenerator sites. The supported dispersion compensation is:

- +/-55000 ps/nm

Block Diagram

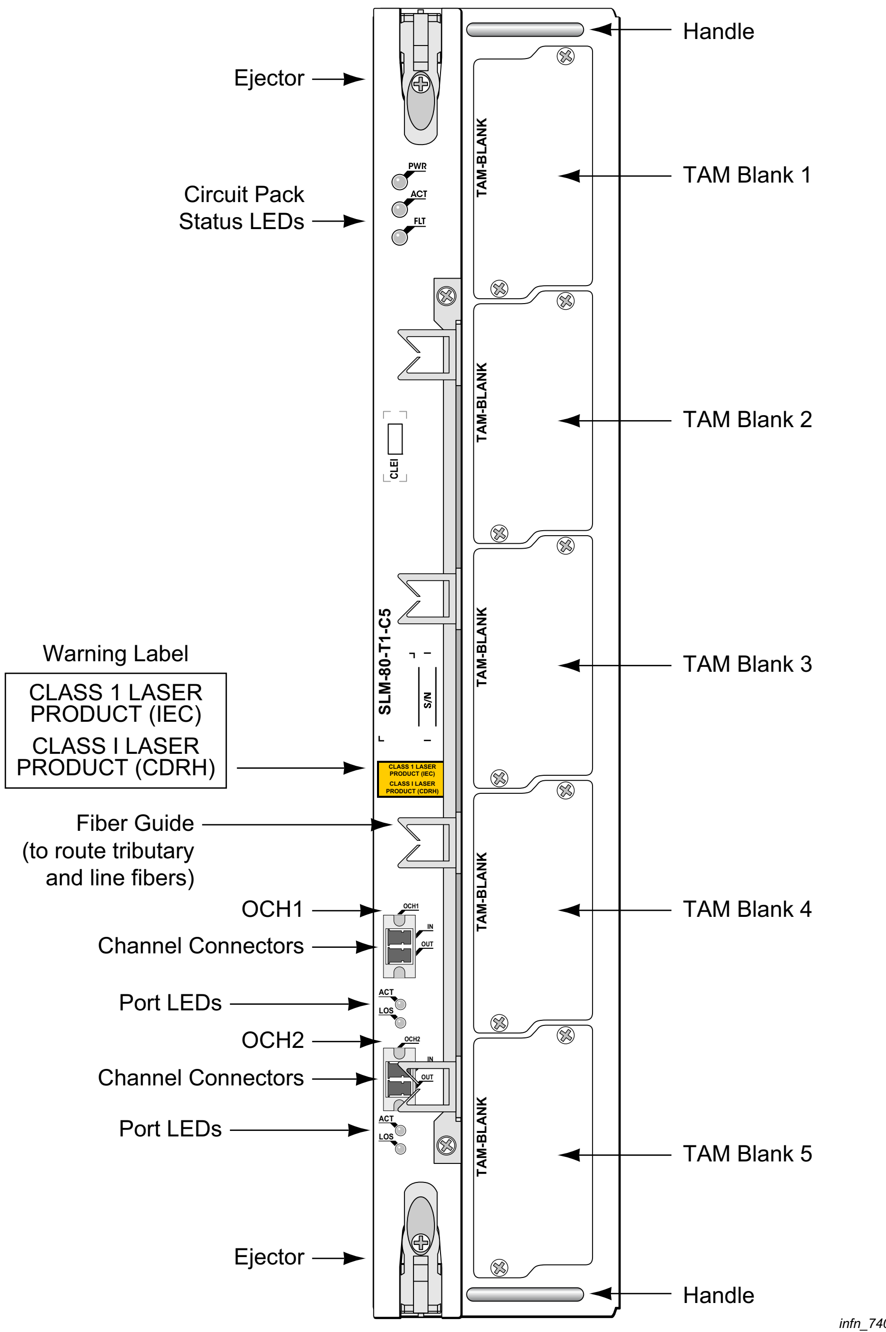
Figure 3-75 SLM-80 Functional Block Diagram



External Indicators and Connectors

The SLM-80 (Figure 3-76) provides circuit pack status/port LED indicators and line connectors.

Figure 3-76 SLM-80 Faceplate



Circuit Pack Level LEDs

The SLM-80 provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-159.

Table 3-159 SLM-80 Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the SLM-80
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the SLM-80 OCH port status indication. The Active LED is either solid Green, flashing Green, or dimmed depending on the status of the circuit pack. The LOS LED indicates if the port is provisioned and if the signal is being received. The significance of an illuminated LED is described in Table 3-160.

Table 3-160 Port Visual Alarm Indicators on the SLM-80

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the port status: Solid Green (Active), flashing Green (acquiring signal for Auto-discovery), or dimmed (Locked or Auto-discovery of LM-80 OCG timed out)
LOS	Red	Indicates the status of the incoming signal. During an OCH Optical Loss of Signal (OLOS), condition this indicator will be lit and dimmed when receiving an OCH signal

Connectors

The SLM-80 provides OCH n IN/OUT interfaces to the CMM as shown in Table 3-161.

Table 3-161 SLM-80 Connectors

Connector	Type	Purpose
OCH 1/OCH 2 IN	LC, Front access	Connects from the corresponding OCH OUT port on the CMM
OCH 1/OCH 2 OUT	LC, Front access	Connects to the corresponding OCH IN port on the CMM

Technical Specifications

Table 3-162 provides the mechanical and electrical specifications for the SLM-80.

Table 3-162 SLM-80 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	18.50 inches / 469.90mm
	Width	3.53 inches / 89.66mm
	Depth	11.10 inches / 281.94mm
	Weight	20.1lb / 9.1kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Optical Specifications

Table 3-163 provides the optical power specifications for the SLM-80.

Table 3-163 SLM-80 Optical Power Range

Type	Parameter	Specification
SLM-80-T1-C5	Input power level	-19.7 to 0.0dBm
	Output power level	-6.0 to -2.3dBm

Table 3-164 provides the wavelength operating range for the SLM-80 per the DTN C-Band optical channel plan.

Table 3-164 SLM-80 Wavelength Operating Range

Type	Parameter	Specification
SLM-80-T1-C5 (configured for OCG 1)	Wavelength range OCG 1	1548.915nm to 1563.455nm
SLM-80-T1-C5 (configured for OCG 2)	Wavelength range OCG 2	1548.515nm to 1563.047nm
SLM-80-T1-C5 (configured for OCG 3)	Wavelength range OCG 3	1548.115nm to 1562.640nm
SLM-80-T1-C5 (configured for OCG 4)	Wavelength range OCG 4	1547.715nm to 1562.233nm
SLM-80-T1-C5 (configured for OCG 5)	Wavelength range OCG 5	1531.507nm to 1545.720nm
SLM-80-T1-C5 (configured for OCG 6)	Wavelength range OCG 6	1531.116nm to 1545.322nm
SLM-80-T1-C5 (configured for OCG 7)	Wavelength range OCG 7	1530.725nm to 1544.924nm
SLM-80-T1-C5 (configured for OCG 8)	Wavelength range OCG 8	1530.334nm to 1544.526nm
SLM-80-T1-C5 (configured for OCG 9)	Wavelength range OCG 9	1549.115nm to 1563.659nm
SLM-80-T1-C5 (configured for OCG 10)	Wavelength range OCG 10	1548.715nm to 1563.251nm
SLM-80-T1-C5 (configured for OCG 11)	Wavelength range OCG 11	1548.315nm to 1562.844nm
SLM-80-T1-C5 (configured for OCG 12)	Wavelength range OCG 12	1547.915nm to 1562.436nm
SLM-80-T1-C5 (configured for OCG 13)	Wavelength range OCG 13	1531.311nm to 1545.521nm
SLM-80-T1-C5 (configured for OCG 14)	Wavelength range OCG 14	1530.920nm to 1545.123nm
SLM-80-T1-C5 (configured for OCG 15)	Wavelength range OCG 15	1530.529nm to 1544.725nm
SLM-80-T1-C5 (configured for OCG 16)	Wavelength range OCG 16	1530.139nm to 1544.327nm

Tributary Adapter Module (TAM)

The TAM maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Note: In the case of a DLM-n-C1-A, contact Infinera Technical Assistance Center (TAC) prior to installing a TAM-8-2.5GM. Also, the TAM-1-100GE, TAM-1-100GR, TAM-1-40G-VSR, TAM-1-40GE, TAM-1-40GR, and TAM-2-10GT are not supported on the DLM-n-C1-A.

Client signals (100Gbps, 40Gbps, 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps payload) are encapsulated into a Digital Transport Frame, referred to as the Trib DTF. The Trib DTF is created and terminated by the TAM. Table 3-165 lists the name and a brief description of each of the supported TAMs.

Table 3-165 TAM Product Details

Product Ordering Name (PON)	Description
TAM-1-100GE	TAM, one 100GE port The TAM-1-100GE provides physical coding sublayer (PCS) layer performance monitoring (PM) data collection
TAM-1-100GR	TAM, one 100GE port The TAM-1-100GR provides both PCS layer and media access control (MAC) layer PM data collection, and Remote Monitoring (RMON) support
TAM-1-40GE	TAM, one 40GE port The TAM-1-40GE provides PCS layer PM data collection
TAM-1-40GR	TAM, one 40GE port The TAM-1-40GR provides both PCS layer and MAC layer PM data collection, and RMON support
TAM-1-40G-VSR	TAM, one 40G port
TAM-2-10G-A	TAM, two 10G ports
TAM-2-10GR	TAM, two 10G ports The TAM-2-10GR provides Ethernet PM data collection and RMON support
TAM-2-10GT	TAM, two 10G ports The TAM-2-10GT provides Layer 1 Optical Private Networking (OPN) services

Table 3-165 TAM Product Details

Product Ordering Name (PON)	Description
TAM-2-10GM	TAM, two 10G ports
TAM-4-2.5G-A	TAM, four 2.5G ports
TAM-8-2.5GM	TAM, eight 2.5G ports
TAM-8-1G	TAM, eight 1GbE ports

Tributary Adapter Module 100GE (TAM-1-100GE)

Functional Description

The Tributary Adapter Module 100GE, referred to as TAM-1-100GE, is a 5-slot height TAM that transports 100Gbps services as ten "virtually concatenated" 10Gbps wavelengths managed as a single circuit across existing Digital Optical Networks using existing network design rules.

The TAM-1-100GE is compliant with 100GbE IEEE 802.3ba while providing digital wrapper transparency of the client signal and requires all five sub-slots located on the ADLM, AXLM, SLM, ADLM-80, AXLM-80, and/or SLM-80.

Note: The TAM-1-100GE is not supported on the DLM, XLM, and/or TEM.

The TAM-1-100GE provides a single sub-slot to enable the insertion of the following TOM types:

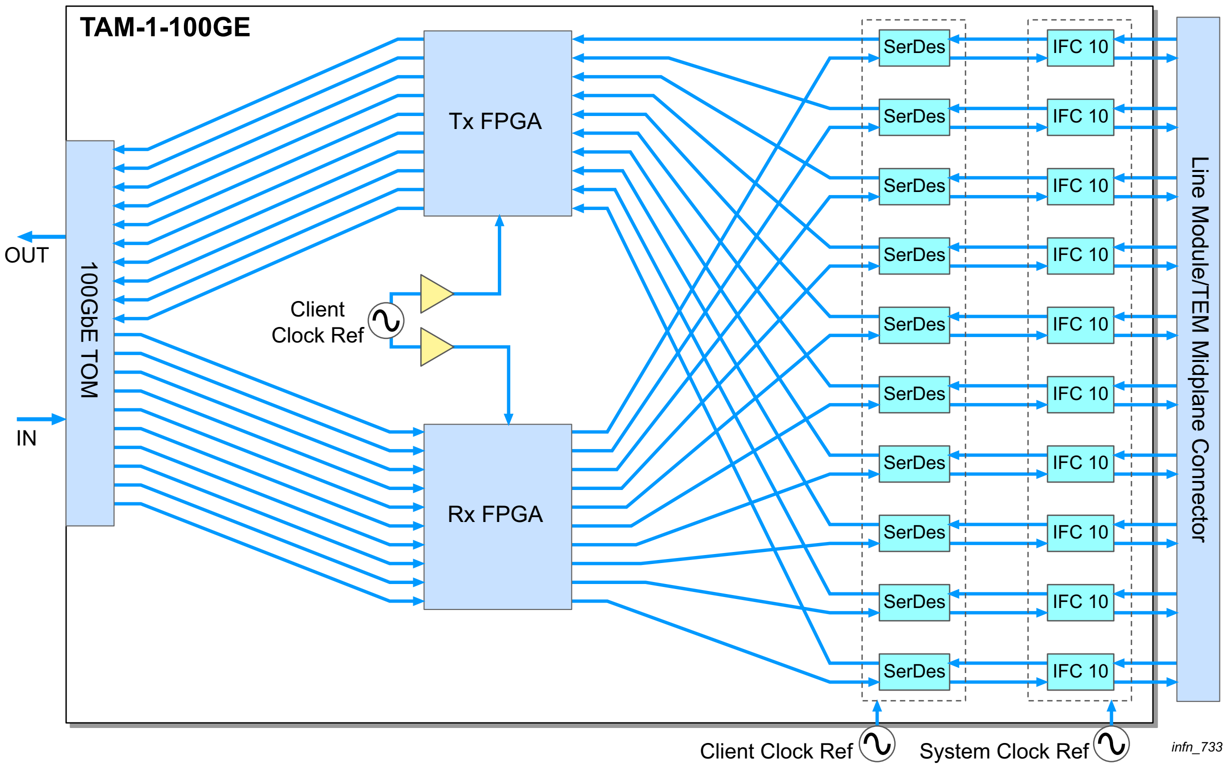
- "Tributary Optical Module 100G (TOM-100G-SR10)" on page 3-289
- "Tributary Optical Module 100G (TOM-100G-S10X)" on page 3-292
- "Tributary Optical Module 100G (TOM-100G-S10X)" on page 3-292
- "Tributary Optical Module 100G (TOM-100G-LR4)" on page 3-295
- "Tributary Optical Module 100G (TOM-100G-L10X)" on page 3-298

The TAM-1-100GE supports the following client interface:

- 100GbE

Block Diagram

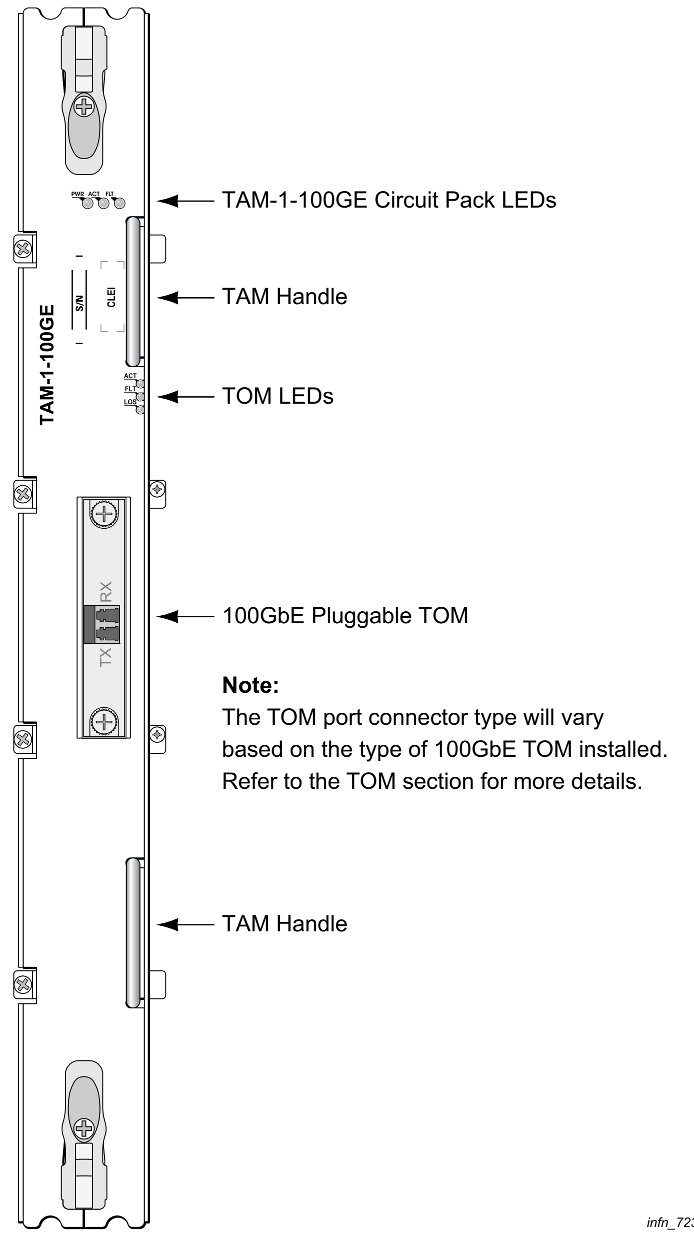
Figure 3-77 TAM-1-100GE Functional Block Diagram



External Indicators and Connectors

The TAM-1-100GE provides circuit pack status/TOM LED indicators and slots for pluggable TOM-100Gs as shown in Figure 3-78.

Figure 3-78 TAM-1-100GE Faceplate



Circuit Pack Level LEDs

The TAM-1-100GE provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-166.

Table 3-166 TAM-1-100GE Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-1-100GE
ACT (Active)	Green / Yellow	Indicates the TAM-1-100GE status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-1-100GE: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-1-100GE houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 3-167.

Table 3-167 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-168 provides the mechanical and electrical specifications for the TAM-1-100GE.

Table 3-168 TAM-1-100GE Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	17.00 inches / 431.80mm
	Width	10.25 inches / 260.35mm
	Depth	1.86 inches / 47.24mm
	Weight	8.4lb / 3.8kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-169 provides the tributary interface details for the TAM-1-100GE.

Table 3-169 TAM-1-100GE Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent
Capacity	Maximum capacity	100Gbps, max 1 TOM-100G-XXX per TAM-1-100GE

Tributary Adapter Module 100GR (TAM-1-100GR)

Functional Description

The Tributary Adapter Module 100GR, referred to as TAM-1-100GR, is a 5-slot height TAM that transports 100Gbps services as ten "virtually concatenated" 10Gbps wavelengths managed as a single circuit across existing Digital Optical Networks using existing network design rules.

The TAM-1-100GR functions similarly to the TAM-1-100GE and provides Ethernet PM data collection and Remote Monitoring (RMON) support.

The TAM-1-100GR is compliant with 100GbE IEEE 802.3ba while providing digital wrapper transparency of the client signal and requires all five sub-slots located on the ADLM, AXLM, SLM, ADLM-80, AXLM-80, and/or SLM-80.

Note: The TAM-1-100GR is not supported on the DLM, XLM, and/or TEM.

The TAM-1-100GR provides a single sub-slot to enable the insertion of the following TOM types:

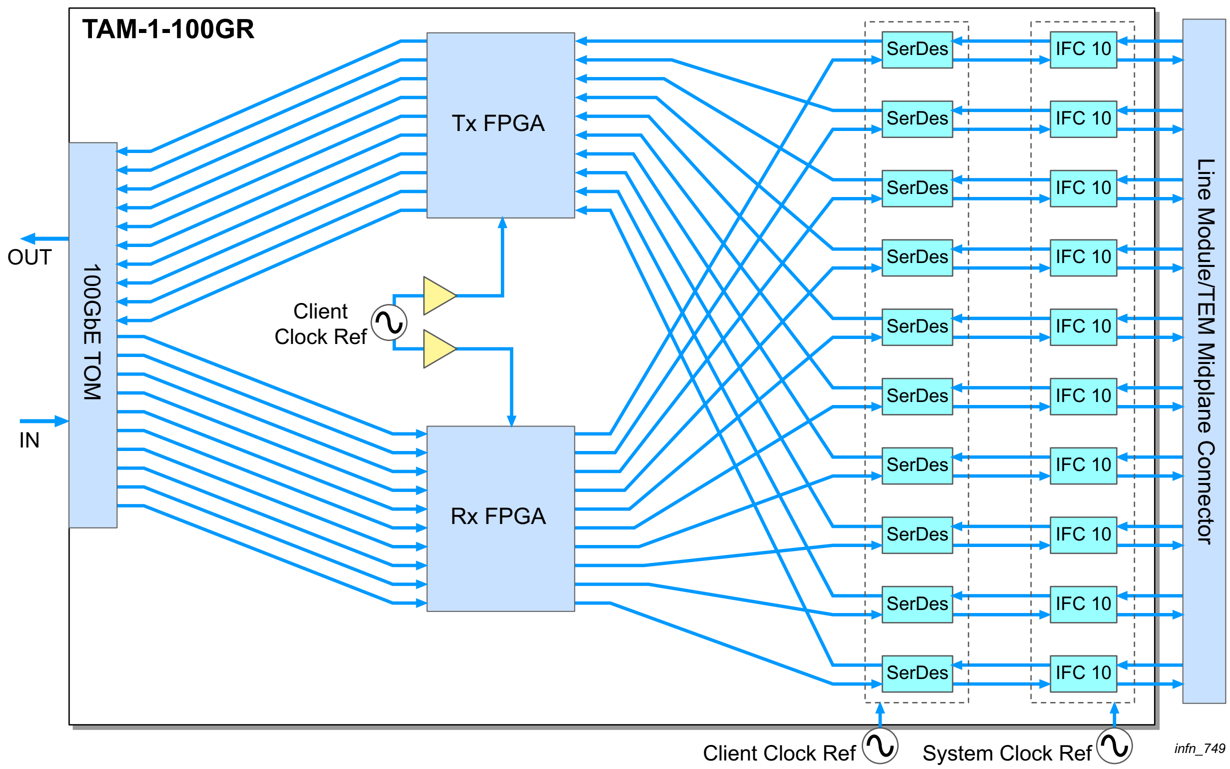
- “Tributary Optical Module 100G (TOM-100G-SR10)” on page 3-289
- “Tributary Optical Module 100G (TOM-100G-S10X)” on page 3-292
- “Tributary Optical Module 100G (TOM-100G-S10X)” on page 3-292
- “Tributary Optical Module 100G (TOM-100G-LR4)” on page 3-295
- “Tributary Optical Module 100G (TOM-100G-L10X)” on page 3-298

The TAM-1-100GR supports the following client interface:

- 100GbE

Block Diagram

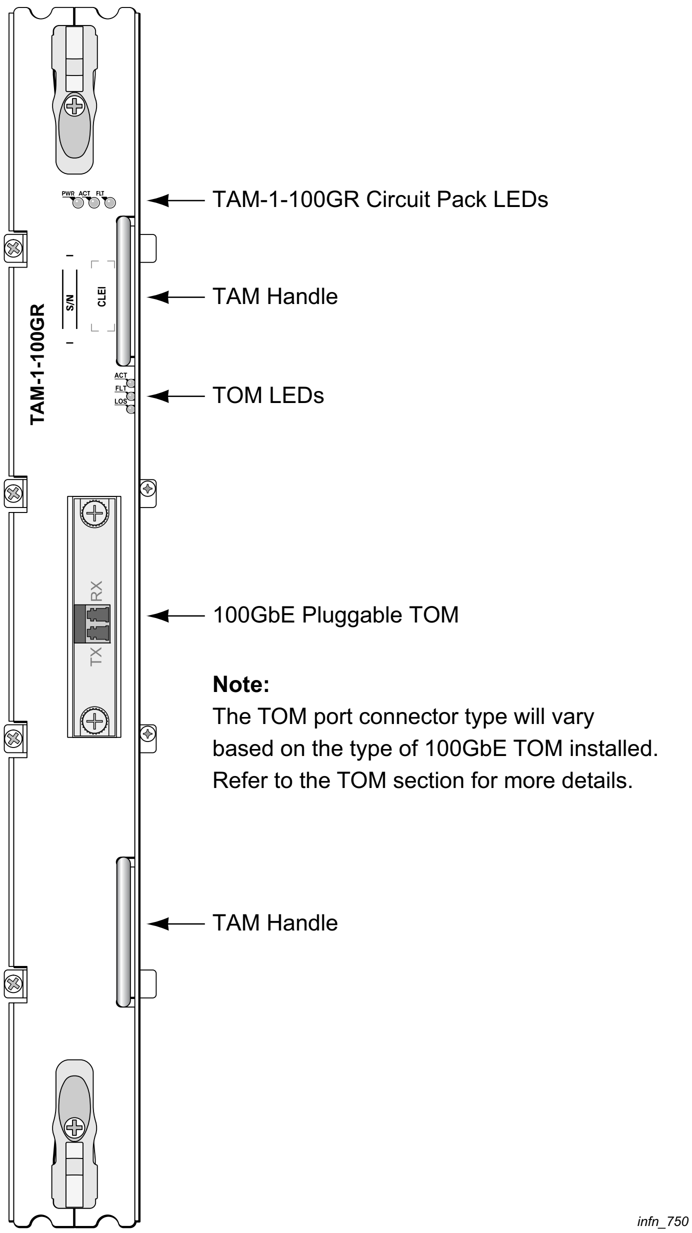
Figure 3-79 TAM-1-100GR Functional Block Diagram



External Indicators and Connectors

The TAM-1-100GR provides circuit pack status/TOM LED indicators and slots for pluggable TOM-100Gs as shown in Figure 3-80.

Figure 3-80 TAM-1-100GR Faceplate



Circuit Pack Level LEDs

The TAM-1-100GR provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-170.

Table 3-170 TAM-1-100GR Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-1-100GR
ACT (Active)	Green / Yellow	Indicates the TAM-1-100GR status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-1-100GR: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-1-100GR houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 3-171.

Table 3-171 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-172 provides the mechanical and electrical specifications for the TAM-1-100GR.

Table 3-172 TAM-1-100GR Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	17.00 inches / 431.80mm
	Width	10.25 inches / 260.35mm
	Depth	1.86 inches / 47.24mm
	Weight	8.4lb / 3.8kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-173 provides the tributary interface details for the TAM-1-100GR.

Table 3-173 TAM-1-100GR Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent, Ethernet PM and Remote Monitoring (RMON) support
Capacity	Maximum capacity	100Gbps, max 1 TOM-100G-XXX per TAM-1-100GR

Tributary Adapter Module 40GE (TAM-1-40GE)

Functional Description

The Tributary Adapter Module 40GE, referred to as TAM-1-40GE, is a double-height TAM that transports 40Gbps services as four "virtually concatenated" 10Gbps wavelengths managed as a single circuit across existing Digital Optical Networks using existing network design rules.

The TAM-1-40GE is compliant with 40GbE IEEE 802.3ba while providing digital wrapper transparency of the client signal and can be housed in sub-slots 1 and 2 or in sub-slots 4 and 5 of a line module and/or TEM (these modules support the removable mechanical spacer between sub-slots 1 and 2 and sub-slots 4 and 5 that accommodate the double-height TAM-1-40GE).

One or two TAM-1-40GEs can be housed on a line module and/or TEM in combination with any of the single-height TAMs.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Note: The TAM-1-40GE is not supported on the DLM-n-C1-A.

The TAM-1-40GE provides further sub-slots to enable the insertion of the following TOM types:

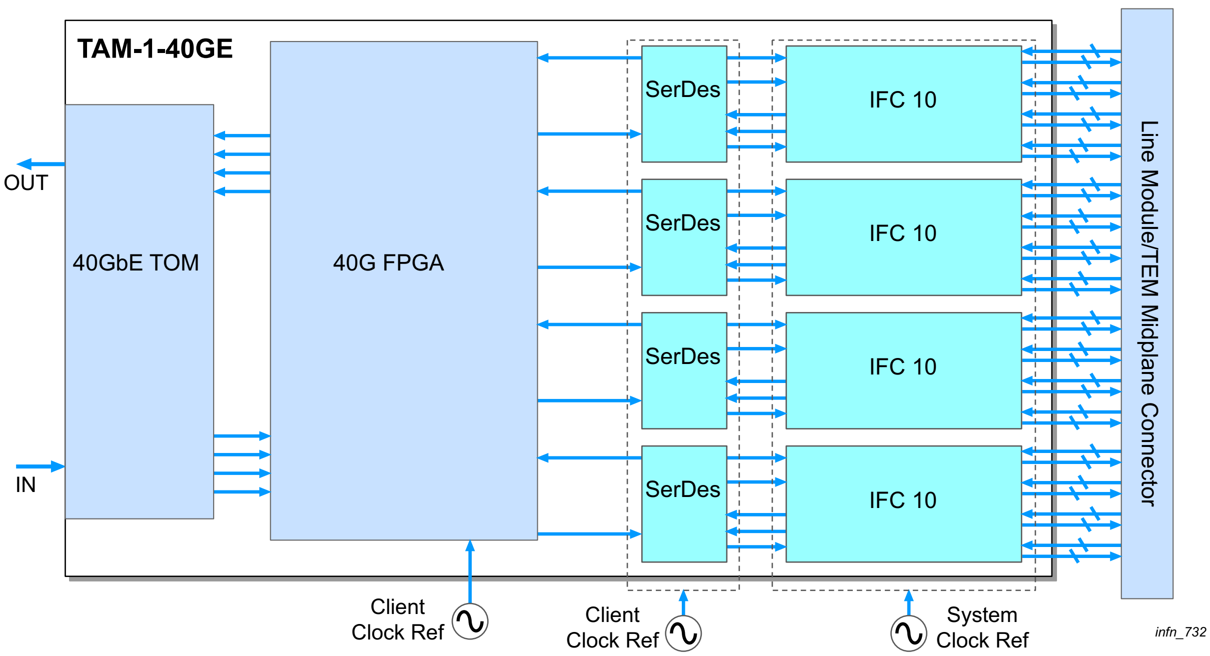
- “Tributary Optical Module 40G (TOM-40G-SR4)” on page 3-301
- “Tributary Optical Module 40G (TOM-40G-LR4)” on page 3-304

The TAM-1-40GE supports the following client interface:

- 40GbE

Block Diagram

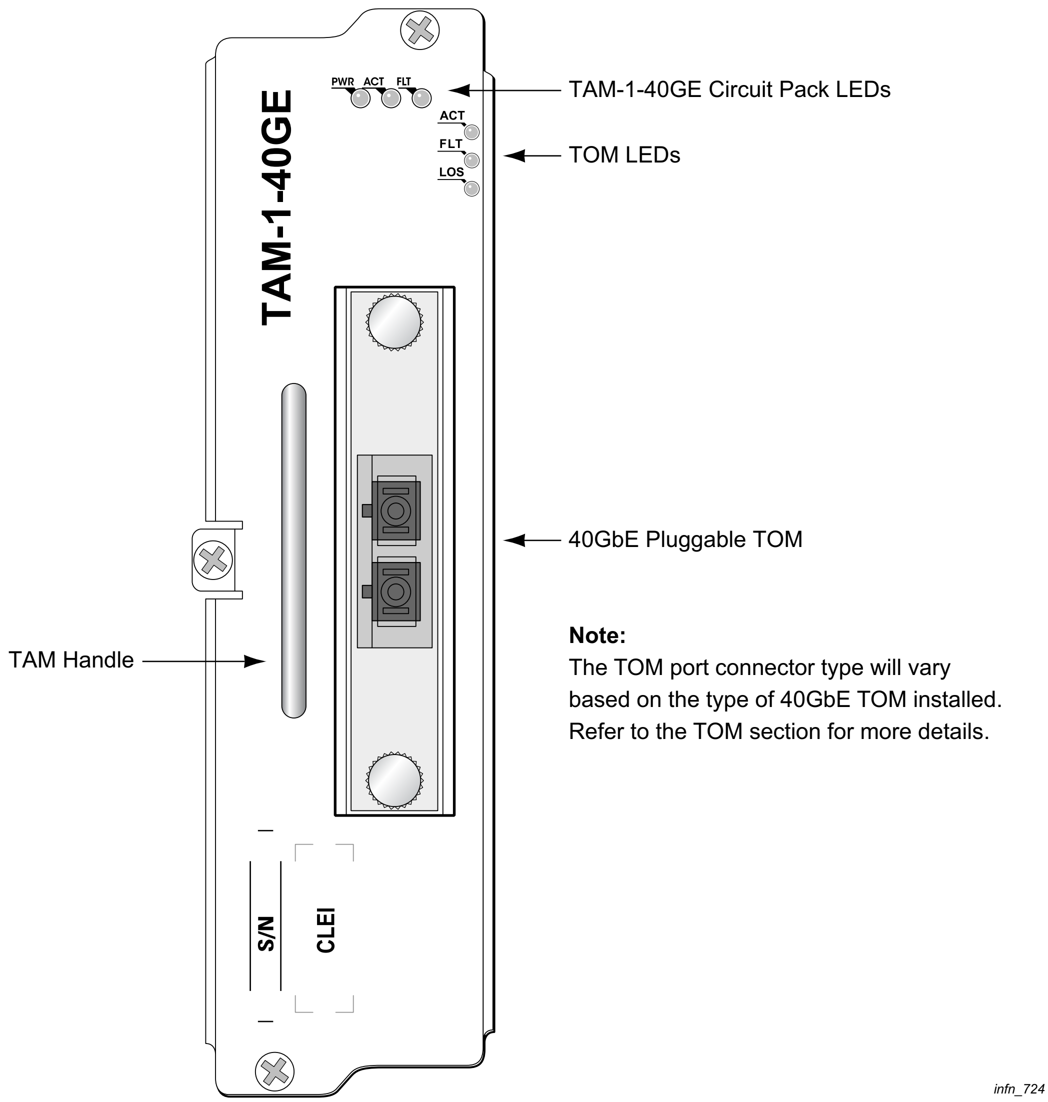
Figure 3-81 TAM-1-40GE Functional Block Diagram



External Indicators and Connectors

The TAM-1-40GE provides circuit pack status/TOM LED indicators and slots for pluggable TOM-40Gs as shown in Figure 3-82.

Figure 3-82 TAM-1-40GE Faceplate



Circuit Pack Level LEDs

The TAM-1-40GE provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-174.

Table 3-174 TAM-1-40GE Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-1-40GE
ACT (Active)	Green / Yellow	Indicates the TAM-1-40GE status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-1-40GE: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-1-40GE houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 3-175.

Table 3-175 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-176 provides the mechanical and electrical specifications for the TAM-1-40GE.

Table 3-176 TAM-1-40GE Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	6.50 inches / 165.10mm
	Width	1.86 inches / 47.24mm
	Depth	10.25 inches / 260.35mm
	Weight	3.6lb / 1.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-177 provides the tributary interface details for the TAM-1-40GE.

Table 3-177 TAM-1-40GE Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	40GbE	Fully transparent
Capacity	Maximum capacity	40Gbps, max 1 TOM-40G-XXX per TAM-1-40GE

Tributary Adapter Module 40GR (TAM-1-40GR)

Functional Description

The Tributary Adapter Module 40GR, referred to as TAM-1-40GR, is a double-height TAM that transports 40Gbps services as four "virtually concatenated" 10Gbps wavelengths managed as a single circuit across existing Digital Optical Networks using existing network design rules.

The TAM-1-40GR functions similarly to the TAM-1-40GE and provides Ethernet PM data collection and Remote Monitoring (RMON) support.

The TAM-1-40GR is compliant with 40GbE IEEE 802.3ba while providing digital wrapper transparency of the client signal and can be housed in sub-slots 1 and 2 or in sub-slots 4 and 5 of a line module and/or TEM (these modules support the removable mechanical spacer between sub-slots 1 and 2 and sub-slots 4 and 5 that accommodate the double-height TAM-1-40GR).

One or two TAM-1-40GRs can be housed on a line module and/or TEM in combination with any of the single-height TAMs.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Note: The TAM-1-40GR is not supported on the DLM-n-C1-A.

The TAM-1-40GR provides further sub-slots to enable the insertion of the following TOM types:

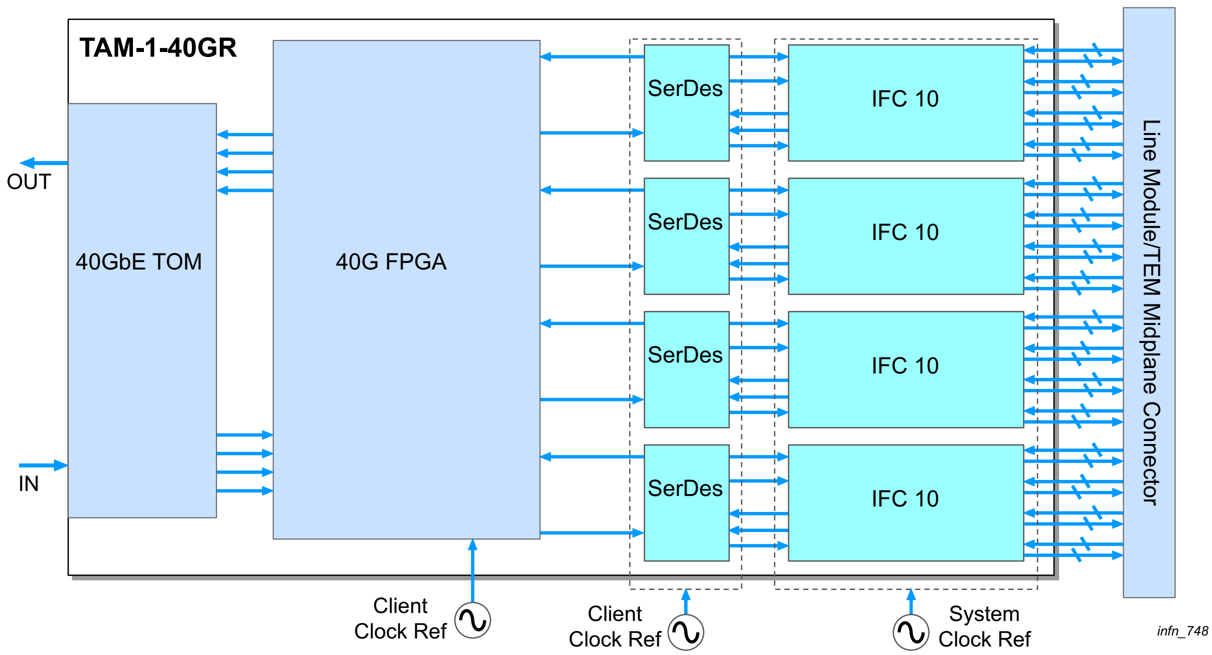
- “Tributary Optical Module 40G (TOM-40G-SR4)” on page 3-301
- “Tributary Optical Module 40G (TOM-40G-LR4)” on page 3-304

The TAM-1-40GR supports the following client interface:

- 40GbE

Block Diagram

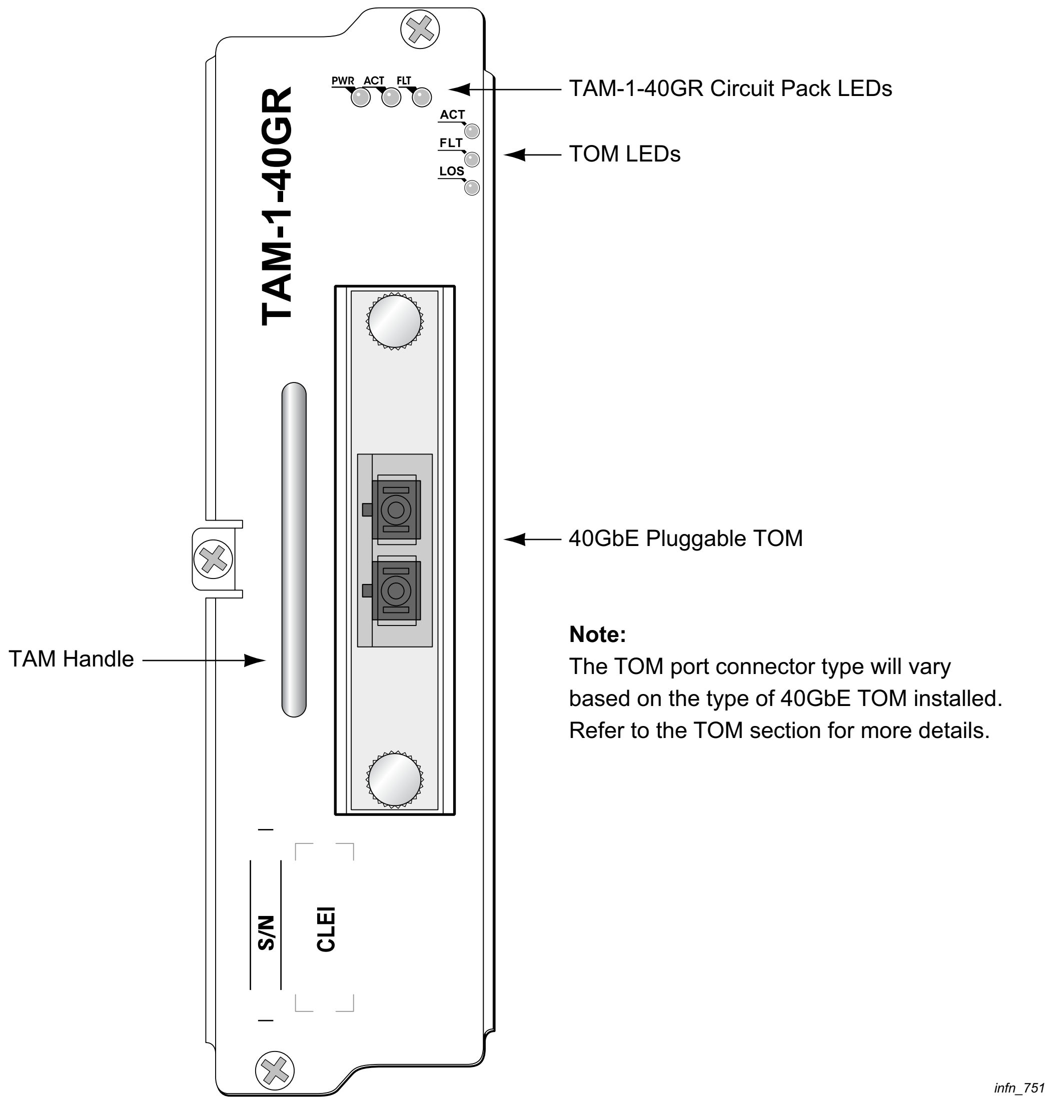
Figure 3-83 TAM-1-40GR Functional Block Diagram



External Indicators and Connectors

The TAM-1-40GR provides circuit pack status/TOM LED indicators and slots for pluggable TOM-40Gs as shown in Figure 3-84.

Figure 3-84 TAM-1-40GR Faceplate



Circuit Pack Level LEDs

The TAM-1-40GR provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-178.

Table 3-178 TAM-1-40GR Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-1-40GR
ACT (Active)	Green / Yellow	Indicates the TAM-1-40GR status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-1-40GR: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-1-40GR houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 3-179.

Table 3-179 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-180 provides the mechanical and electrical specifications for the TAM-1-40GR.

Table 3-180 TAM-1-40GR Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	6.50 inches / 165.10mm
	Width	1.86 inches / 47.24mm
	Depth	10.25 inches / 260.35mm
	Weight	3.6lb / 1.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-181 provides the tributary interface details for the TAM-1-40GR.

Table 3-181 TAM-1-40GR Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	40GbE	Fully transparent, Ethernet PM and Remote Monitoring (RMON) support
Capacity	Maximum capacity	40Gbps, max 1 TOM-40G-XXX per TAM-1-40GR

Tributary Adapter Module 40G (TAM-1-40G-VSR)

Functional Description

The Tributary Adapter Module 40G, referred to as TAM-1-40G-VSR, is a double-height TAM that transports 40Gbps services as four "virtually concatenated" 10Gbps wavelengths managed as a single circuit across existing Digital Optical Networks using existing network design rules. The TAM-1-40G-VSR has one integrated non-pluggable Tributary Optical Module (TOM) that supports SONET OC-768 and SDH STM-256 client interfaces.

The TAM-1-40G-VSR can be housed in sub-slots 1 and 2 or in sub-slots 4 and 5 of a line module and/or TEM (these modules support the removable mechanical spacer between sub-slots 1 and 2 and sub-slots 4 and 5 that accommodate the double-height TAM-1-40G-VSR). One or two TAM-1-40G-VSRs can be housed on a line module and/or TEM in combination with any of the single-height TAMs.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The particular modules and their associated sub-slots are listed in Table 3-182.

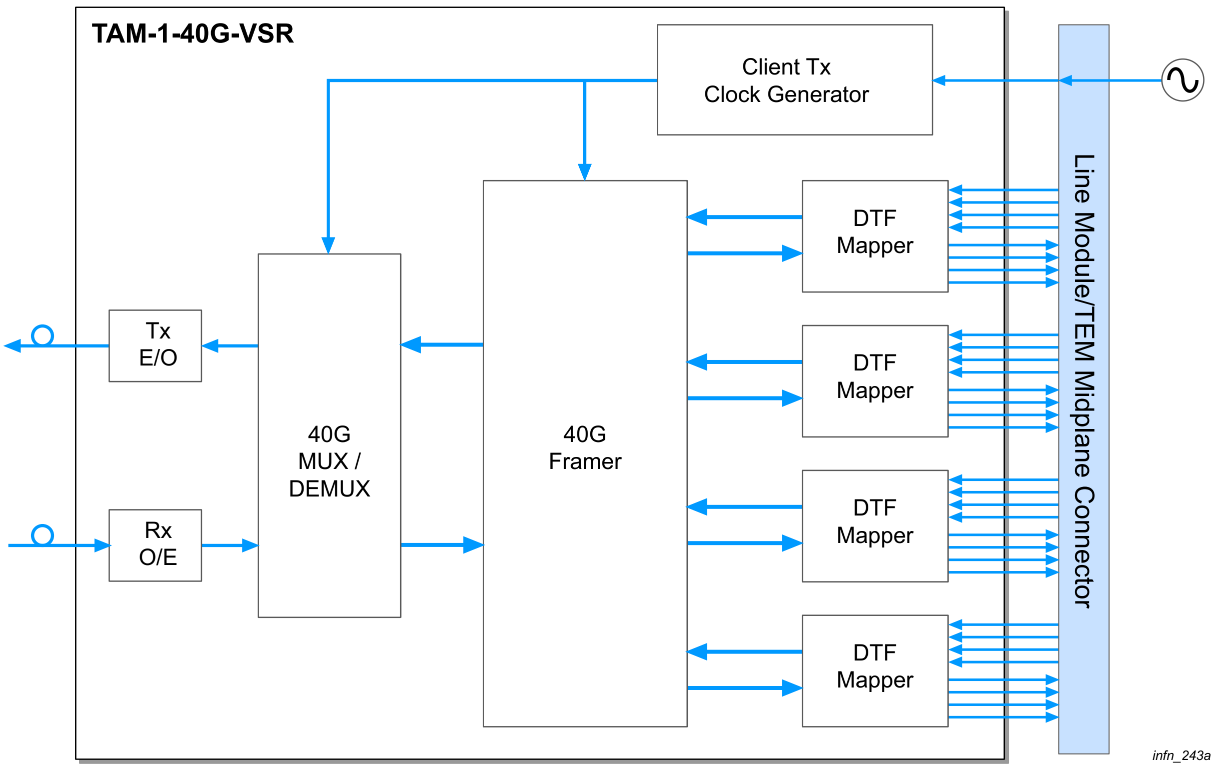
Table 3-182 TAM-1-40G-VSR Sub-slot Assignments

Line Module/TEM Type	Sub-Slot Location for TAM-1-40G-VSR
DLM-n-C1-B (n=1 to 8)	1 and 2
	4 and 5
DLM-n-C2/C3 (n=1 to 8)	1 and 2
	4 and 5
XLM-n-C3 (n=1 to 8)	1 and 2
	4 and 5
TEM	1 and 2
	4 and 5
ADLM-T4-n-C4/C5 (n=1, 3, 5, or 7)	1 and 2
	4 and 5
AXLM-T4-n-C4/C5 (n=1, 3, 5, or 7)	1 and 2
	4 and 5
SLM-T4-n-C4/C5 (n=1, 3, 5, or 7)	1 and 2
	4 and 5

Note: The TAM-1-40G-VSR is not supported on the DLM-n-C1-A.

Block Diagram

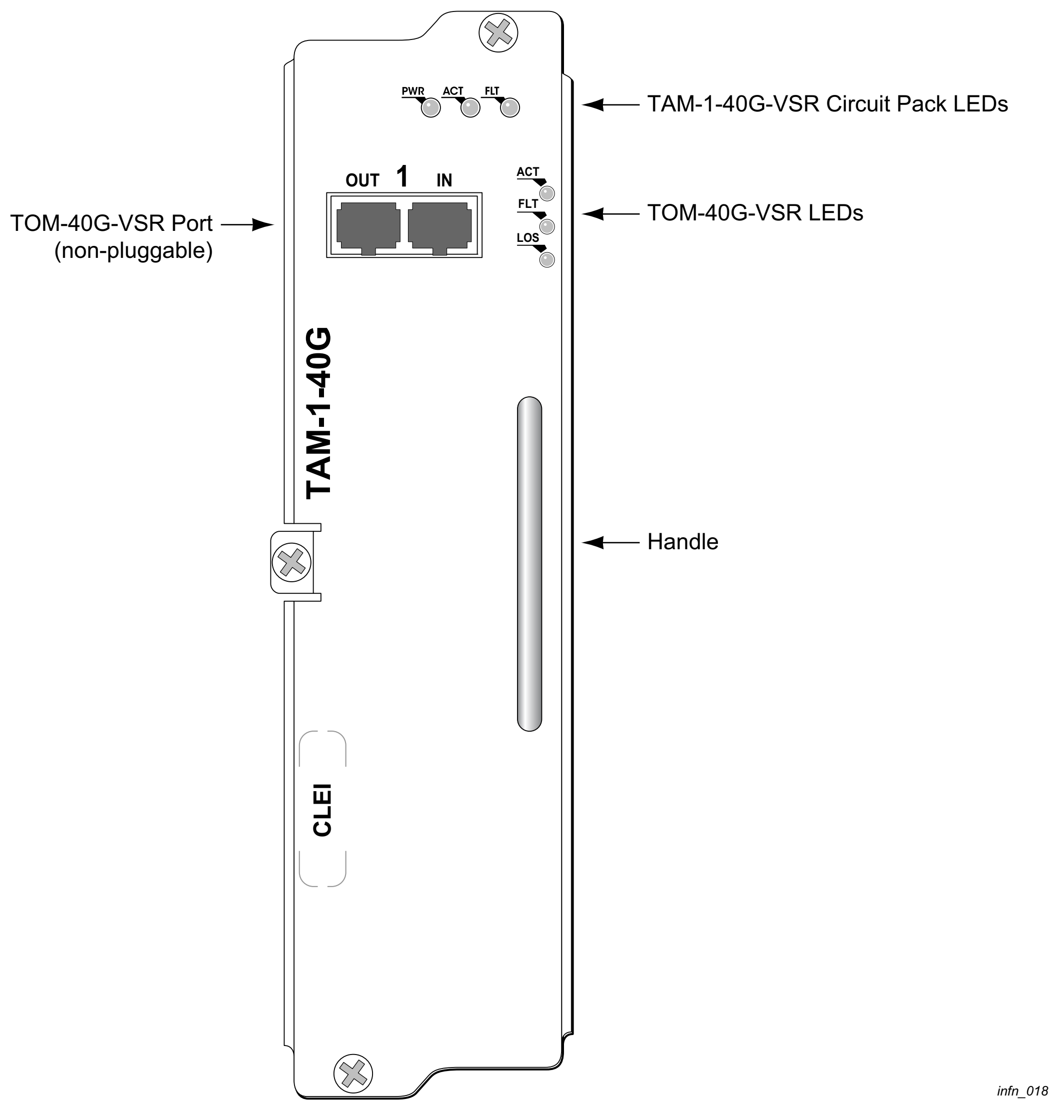
Figure 3-85 TAM-1-40G-VSR Functional Block Diagram



External Indicators and Connectors

The TAM-1-40G-VSR provides circuit pack status/TOM LED indicators and 40G TOM port connectors as shown in Figure 3-86.

Figure 3-86 TAM-1-40G-VSR Faceplate



Circuit Pack Level LEDs

The TAM-1-40G-VSR provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-183.

Table 3-183 TAM-1-40G-VSR Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-1-40G-VSR
ACT (Active)	Green / Yellow	Indicates the TAM-1-40G-VSR status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-1-40G-VSR: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM-40G LEDs

In addition to TAM status indicators, the TAM-1-40G-VSR houses the port level LEDs in support of the TOM: ACT (Active), FLT (Fault) and LOS. The significance of an illuminated LED is described in Table 3-184.

Table 3-184 TOM-1-40G Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-185 provides the mechanical and electrical specifications for the TAM-1-40G-VSR.

Table 3-185 TAM-1-40G-VSR Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	7.30 inches / 185.42mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	4.5lb / 2.0kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-186 provides the tributary interface details for the TAM-1-40G-VSR.

Table 3-186 TAM-1-40G-VSR Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-768	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-256	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
Capacity	Maximum capacity	40Gbps, max 1 TOM-40G-XXX per TAM-1-40G-VSR

Tributary Adapter Module 10G (TAM-2-10G)

Functional Description

The Tributary Adapter Module 10G, referred to as TAM-2-10G, maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

The TAM-2-10G can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The TAM-2-10G provides further sub-slots to enable the insertion of the following TOM types:

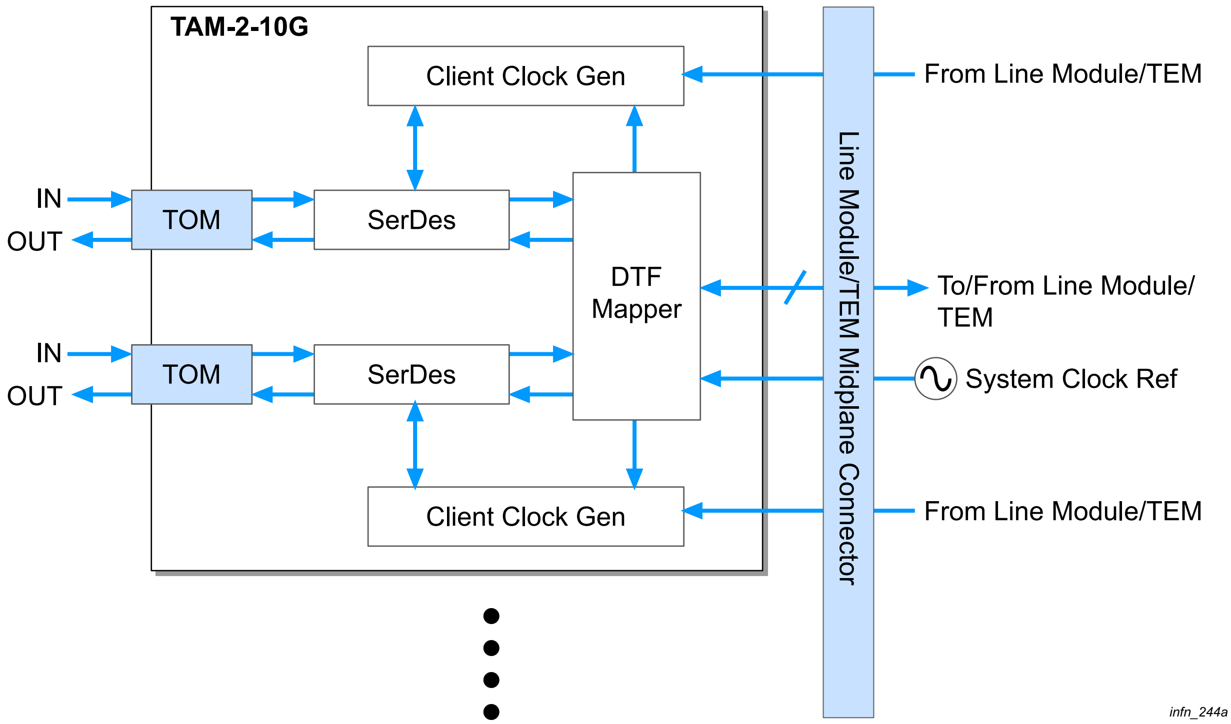
- “Tributary Optical Module 10G (TOM-10G-SR0)” on page 3-309
- “Tributary Optical Module 10G (TOM-10G-SR1)” on page 3-312
- “Tributary Optical Module 10G (TOM-10G-IR2)” on page 3-315
- “Tributary Optical Module 10G (TOM-10G-LR2)” on page 3-318
- “Tributary Optical Module 10G (TOM-10G-Dn-LR2)” on page 3-321
- “Tributary Optical Module 8G (TOM-8G-SM-LC-L)” on page 3-326

The TAM-2-10G supports the following client interfaces:

- SONET OC-192
- SDH STM-64
- DWDM 10G SONET
- DWDM 10G SDH
- DWDM 10G Ethernet
- 10GbE LAN
- 10GbE WAN
- 10G Clear Channel
- 10.3G Clear Channel

Block Diagram

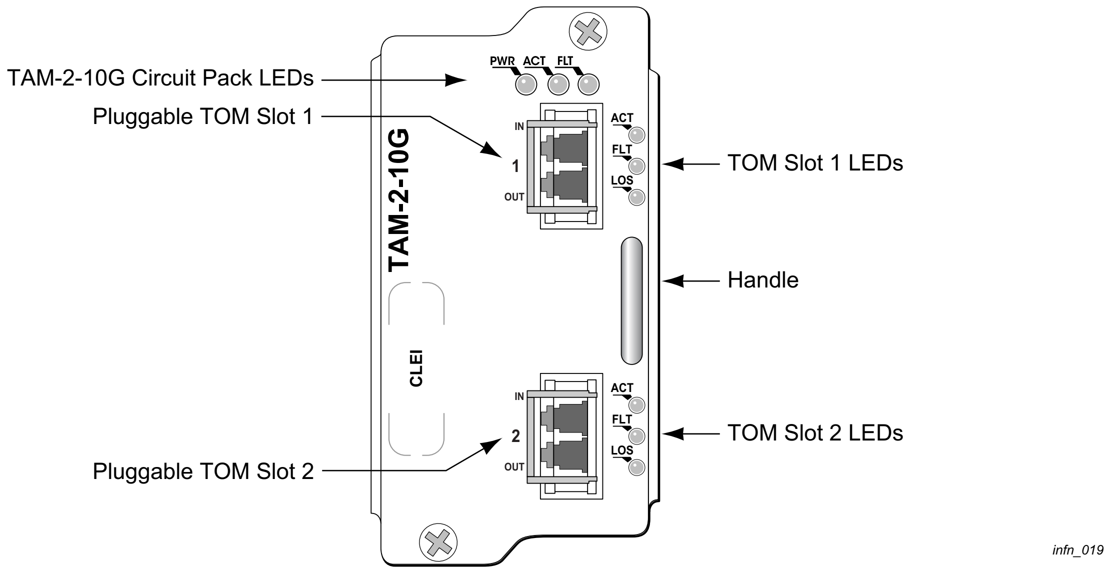
Figure 3-87 TAM-2-10G Functional Block Diagram



External Indicators and Connectors

The TAM-2-10G provides circuit pack status/TOM LED indicators and slots for pluggable TOM-10Gs as shown in Figure 3-88.

Figure 3-88 TAM-2-10G Faceplate



Circuit Pack Level LEDs

The TAM-2-10G provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-187.

Table 3-187 TAM-2-10G Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-2-10G
ACT (Active)	Green / Yellow	Indicates the TAM-2-10G status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-2-10G: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-2-10G houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-188.

Table 3-188 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-189 provides the mechanical and electrical specifications for the TAM-2-10G.

Table 3-189 TAM-2-10G Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.4lb / 0.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-190 provides the tributary interface details for the TAM-2-10G.

Table 3-190 TAM-2-10G Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-64	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	10GbE LAN PHY	Fully transparent
	10GbE WAN PHY	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	10G Clear Channel	Fully transparent
	10.3G Clear Channel	
Capacity	Maximum capacity	20Gbps, max 2 TOM-10G-XXX per TAM-2-10G

Tributary Adapter Module 10GR (TAM-2-10GR)

Functional Description

The Tributary Adapter Module 10GR, referred to as TAM-2-10GR, functions similarly to the TAM-2-10G and provides Ethernet PM data collection and Remote Monitoring (RMON) support. The TAM-2-10GR maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

The TAM-2-10GR can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the "line module" will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the "LM-80" will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The TAM-2-10GR provides further sub-slots to enable the insertion of the following TOM types:

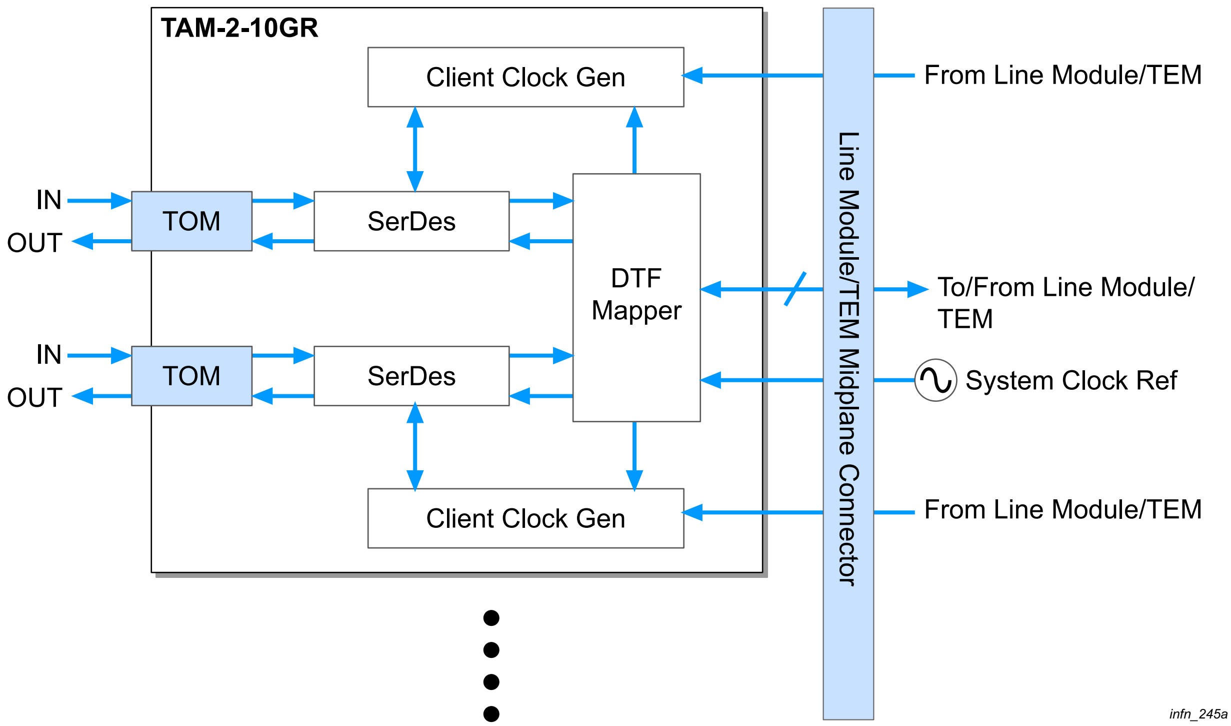
- "Tributary Optical Module 10G (TOM-10G-SR0)" on page 3-309
- "Tributary Optical Module 10G (TOM-10G-SR1)" on page 3-312
- "Tributary Optical Module 10G (TOM-10G-IR2)" on page 3-315
- "Tributary Optical Module 10G (TOM-10G-LR2)" on page 3-318
- "Tributary Optical Module 10G (TOM-10G-Dn-LR2)" on page 3-321
- "Tributary Optical Module 8G (TOM-8G-SM-LC-L)" on page 3-326

The TAM-2-10GR supports the following client interfaces:

- SONET OC-192
- SDH STM-64
- DWDM 10G SONET
- DWDM 10G SDH
- DWDM 10G Ethernet
- 10GbE LAN
- 10GbE WAN
- 10G Clear Channel
- 10.3G Clear Channel

Block Diagram

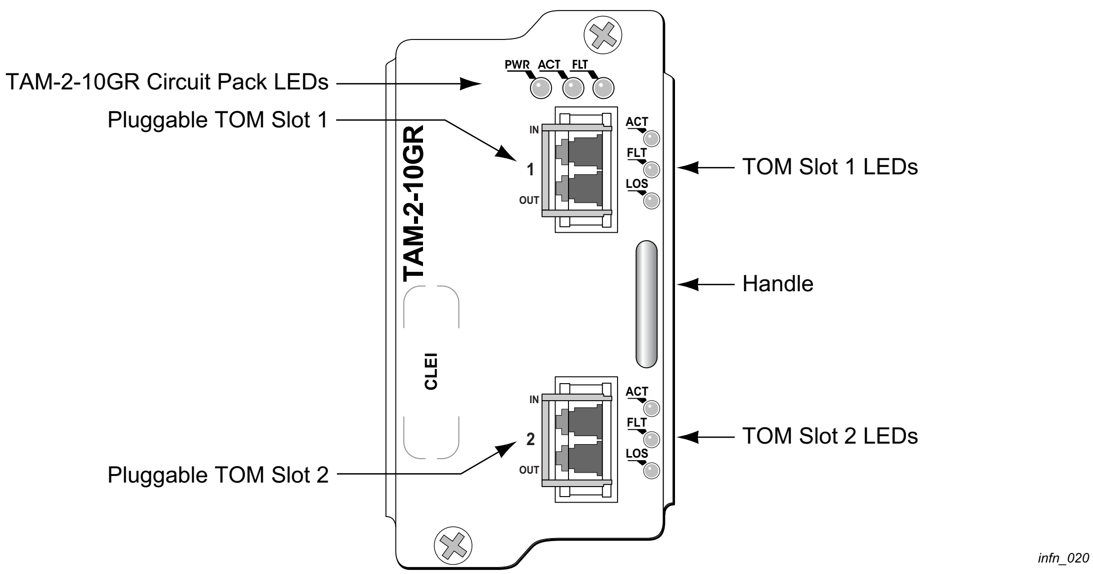
Figure 3-89 TAM-2-10GR Functional Block Diagram



External Indicators and Connectors

The TAM-2-10GR provides circuit pack status/TOM LED indicators and slots for pluggable TOM-10Gs as shown in Figure 3-90.

Figure 3-90 TAM-2-10GR Faceplate



Circuit Pack Level LEDs

The TAM-2-10GR provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-191.

Table 3-191 TAM-2-10GR Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-2-10GR
ACT (Active)	Green / Yellow	Indicates the TAM-2-10GR status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-2-10GR: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-2-10GR houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-192.

Table 3-192 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-193 provides the mechanical and electrical specifications for the TAM-2-10GR.

Table 3-193 TAM-2-10GR Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.4lb / 0.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-194 provides the tributary interface details for the TAM-2-10GR.

Table 3-194 TAM-2-10GR Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-64	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	10GbE LAN PHY	Fully transparent, Ethernet PM and Remote Monitoring (RMON) support
	10GbE WAN PHY	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	10G Clear Channel	Fully transparent
	10.3G Clear Channel	
Capacity	Maximum capacity	20Gbps, max 2 TOM-10G-XXX per TAM-2-10GR

Tributary Adapter Module 10GT (TAM-2-10GT)

Functional Description

The Tributary Adapter Module 10GT, referred to as TAM-2-10GT, provides Layer 1 Optical Private Network (OPN) services. The TAM-2-10GT receives 10G DTF electrical signals and converts the 10G DTF to an optical signal for transmission across a fiber to another TAM-2-10GT providing Layer 1 OPN services.

The Layer 1 OPN is implemented via the TAM-2-10GT, which provides digital wrapper transparency between two networks. A TAM-2-10GT must be installed at the ingress and egress points of the end-customer's network.

The Layer 1 OPN allows a customer's network to have data plane isolation from other customers' networks, and allows the customer to manage their network and provision circuits using their assigned resources. The Layer 1 OPN can terminate 10Gbps, 2.5Gbps, 1GbE, 622Mbps, and/or 155Mbps services.

Support is provided for GMPLS end-to-end service provisioning using L1 OPN Out of Band signaling. SNCs are supported for 10G routes as well as 2.5G (and lower rate) routes. There is no direct GMPLS access between the provider's network and the end-customer's network. The end-customer's nodes do not receive routing information from the other remote end-customer's nodes, nor from the provider's network. For more information regarding Layer 1 OPN services, refer to the *Infinera DTN and DTN-X System Description Guide*.

The TAM-2-10GT can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM and provides further sub-slots to enable the insertion of the following TOM types:

- “Tributary Optical Module 10G (TOM-10G-SR1)” on page 3-312
- “Tributary Optical Module 10G (TOM-10G-IR2)” on page 3-315
- “Tributary Optical Module 10G (TOM-10G-LR2)” on page 3-318
- “Tributary Optical Module 10G (TOM-10G-Dn-LR2)” on page 3-321
- “Tributary Optical Module 8G (TOM-8G-SM-LC-L)” on page 3-326

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

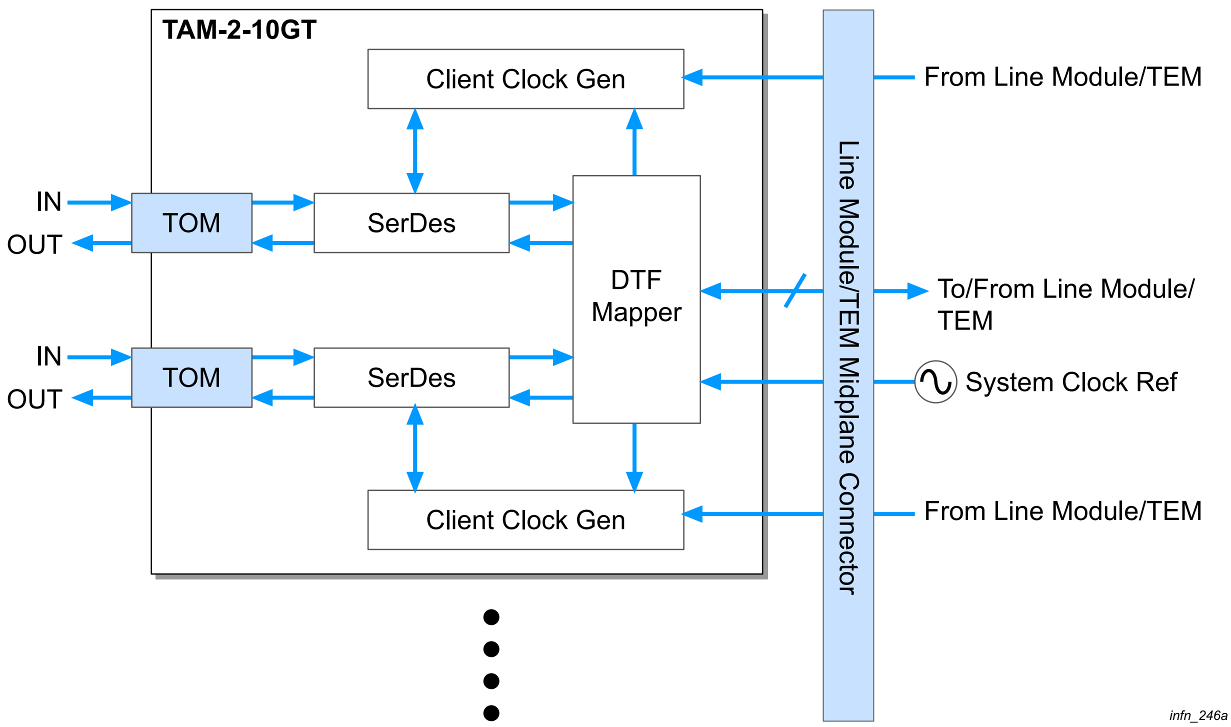
Note: The TAM-2-10GT is not supported on the DLM-n-C1-A.

The TAM-2-10GT supports the following client interface:

- 10G DTF (with a line rate of 11.1Gbps)

Block Diagram

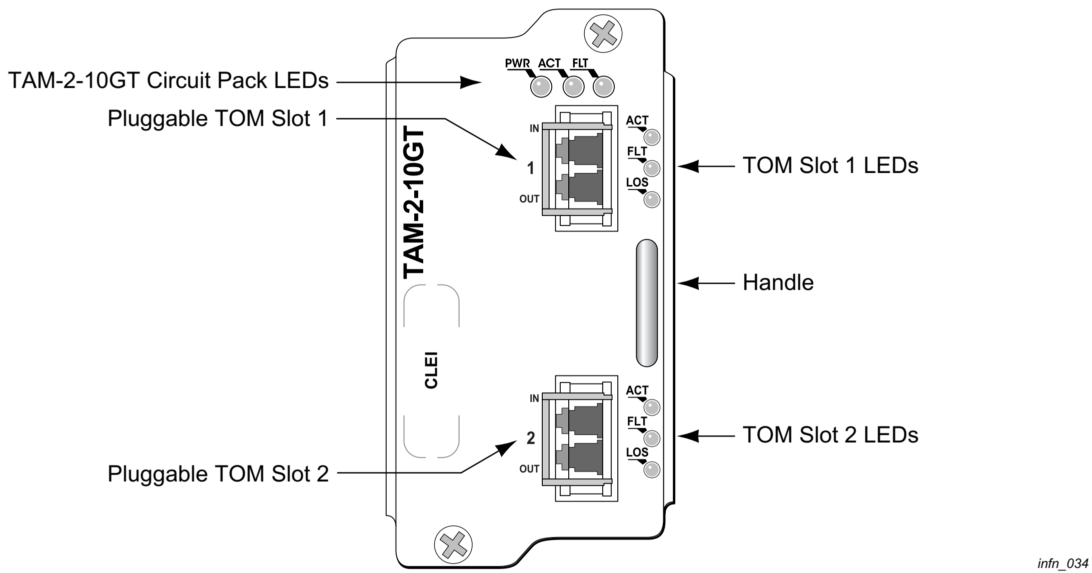
Figure 3-91 TAM-2-10GT Functional Block Diagram



External Indicators and Connectors

The TAM-2-10GT provides circuit pack status/TOM LED indicators and slots for pluggable TOM-10Gs as shown in Figure 3-92.

Figure 3-92 TAM-2-10GT Faceplate



Circuit Pack Level LEDs

The TAM-2-10GT provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-195.

Table 3-195 TAM-2-10GT Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-2-10GT
ACT (Active)	Green / Yellow	Indicates the TAM-2-10GT status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-2-10GT: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-2-10GT houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-196.

Table 3-196 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-197 provides the mechanical and electrical specifications for the TAM-2-10GT.

Table 3-197 TAM-2-10GT Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.4lb / 0.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-198 provides the tributary interface details for the TAM-2-10GT.

Table 3-198 TAM-2-10GT Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	10G DTF	Section layer DTF PMs
Capacity	Maximum capacity	20Gbps, max 2 TOM-10G-XXX per TAM-2-10GT

Tributary Adapter Module 10GM (TAM-2-10GM)

Functional Description

The Tributary Adapter Module 10GM, referred to as TAM-2-10GM, maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

The TAM-2-10GM supports a wide range of client interfaces (see below) on any available port with configurable service rates ranging from 8G to 11.1G providing digital wrapper transparency of client signals.

The TAM-2-10GM can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM and provides further sub-slots to enable the insertion of the following TOM types:

- “Tributary Optical Module 10G (TOM-10G-SR0)” on page 3-309
- “Tributary Optical Module 10G (TOM-10G-SR1)” on page 3-312
- “Tributary Optical Module 10G (TOM-10G-IR2)” on page 3-315
- “Tributary Optical Module 10G (TOM-10G-LR2)” on page 3-318
- “Tributary Optical Module 10G (TOM-10G-Dn-LR2)” on page 3-321
- “Tributary Optical Module 8G (TOM-8G-SM-LC-L)” on page 3-326

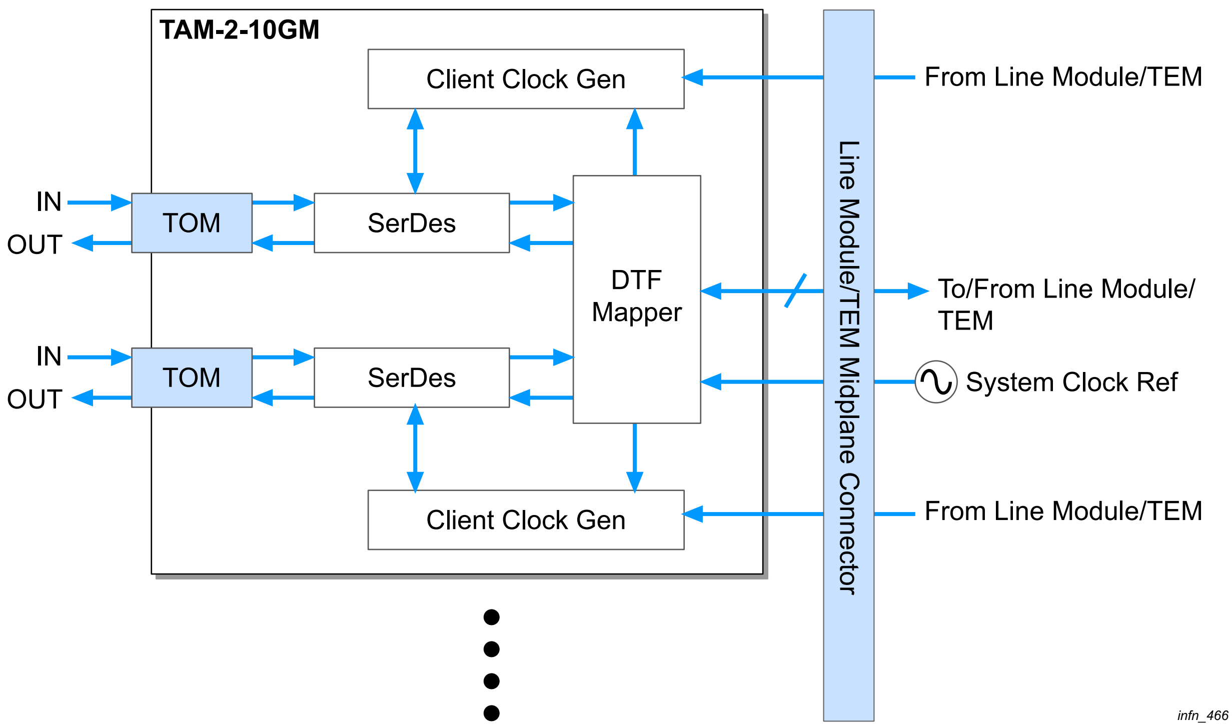
Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The TAM-2-10GM supports the following client interfaces:

- SONET OC-192
- SDH STM-64
- 10GbE LAN
- 10GbE WAN
- 10G Clear Channel
- 10.3G Clear Channel
- OTU1e
- OTU2
- OTU2e
- 10G Fibre Channel
- InfiniBand 10G Clear Channel

Block Diagram

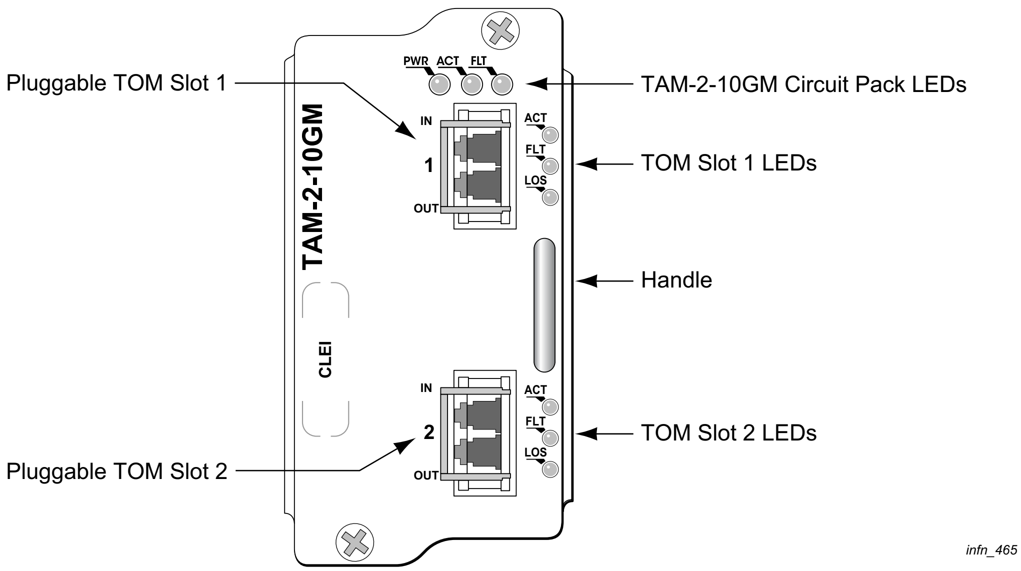
Figure 3-93 TAM-2-10GM Functional Block Diagram



External Indicators and Connectors

The TAM-2-10GM provides circuit pack status/TOM LED indicators and slots for pluggable TOM-10Gs as shown in Figure 3-94.

Figure 3-94 TAM-2-10GM Faceplate



Circuit Pack Level LEDs

The TAM-2-10GM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-199.

Table 3-199 TAM-2-10GM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-2-10GM
ACT (Active)	Green / Yellow	Indicates the TAM-2-10GM status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-2-10GM: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-2-10GM houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-200.

Table 3-200 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-201 provides the mechanical and electrical specifications for the TAM-2-10GM.

Table 3-201 TAM-2-10GM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.7lb / 0.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-202 provides the tributary interface details for the TAM-2-10GM.

Table 3-202 TAM-2-10GM Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-64	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	10GbE LAN PHY	Fully transparent mapping based on ITU G.Sup43 Clause 7.1 (OTU2e) and Clause 7.2 (OTU1e); Ethernet PM and Remote Monitoring (RMON) support
	10GbE WAN PHY	Fully transparent mapping based on ITU G.Sup43 Clause 7.1 (OTU2e) and Clause 7.2 (OTU1e); A1, A2, B1, and J0 monitoring, Section PM
	10G Clear Channel	Fully transparent
	10.3G Clear Channel	
	OTU1e	ODU/OTU OH monitoring, OTU2/OTU2e/OTU1e FEC terminated at ingress and regenerated at egress
	OTU2	
	OTU2e	
	10G Fibre Channel	Transparent recoding from 66B/64B to 130B/128B; Frame-aware PM
	InfiniBand 10G Clear Channel	Fully transparent
Capacity	Maximum capacity	20Gbps, max 2 TOM-10G-XXX per TAM-2-10GM

Tributary Adapter Module 2.5G (TAM-4-2.5G)

Functional Description

The Tributary Adapter Module 2.5G, referred to as TAM-4-2.5G, maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The TAM-4-2.5G can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM and provides further sub-slots to enable the insertion of the following TOM types:

- “Tributary Optical Module 2.5G (TOM-2.5G-SR1)” on page 3-329
- “Tributary Optical Module 2.5G (TOM-2.5G-IR1)” on page 3-332
- “Tributary Optical Module 2.5G (TOM-2.5G-IR2)” on page 3-335
- “Tributary Optical Module 2.5G (TOM-2.5G-LR2)” on page 3-339
- “Tributary Optical Module 2.5G (TOM-2.5GCn-LR2)” on page 3-343
- “Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)” on page 3-347
- “Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)” on page 3-351
- “Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)” on page 3-355
- “Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)” on page 3-359

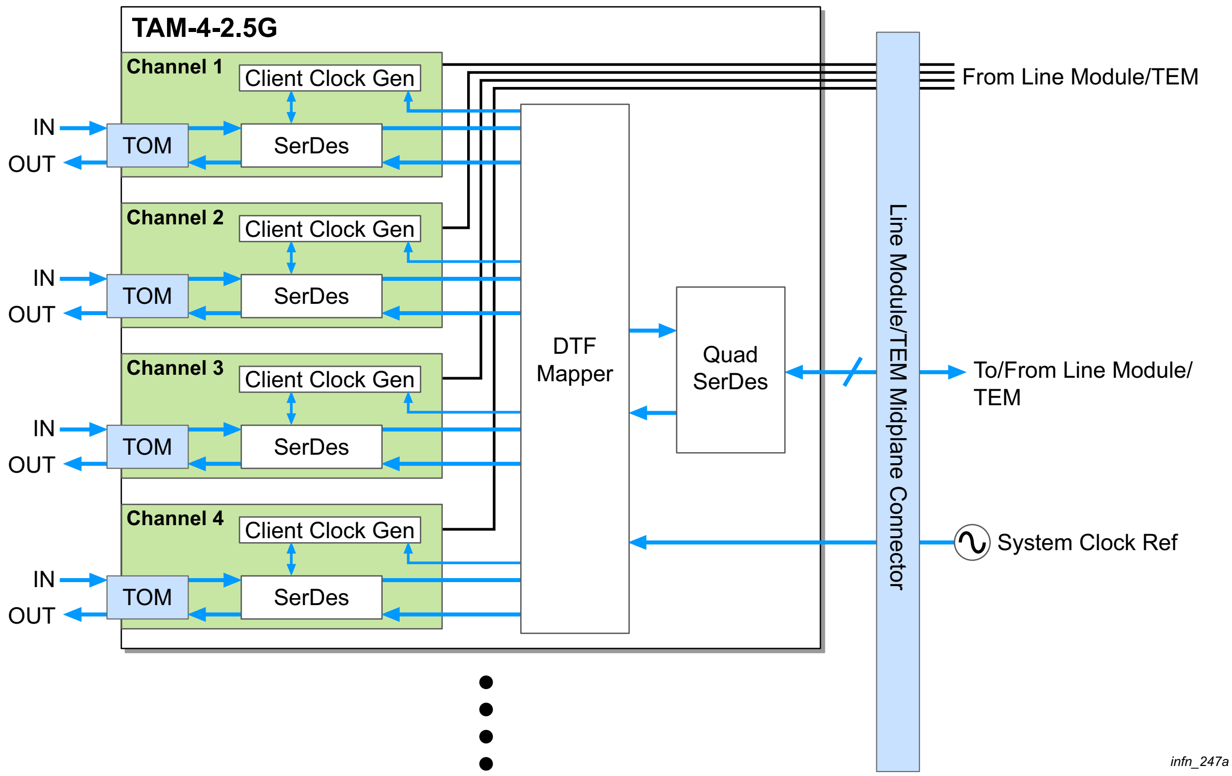
The TAM-4-2.5G supports the following client interfaces:

- SONET OC-48
- SONET OC-12
- SONET OC-3
- SDH STM-16
- SDH STM-4
- SDH STM-1
- 2.5G Clear Channel

Note: The TOM-2.5G-IR2 and TOM-2.5G-LR2 only support SONET OC-48, SDH STM-16, and 2.5G Clear Channel client interfaces when inserted into the TAM-4-2.5G.

Block Diagram

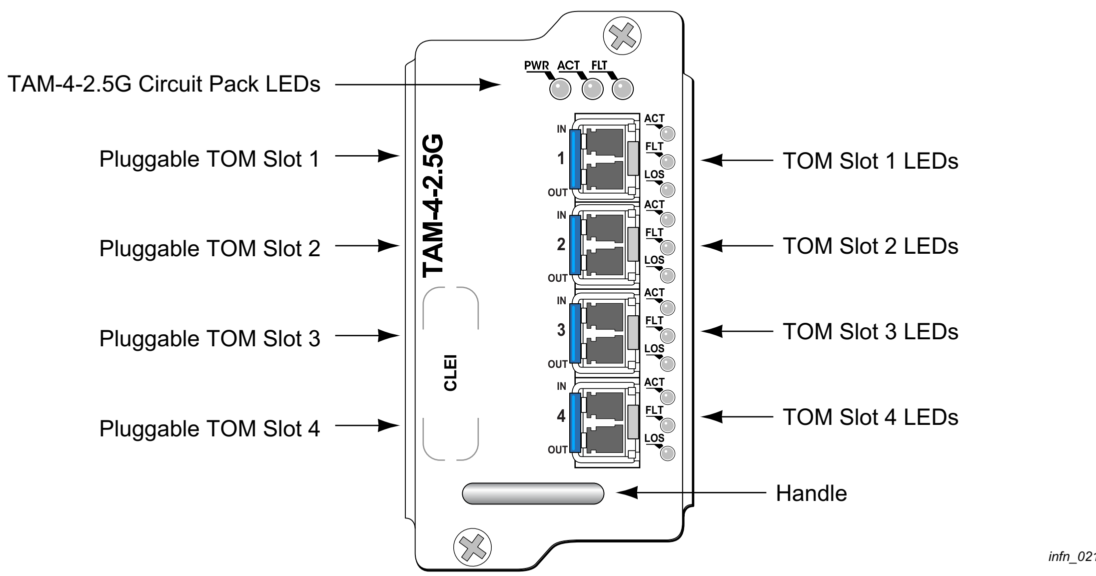
Figure 3-95 TAM-4-2.5G Functional Block Diagram



External Indicators and Connectors

The TAM-4-2.5G provides circuit pack status/TOM LED indicators and slots for pluggable TOM-2.5Gs as shown in Figure 3-96.

Figure 3-96 TAM-4-2.5G Faceplate



Circuit Pack Level LEDs

The TAM-4-2.5G provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-203.

Table 3-203 TAM-4-2.5G Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-4-2.5G
ACT (Active)	Green / Yellow	Indicates the TAM-4-2.5G status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-4-2.5G: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-4-2.5G houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-204.

Table 3-204 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-205 provides the mechanical and electrical specifications for the TAM-4-2.5G.

Table 3-205 TAM-4-2.5G Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.6lb / 0.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-206 provides the tributary interface specifications for the TAM-4-2.5G.

Table 3-206 TAM-4-2.5G Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SONET OC-12	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SONET OC-3	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-16	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	SDH STM-4	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	SDH STM-1	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	2.5G Clear Channel	Fully transparent
Capacity	Maximum capacity	10Gbps, max 4 TOM-2.5G-XXX per TAM-4-2.5G

Tributary Adapter Module 2.5GM (TAM-8-2.5GM)

Functional Description

The Tributary Adapter Module 2.5GM, referred to as TAM-8-2.5GM, maps the customer client optical signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the “line module” will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

Note: In the case of a DLM-n-C1-A, contact Infinera Technical Assistance Center (TAC) prior to installing a TAM-8-2.5GM.

Note: The TAM-8-2.5GM supports 4G Clear Channel and 8G Fibre Channel services via the TOM-8G-SM-LC-L on ports 1 and 5 only.

The TAM-8-2.5GM supports a wide range of client interfaces (see below) on any available port with configurable service rates ranging from 155M to 8G providing digital wrapper transparency of client signals.

The TAM-8-2.5GM can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM and provides further sub-slots to enable the insertion of the following TOM types:

- “Tributary Optical Module 8G (TOM-8G-SM-LC-L)” on page 3-326
- “Tributary Optical Module 2.5G (TOM-2.5G-SR1)” on page 3-329
- “Tributary Optical Module 2.5G (TOM-2.5G-IR1)” on page 3-332
- “Tributary Optical Module 2.5G (TOM-2.5G-IR2)” on page 3-335
- “Tributary Optical Module 2.5G (TOM-2.5G-LR2)” on page 3-339
- “Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)” on page 3-347
- “Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)” on page 3-351
- “Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)” on page 3-355
- “Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)” on page 3-359
- “Tributary Optical Module 1G (TOM-1G-SX)” on page 3-363
- “Tributary Optical Module 1G (TOM-1G-LX)” on page 3-366
- “Tributary Optical Module 1G (TOM-1G-ZX)” on page 3-369

Note: A maximum of four (4) video TOMs can be inserted in the TAM-8-2.5GM. The TOM slot(s) next to the video TOM must be left open to avoid mechanical interference. Mechanical interference can cause difficulties in inserting and removing the adjacent TOMs, which may result in damage to the TAM/TOMs.

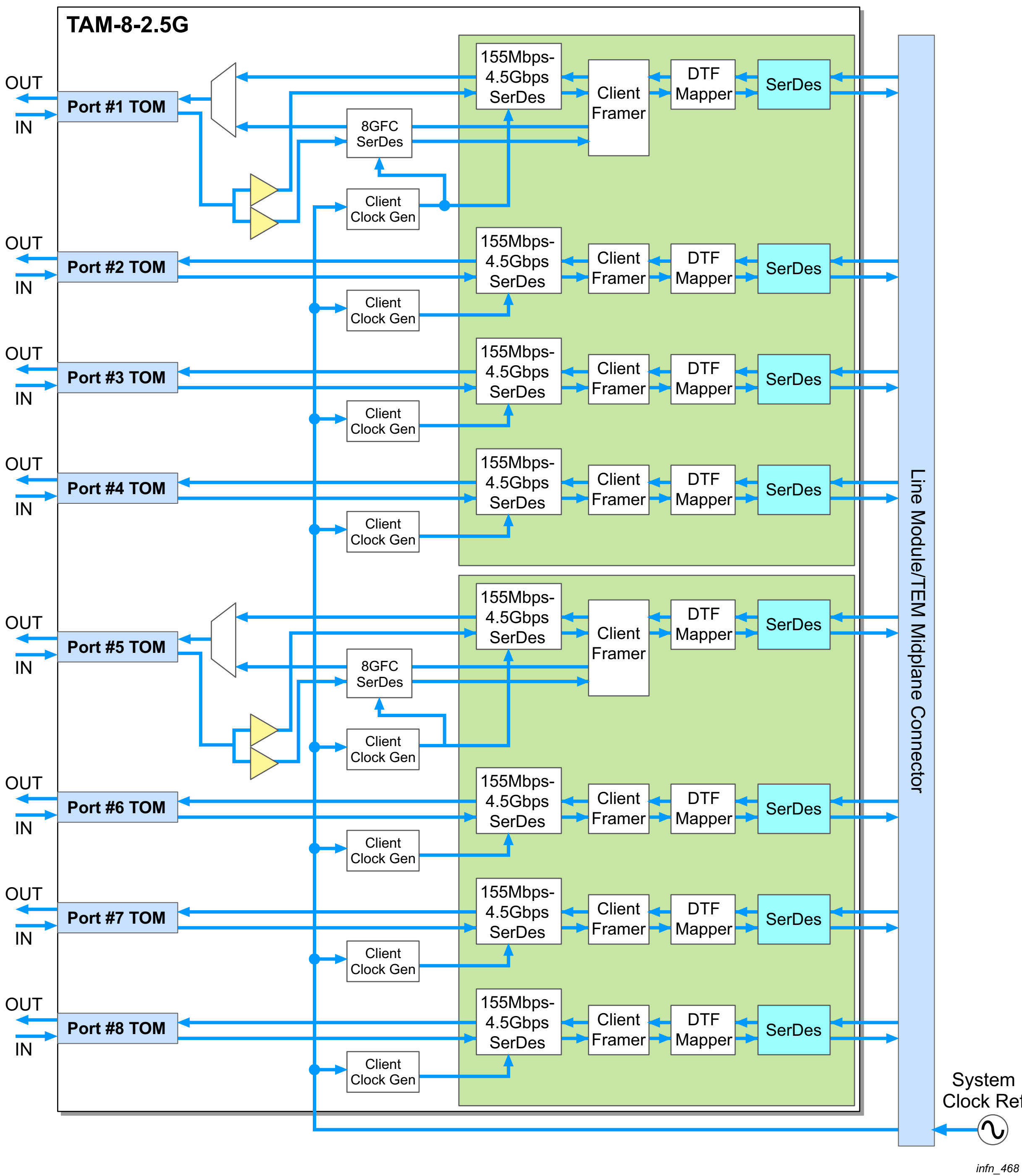
- "Tributary Optical Module HD-SDI (TOM-1.485HD-RX)" on page 3-372
- "Tributary Optical Module HD-SDI (TOM-1.485HD-TX)" on page 3-375
- "Tributary Optical Module HD-SDI (TOM-1.4835HD-RX)" on page 3-378
- "Tributary Optical Module HD-SDI (TOM-1.4835HD-TX)" on page 3-381

The TAM-8-2.5GM supports the following client interfaces:

- SONET OC-48
- SONET OC-12
- SONET OC-3
- SDH STM-16
- SDH STM-4
- SDH STM-1
- 2.5G Clear Channel
- 1.25G Clear Channel
- 1GbE
- OTU1
- 1G Fibre Channel
- 2G Fibre Channel
- 4G Fibre Channel (transported via 4G Clear Channel)
- 8G Fibre Channel
- Enterprise Systems Connection (ESCON) 200M Clear Channel
- InfiniBand 2.5G Clear Channel
- Video High Definition (HD) 1.485G
- Video High Definition (HD) 1.4835G
- Video Standard Definition (SD) 270M
- Digital Video Broadcasting (DVB) 270M
- Digital Video (DV) 6000

Block Diagram

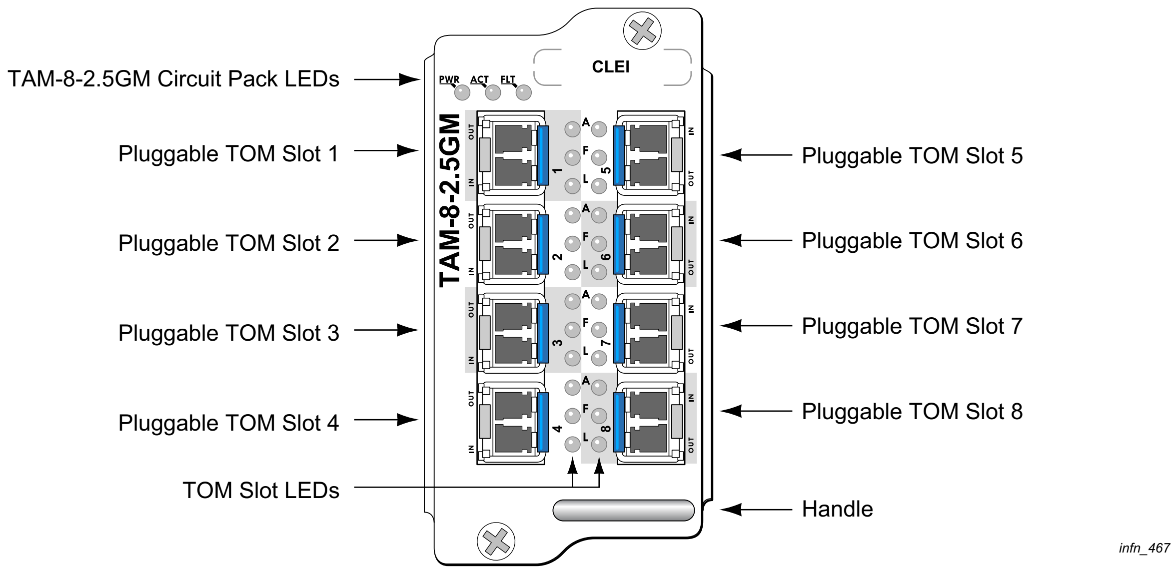
Figure 3-97 TAM-8-2.5GM Functional Block Diagram



External Indicators and Connectors

The TAM-8-2.5GM provides circuit pack status/TOM LED indicators and slots for pluggable TOM-2.5Gs as shown in Figure 3-98.

Figure 3-98 TAM-8-2.5GM Faceplate



Circuit Pack Level LEDs

The TAM-8-2.5GM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-207.

Table 3-207 TAM-8-2.5GM Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-8-2.5GM
ACT (Active)	Green / Yellow	Indicates the TAM-8-2.5GM status: Solid Green (Active, In-service), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-8-2.5GM: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-8-2.5GM houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-208.

Table 3-208 TOM Status Indicators

LED	Color	Description
ACT (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
LOS	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-209 provides the mechanical and electrical specifications for the TAM-8-2.5GM.

Table 3-209 TAM-8-2.5GM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.4lb / 0.6kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-210 provides the tributary interface specifications for the TAM-8-2.5GM.

Table 3-210 TAM-8-2.5GM Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SONET OC-12	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SONET OC-3	Fully transparent, A1, A2, B1, and J0 monitoring, Section PM
	SDH STM-16	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	SDH STM-4	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	SDH STM-1	Fully transparent, A1, A2, B1, and J0 monitoring, RS PM
	2.5G Clear Channel	Fully transparent
	1.25G Clear Channel	
	1GbE	Remote Monitoring (RMON) support
	OTU1	ODU/OTU OH monitoring; OTU1 FEC terminated
	1G Fibre Channel	Transparent mapping; Frame-aware PM **NOTE:** The TAM-8-2.5GM supports 4G Clear Channel and 8G Fibre Channel services via the TOM-8G-SM-LC-L on ports 1 and 5 only.
	2G Fibre Channel	
	4G Fibre Channel (transported via 4G Clear Channel)	
	8G Fibre Channel	
	ESCON 200M Clear Channel	Fully transparent
	InfiniBand 2.5G Clear Channel	
	Video HD1.485G	Transparent transport (both 1.485G and 1.4835G HD-SDI rates supported)
	Video HD1.4835G	
	Video SD270M	Fully transparent
	Video DVB270M	
	Video DV6000	
Capacity	Maximum capacity	20Gbps, max 8 TOM-2.5G-XXX per TAM-8-2.5GM

Tributary Adapter Module 1G (TAM-8-1G)

Functional Description

The Tributary Adapter Module 1G, referred to as TAM-8-1G, maps the customer client Ethernet signals into internal electrical signals for subsequent transmission through the line module and/or TEM.

Note: Unless specifically noted otherwise, all references to the "line module" will refer to either the DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the "LM-80" will refer to the ADLM-80, AXLM-80, and/or SLM-80 interchangeably.

The TAM-8-1G can be arbitrarily equipped in any of the sub-slots located on the line module and/or TEM. TAM-8-1Gs provide further sub-slots to enable the insertion of the following TOM types:

- "Tributary Optical Module 2.5G (TOM-2.5GCn-LR2)" on page 3-343
- "Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)" on page 3-347
- "Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)" on page 3-351
- "Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)" on page 3-355
- "Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)" on page 3-359
- "Tributary Optical Module 1G (TOM-1G-SX)" on page 3-363
- "Tributary Optical Module 1G (TOM-1G-LX)" on page 3-366
- "Tributary Optical Module 1G (TOM-1G-ZX)" on page 3-369

Note: Release 8.0 allows for the provisioning of the TOM types listed above however, the only service type supported on the Trib PTP is 1GbE which allows for the creation of a 1GbE client facility. The supported payload type is 1GbE LAN.

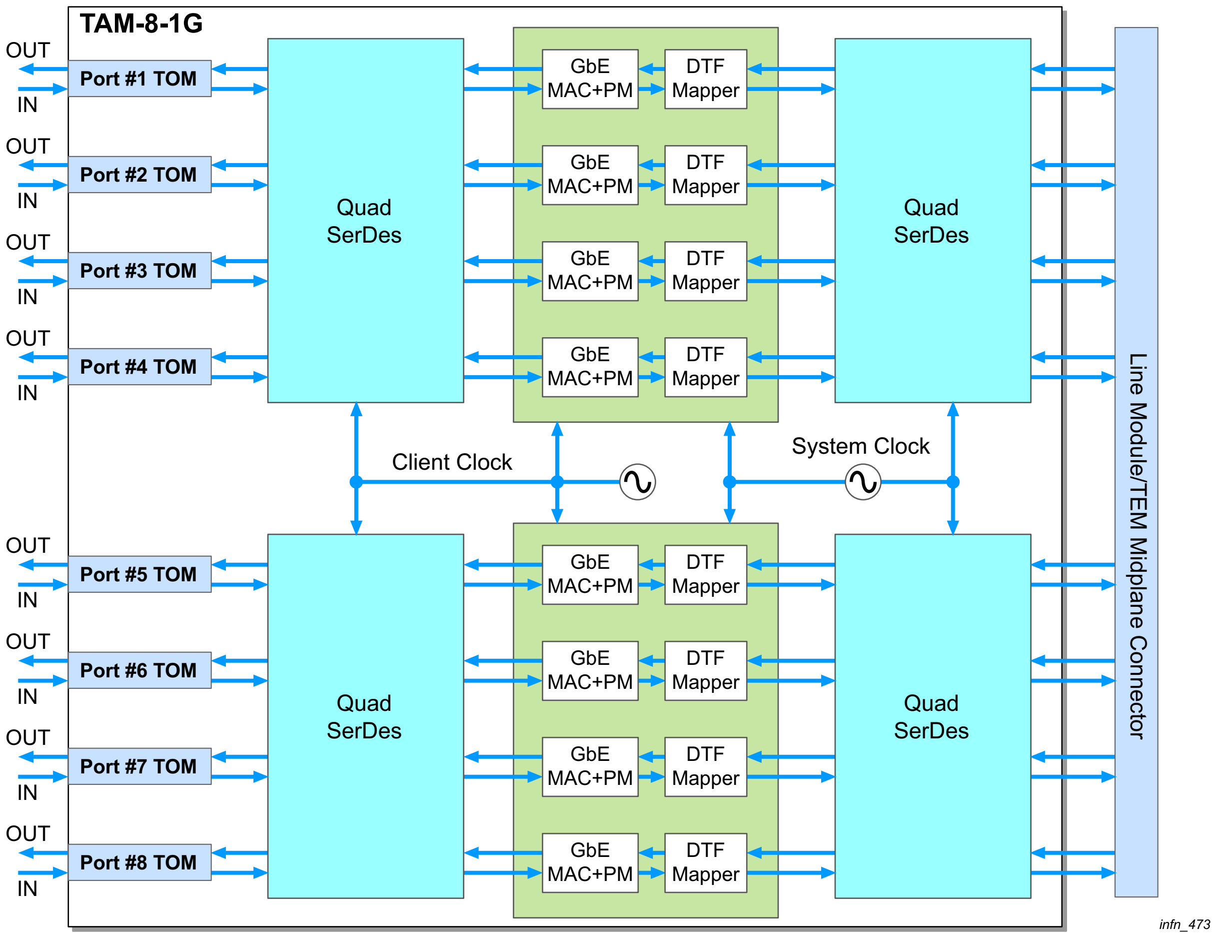
The physical ports on the TAM-8-1G are numbered 1a, 1b, 2a, 2b, 3a, 3b, 4a, and 4b. Traffic on each of these port pairs (for example, 1a and 1b) is mapped together into a single 2.5G digital path. This means that traffic on any port must be added and dropped in the same locations as the traffic on its pair (for example, the traffic on port 2a must originate and terminate in the same locations as the traffic on port 2b).

The TAM-8-1G supports the following client interface:

- 1GbE

Block Diagram

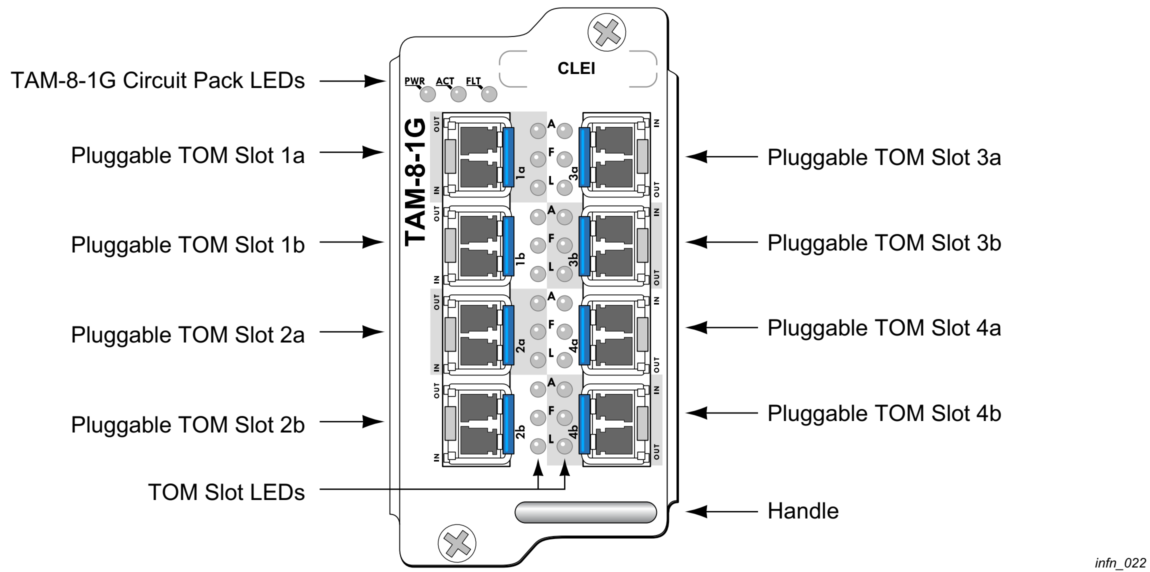
Figure 3-99 TAM-8-1G Functional Block Diagram



External Indicators and Connectors

The TAM-8-1G provides circuit pack status/TOM LED indicators and slots for pluggable TOMs as shown in Figure 3-100.

Figure 3-100 TAM-8-1G Faceplate



Circuit Pack Level LEDs

The TAM-8-1G provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 3-211.

Table 3-211 TAM-8-1G Status LED Indicators

LED	Color	Description
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the TAM-8-1G
ACT (Active)	Green / Yellow	Indicates the TAM-8-1G status: Solid Green (Active, In-service), flashing Yellow (In Maintenance), or dimmed (Locked state)
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the TAM-8-1G: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

TOM LEDs

In addition to TAM status indicators, the TAM-8-1G houses the port level LEDs in support of the TOMs: ACT (Active), FLT (Fault) and LOS, one set for each TOM. The significance of an illuminated LED is described in Table 3-212.

Table 3-212 TOM Status Indicators

LED	Color	Description
A (Active)	Green / Yellow	Indicates the TOM status: Solid Green (Active), Flashing Green (Bring-up mode), solid Yellow (Standby), flashing Yellow (In maintenance), or dimmed (Locked state)
F (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of a fault on the TOM
L (LOS)	Red	Indicates the status of the incoming signal on the TOM. During a Loss of Signal (LOS) condition, this indicator will be lit and dimmed when receiving a signal

Technical Specifications

Table 3-213 provides the mechanical and electrical specifications for the TAM-8-1G.

Table 3-213 TAM-8-1G Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.65 inches / 92.71mm
	Width	1.86 inches / 47.24mm
	Depth	10.82 inches / 274.83mm
	Weight	1.6lb / 0.7kg (approximately)
Electrical specifications	Power consumption	See Table 3-1 on page 3-4

Tributary Interface Specifications

Table 3-214 provides the tributary interface specifications for the TAM-8-1G.

Table 3-214 TAM-8-1G Tributary Interface Specifications

Type	Parameter	Specification
Tributary protocols	1GbE	Fully transparent, Ethernet PM and Remote Monitoring (RMON) support

Tributary Optical Module (TOM)

The TOM (shown in Figure 3-101 on page 3-286, Figure 3-102 on page 3-287, Figure 3-103 on page 3-288, and Figure 3-104 on page 3-288) is a field-replaceable, pluggable module that converts the client optical signals to and from a serial electrical signal. The TOM is hot-pluggable into any of the sub-slots in the corresponding TAMs, and is powered through the pluggable interface.

Table 3-215 lists the name and a brief description of each of the supported TOMs.

Table 3-215 TOM Product Details

Product Ordering Name (PON)	Description
TOM-100G-SR10	Tributary Optical Module 100G Short Reach
TOM-100G-S10X	Tributary Optical Module 100G Short Reach
TOM-100G-LR4	Tributary Optical Module 100G Long Reach
TOM-100G-L10X	Tributary Optical Module 100G Long Reach
TOM-40G-SR4	Tributary Optical Module 40G Short Reach
TOM-40G-LR4	Tributary Optical Module 40G Long Reach
TOM-40G-VSR	Tributary Optical Module 40G Very Short Reach (built-in, non-replaceable, 40 Gigabit optical transceiver that is integrated into the TAM-1-40G-VSR)
TOM-10G-SR0	Tributary Optical Module 10G Short Reach
TOM-10G-SR1-A	Tributary Optical Module 10G Short Reach
TOM-10G-IR2-A	Tributary Optical Module 10G Intermediate Reach
TOM-10G-LR2	Tributary Optical Module 10G Long Reach
TOM-10G-Dn-LR2[a]	Tributary Optical Module 10G Dense Wavelength Division Multiplexing (DWDM) Long Reach
TOM-8G-SM-LC-L	Tributary Optical Module 8G Single Mode, Long Wavelength Laser, Long Distance
TOM-2.5G-SR1-A	Tributary Optical Module 2.5G Short Reach
TOM-2.5G-IR1-A[b]	Tributary Optical Module 2.5G Intermediate Reach
TOM-2.5G-IR2	Tributary Optical Module 2.5G Intermediate Reach
TOM-2.5G-LR2	Tributary Optical Module 2.5G Long Reach
TOM-2.5GCn-LR2[c]	Tributary Optical Module 2.5G Multi-rate Coarse Wavelength Division Multiplexing (CWDM) Long Reach
TOM-2.5GMR-SR1	Tributary Optical Module 2.5G Multi-rate Short Reach
TOM-2.5GMR-IR1	Tributary Optical Module 2.5G Multi-rate Intermediate Reach
TOM-MR-Dn-LR2[a]	Tributary Optical Module 2.5G Multi-rate Long Reach
TOM-MR-Cn-LR2[c]	Tributary Optical Module 2.5G Multi-rate Coarse Wavelength Division Multiplexing (CWDM) Long Reach
TOM-1G-SX-A	Tributary Optical Module 1GbE Short Wavelength
TOM-1G-LX-A	Tributary Optical Module 1GbE Long Wavelength

Table 3-215 TOM Product Details

Product Ordering Name (PON)	Description
TOM-1G-ZX	Tributary Optical Module 1GbE Extended Distance
TOM-1.485HD-RX	Tributary Optical Module High-definition Serial Digital Interface (HD-SDI) 1.485G Receive
TOM-1.485HD-TX	Tributary Optical Module High-definition Serial Digital Interface (HD-SDI) 1.485G Transmit
TOM-1.4835HD-RX	Tributary Optical Module High-definition Serial Digital Interface (HD-SDI) 1.4835G Receive
TOM-1.4835HD-TX	Tributary Optical Module High-definition Serial Digital Interface (HD-SDI) 1.4835G Transmit

a. Value (n=18-37,40-59) corresponds to specific wavelengths.
b. TOM-2.5G-IR1-A is generally no longer available but is still supported (replacement TOM is: TOM-2.5GMR-IR1).
c. Value (n=47,49,51,53,55,57,59,61) corresponds to specific wavelengths.

Figure 3-101 100GbE Optical TOM

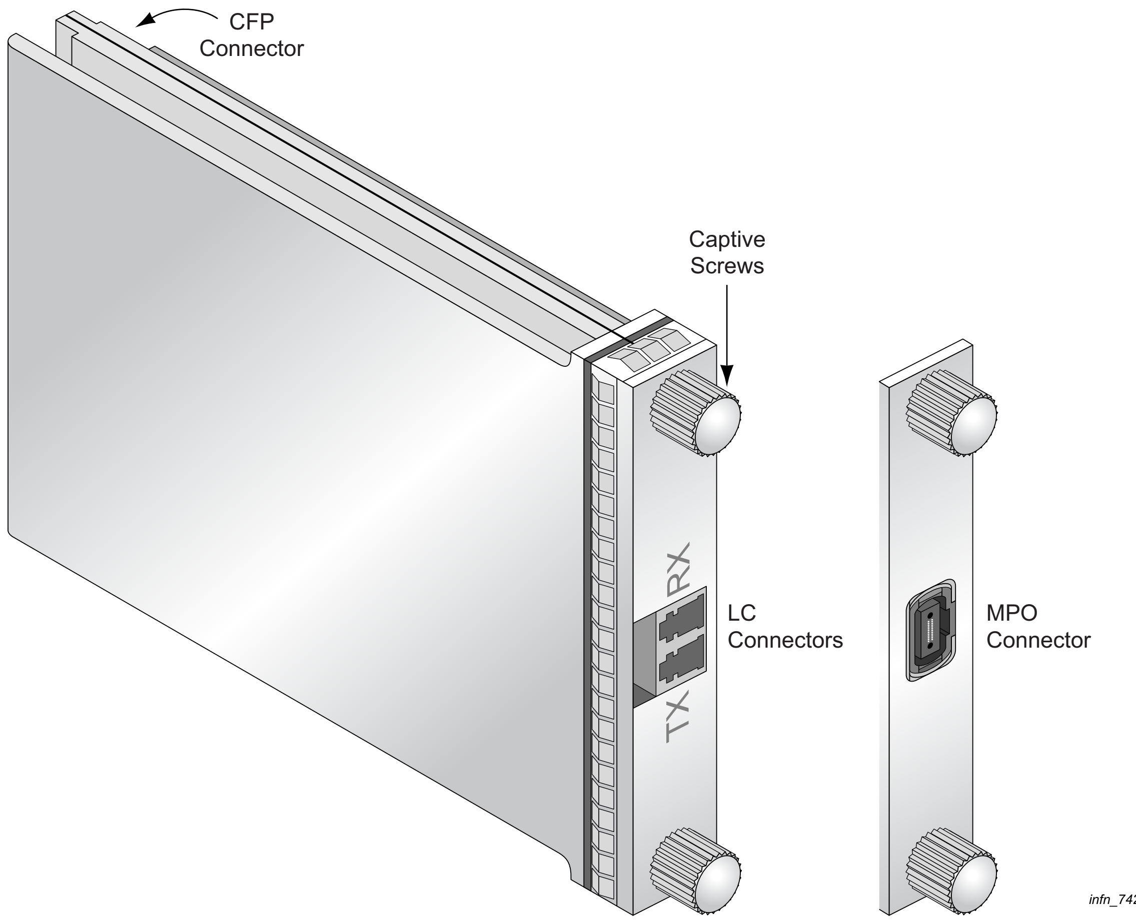


Figure 3-102 40GbE Optical TOM

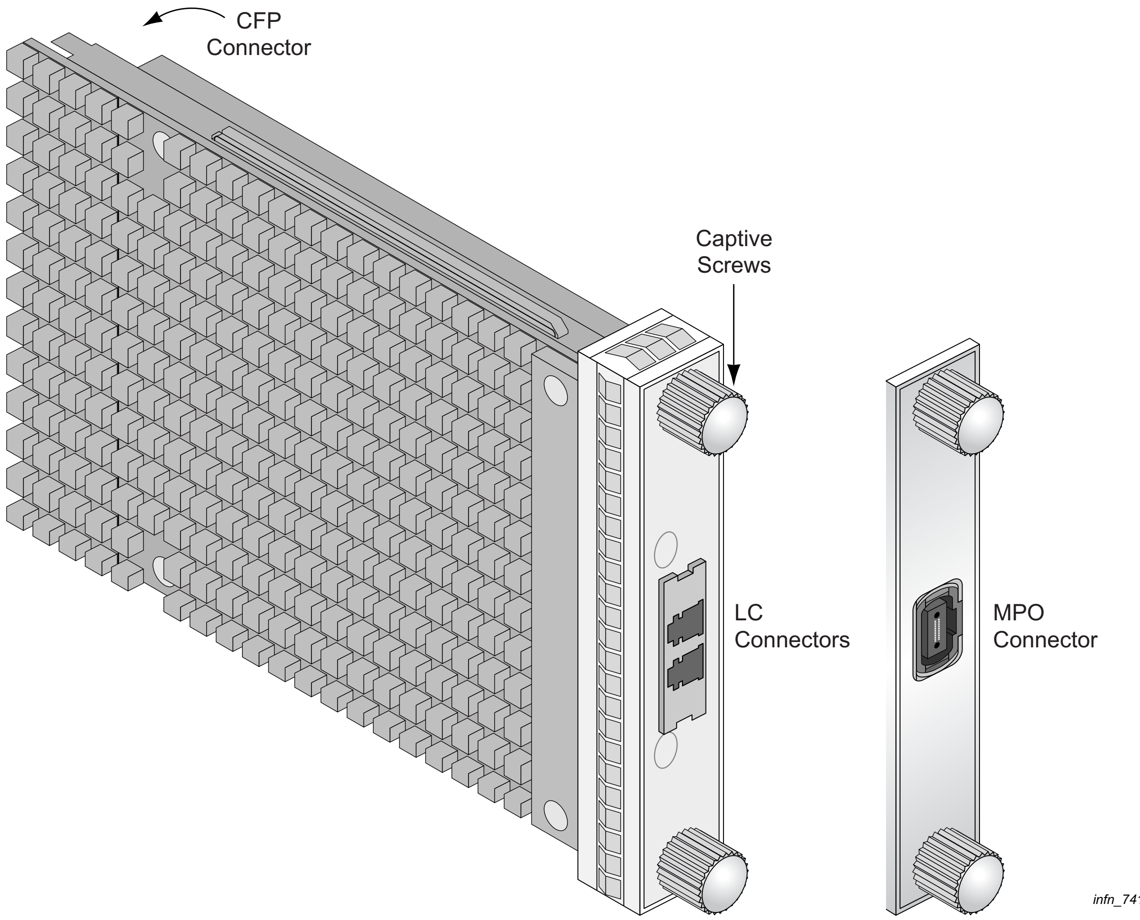


Figure 3-103 1GbE/2.5G/8G/10G Optical TOM

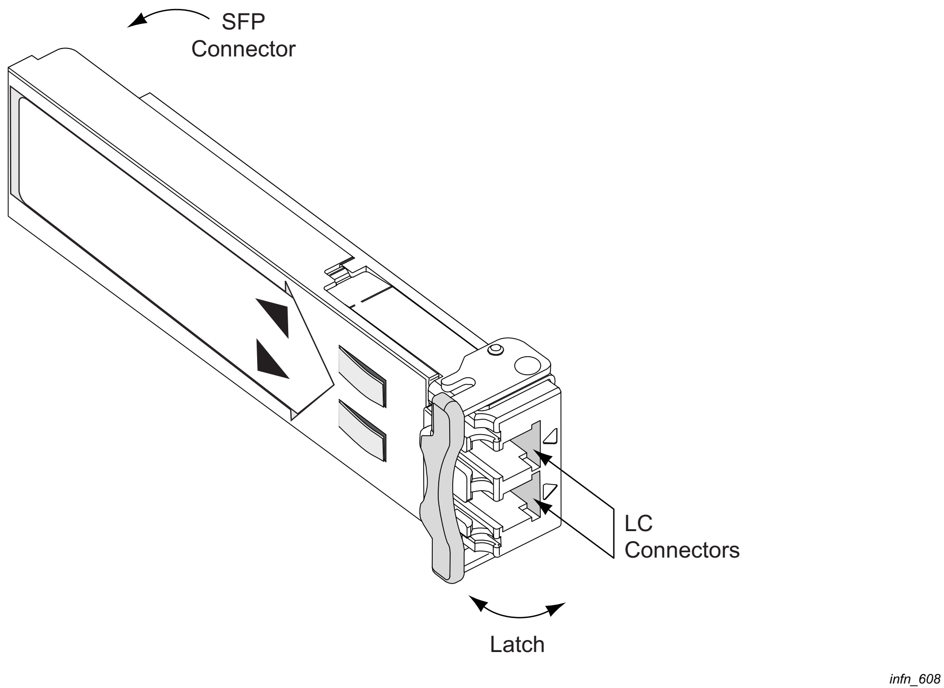
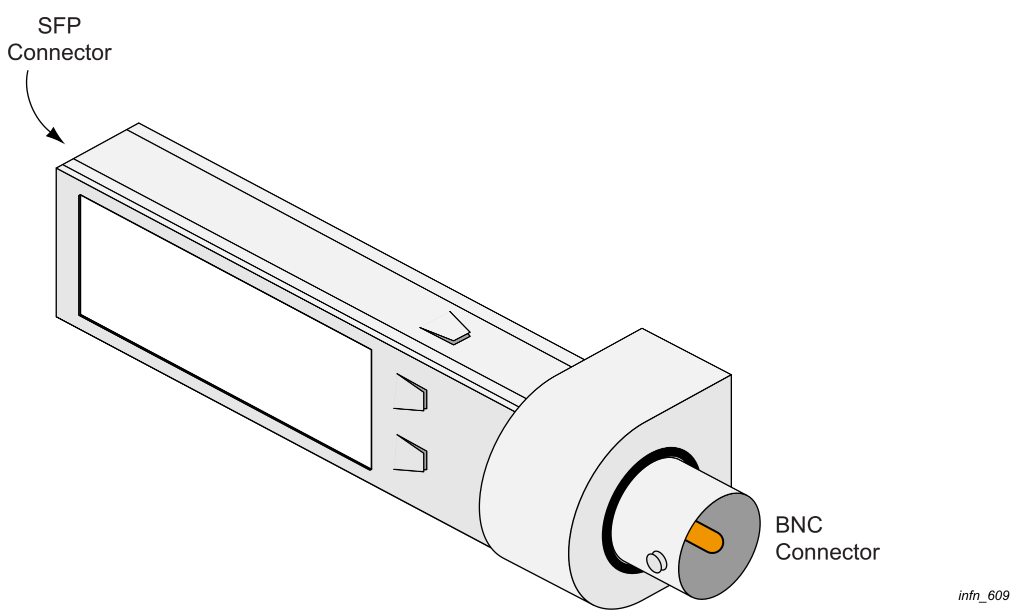


Figure 3-104 Video TOM



Tributary Optical Module 100G (TOM-100G-SR10)

Table 3-216 TOM-100G-SR10 Product Features

Product Ordering Name (PON)	Features
TOM-100G-SR10	100G Tributary Optical Module Reach: • 100GbE: IEEE 802.3ba 100GBase-SR10

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-SR10, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-SR10s are hot-pluggable into the sub-slot in the TIM (TIM-1-100GE) and are powered through the pluggable interface.

The TOM-100G-SR10 supports 100GbE client signals and the optical interface complies with IEEE 802.3ba 100GBase-SR10.

TOM-100G-SR10 port status LEDs are located on the TAM as shown in Figure 3-78 on page 3-227.

Connectors

The TOM-100G-SR10 provides the optical interfaces to the client equipment through the ports as described in Table 3-217.

Table 3-217 TOM-100G-SR10 Connectors

Connector	Type	Purpose
Trib port IN	Single MTP®/MPO	Connects from the client equipment
Trib port OUT		Connects to the client equipment

Note: The TOM-100G-SR10 does not support a Y-cable protection configuration.

Technical Specifications

Table 3-218 lists the mechanical and electrical specifications for the TOM-100G-SR10.

Table 3-218 TOM-100G-SR10 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-219.

Table 3-219 TOM-100G-SR10 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Receiver sensitivity (OMA)	-5.4dBm
Receiver maximum power (per lane)	+2.4dBm
Receiver minimum power (per lane)	-9.5dBm
Receiver wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 3-220.

Table 3-220 TOM-100G-SR10 Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Transmitter output power (per lane)	-8.0dBm to +2.4dBm
Transmitter wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 3-221.

Table 3-221 TOM-100G-SR10 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-S10X)

Table 3-222 TOM-100G-S10X Product Features

Product Ordering Name (PON)	Features
TOM-100G-S10X	100G Tributary Optical Module Reach: • 100G CFP 10x10 MSA

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-S10X, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-S10Xs are hot-pluggable into the sub-slot in the TAM (TAM-1-100GE and/or TAM-1-100GR) and are powered through the pluggable interface.

The TOM-100G-S10X supports 100GbE client signals and the optical interface complies with 100G CFP 10x10 MSA.

TOM-100G-S10X port status LEDs are located on the TAM as shown in Figure 3-78 on page 3-227.

Connectors

The TOM-100G-S10X provides the optical interfaces to the client equipment through the ports as described in Table 3-223.

Table 3-223 TOM-100G-S10X Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-224 lists the mechanical and electrical specifications for the TOM-100G-S10X.

Table 3-224 TOM-100G-S10X Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-225.

Table 3-225 TOM-100G-S10X Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-6.3dBm
Receiver maximum power (per lane)	+3.0dBm
Receiver minimum power (per lane)	-9.5dBm
Receiver wavelength	1550nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 3-226.

Table 3-226 TOM-100G-S10X Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Transmitter output power (total)	+4.9dBm to +13.0dBm
Receiver lane center wavelengths (L1, L2, L3, L4, L5, L6, L7, L8, L9, and L10)	L1: 1521nm to 1525nm
	L2: 1529nm to 1533nm
	L3: 1537nm to 1541nm
	L4: 1545nm to 1549nm
	L5: 1553nm to 1557nm
	L6: 1561nm to 1565nm
	L7: 1569nm to 1573nm
	L8: 1577nm to 1581nm
	L9: 1585nm to 1589nm
	L10: 1593nm to 1597nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 3-227.

Table 3-227 TOM-100G-S10X Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-LR4)

Table 3-228 TOM-100G-LR4 Product Features

Product Ordering Name (PON)	Features
TOM-100G-LR4	100G Tributary Optical Module Reach: • 100GbE: IEEE 802.3ba 100GBase-LR4

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-LR4, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-LR4s are hot-pluggable into the sub-slot in the TAM (TAM-1-100GE and/or TAM-1-100GR) and are powered through the pluggable interface.

The TOM-100G-LR4 supports 100GbE client signals and the optical interface complies with IEEE 802.3ba 100GBase-LR4.

TOM-100G-LR4 port status LEDs are located on the TAM as shown in Figure 3-78 on page 3-227.

Connectors

The TOM-100G-LR4 provides the optical interfaces to the client equipment through the ports as described in Table 3-229.

Table 3-229 TOM-100G-LR4 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-230 lists the mechanical and electrical specifications for the TOM-100G-LR4.

Table 3-230 TOM-100G-LR4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-231.

Table 3-231 TOM-100G-LR4 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-8.6dBm
Receiver maximum power (per lane)	+4.5dBm
Receiver minimum power (per lane)	-10.6dBm
Receiver wavelength	1310nm
Data rate (per lane)	25.78125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 3-232.

Table 3-232 TOM-100G-LR4 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power (total)	+2.3dBm to +10.5dBm
Transmitter wavelength	1310nm
Transmitter lane center wavelengths (L1, L2, L3, and L4)	L1: 1294.53nm to 1296.59nm
	L2: 1299.02nm to 1301.09nm
	L3: 1303.54nm to 1305.63nm
	L4: 1308.09nm to 1310.19nm
Data rate (per lane)	25.78125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 3-233.

Table 3-233 TOM-100G-LR4 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 100G (TOM-100G-L10X)

Table 3-234 TOM-100G-L10X Product Features

Product Ordering Name (PON)	Features
TOM-100G-L10X	100G Tributary Optical Module Reach: • 100G CFP 10x10 MSA

Functional Description

The Tributary Optical Module 100G, referred to as TOM-100G-L10X, is a field-replaceable 100G CFP module. It converts client optical signals to and from serial electrical signals. TOM-100G-L10Xs are hot-pluggable into the sub-slot in the TAM (TAM-1-100GE and/or TAM-1-100GR) and are powered through the pluggable interface.

The TOM-100G-L10X supports 100GbE client signals and the optical interface complies with 100G CFP 10x10 MSA.

TOM-100G-L10X port status LEDs are located on the TAM as shown in Figure 3-78 on page 3-227.

Connectors

The TOM-100G-L10X provides the optical interfaces to the client equipment through the ports as described in Table 3-235.

Table 3-235 TOM-100G-L10X Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-236 lists the mechanical and electrical specifications for the TOM-100G-L10X.

Table 3-236 TOM-100G-L10X Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-237.

Table 3-237 TOM-100G-L10X Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-6.9dBm
Receiver maximum power (per lane)	+3.0dBm
Receiver minimum power (per lane)	-10.8dBm
Receiver wavelength	1550nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

The optical specifications for tributary port OUT are listed in Table 3-238.

Table 3-238 TOM-100G-L10X Tributary Port OUT Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Transmitter output power (total)	+5.8dBm to +13.0dBm
Transmitter lane center wavelengths (L1, L2, L3, L4, L5, L6, L7, L8, L9, and L10)	L1: 1520nm to 1526nm
	L2: 1528nm to 1534nm
	L3: 1536nm to 1542nm
	L4: 1544nm to 1550nm
	L5: 1552nm to 1558nm
	L6: 1560nm to 1566nm
	L7: 1568nm to 1574nm
	L8: 1576nm to 1582nm
	L9: 1584nm to 1590nm
	L10: 1592nm to 1598nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	103.125Gbps

Interface Specifications

The tributary interface details are listed in Table 3-239.

Table 3-239 TOM-100G-L10X Tributary Facilities

Type	Parameter	Specification
Tributary protocols	100GbE	Fully transparent

Tributary Optical Module 40G (TOM-40G-SR4)

Table 3-240 TOM-40G-SR4 Product Features

Product Ordering Name (PON)	Features
TOM-40G-SR4	40G Tributary Optical Module Reach: • 40GbE: IEEE 802.3ba 40GBase-SR4

Functional Description

The Tributary Optical Module 40G, referred to as TOM-40G-SR4, is a field-replaceable 40G CFP module. It converts client optical signals to and from serial electrical signals. TOM-40G-SR4s are hot-pluggable into the sub-slot in the TAM (TAM-1-40GE and/or TAM-1-40GR) and are powered through the pluggable interface.

The TOM-40G-SR4 supports 40GbE client signals and the optical interface complies with IEEE 802.3ba 40GBase-SR4.

TOM-40G-SR4 port status LEDs are located on the TAM as shown in Figure 3-82 on page 3-237.

Connectors

The TOM-40G-SR4 provides the optical interfaces to the client equipment through the ports as described in Table 3-241.

Table 3-241 TOM-40G-SR4 Connectors

Connector	Type	Purpose
Trib port IN	Single MTP®/MPO	Connects from the client equipment
Trib port OUT		Connects to the client equipment

Technical Specifications

Table 3-242 lists the mechanical and electrical specifications for the TOM-40G-SR4.

Table 3-242 TOM-40G-SR4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-243.

Table 3-243 TOM-40G-SR4 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Receiver sensitivity (OMA)	-5.4dBm
Receiver maximum power (per lane)	+2.4dBm
Receiver minimum power (per lane)	-9.5dBm
Receiver wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	41.25Gbps

The optical specifications for tributary port OUT are listed in Table 3-244.

Table 3-244 TOM-40G-SR4 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Multi-mode
Transmitter output power (per lane)	-8.0dBm to +2.4dBm
Transmitter wavelength	840nm to 860nm
Data rate (per lane)	10.3125Gbps
Aggregate data rate	41.25Gbps

Interface Specifications

The tributary interface details are listed in Table 3-245.

Table 3-245 TOM-40G-SR4 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	40GbE	Fully transparent

Tributary Optical Module 40G (TOM-40G-LR4)

Table 3-246 TOM-40G-LR4 Product Features

Product Ordering Name (PON)	Features
TOM-40G-LR4	40G Tributary Optical Module Reach: • 40GbE: IEEE 802.3ba 40GBase-LR4

Functional Description

The Tributary Optical Module 40G, referred to as TOM-40G-LR4, is a field-replaceable 40G CFP module. It converts client optical signals to and from serial electrical signals. TOM-40G-LR4s are hot-pluggable into the sub-slot in the TAM (TAM-1-40GE and/or TAM-1-40GR) and are powered through the pluggable interface.

The TOM-40G-LR4 supports 40GbE client signals and the optical interface complies with IEEE 802.3ba 40GBase-LR4.

TOM-40G-LR4 port status LEDs are located on the TAM as shown in Figure 3-82 on page 3-237.

Connectors

The TOM-40G-LR4 provides the optical interfaces to the client equipment through the ports as described in Table 3-247.

Table 3-247 TOM-40G-LR4 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-248 lists the mechanical and electrical specifications for the TOM-40G-LR4.

Table 3-248 TOM-40G-LR4 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	3.23 inches / 82.00mm
	Width	0.55 inches / 14.00mm
	Depth	5.70 inches / 144.75mm
	Weight	0.7lb / 0.35kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-249.

Table 3-249 TOM-40G-LR4 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity (OMA)	-11.5dBm
Receiver maximum power (per lane)	+2.3dBm
Receiver minimum power (per lane)	-13.7dBm
Receiver wavelength	1310nm
Data rate (per lane)	10.30125Gbps
Aggregate data rate	41.25Gbps

The optical specifications for tributary port OUT are listed in Table 3-250.

Table 3-250 TOM-40G-LR4 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power (total)	-1.0dBm to +8.3dBm
Transmitter wavelength	1310nm
Receiver lane center wavelengths (L1, L2, L3, and L4)	L1: 1264.50nm to 1277.50nm
	L2: 1284.50nm to 1297.50nm
	L3: 1304.50nm to 1317.50nm
	L4: 1324.50nm to 1337.50nm
Data rate (per lane)	10.30125Gbps
Aggregate data rate	41.25Gbps

Interface Specifications

The tributary interface details are listed in Table 3-251.

Table 3-251 TOM-40G-LR4 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	40GbE	Fully transparent

Tributary Optical Module 40G (TOM-40G-VSR)

Table 3-252 TOM-40G-VSR Product Features

Product Ordering Name (PON)	Features
TOM-40G-VSR	40G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-768 SR-2 • ITU-T G.693 VSR2000-3R2/3R3/3R5

Functional Description

The Tributary Optical Module 40G, referred to as TOM-40G-VSR, is an integrated component of the TAM-1-40G-VSR module and thus not a pluggable TOM. It converts client optical signals to and from serial electrical signals.

TOM-40G-VSR supports OC-768 and STM-256 client signals. The optical interface complies with Telcordia GR-253-CORE OC-768 SR-2 for the OC-768 client signal and ITU-T G.693 VSR2000-3R2/3R3/3R5 for the STM-256 client signal.

TOM-40G-VSR port status LEDs are located on the TAM-1-40G-VSR as shown in Figure 3-86 on page 3-247.

Connectors

The TOM-40G-VSR provides the optical interfaces to the client equipment through the ports as listed in Table 3-253.

Table 3-253 TOM-40G-VSR Connectors

Connector	Type	Purpose
Trib port IN	SC	Connects from the client equipment
Trib port OUT	SC	Connects to the client equipment

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-254.

Table 3-254 TOM-40G-VSR Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-6.0dBm
Receiver overload	+3.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	39.81312Gbps

The optical specifications for tributary port OUT are listed in Table 3-255.

Table 3-255 TOM-40G-VSR Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	0.0dBm to +3.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	39.81312Gbps

Interface Specifications

The tributary interface details are listed in Table 3-256.

Table 3-256 TOM-40G-VSR Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-768	Fully transparent
	SDH STM-256	Fully transparent

Tributary Optical Module 10G (TOM-10G-SR0)

Table 3-257 TOM-10G-SR0 Product Features

Product Ordering Name (PON)	Features
TOM-10G-SR0	10G Tributary Optical Module Reach: • 10GbE LAN: IEEE 802.3ae 10GBase-SR • 10GbE WAN: IEEE 802.3ae 10GBase-SW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-SR0, is a field-replaceable 10G Small Form Factor Pluggable (XFP) module. It converts client optical signals to and from serial electrical signals. TOM-10G-SR0s are hot-pluggable into any of the two sub-slots in the TAM (TAM-2-10G, TAM-2-10GR, and/or TAM-2-10GM) and are powered through the pluggable interface.

TOM-10G-SR0 supports 10GbE LAN, 10GbE WAN, 10G Clear Channel, 10.3G Clear Channel, and/or 10G Fibre Channel client signals. The optical interface complies with IEEE 802.3ae 10GBase-SR for the 10GbE LAN client signal and IEEE 802.3ae 10GBase-SW for the 10GbE WAN client signal.

TOM-10G-SR0 port status LEDs are located on the TAM as shown in Figure 3-88 on page 3-252.

Connectors

The TOM-10G-SR0 provides the optical interfaces to the client equipment through the ports as described in Table 3-258.

Table 3-258 TOM-10G-SR0 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-259 lists the mechanical and electrical specifications for the TOM-10G-SR0.

Table 3-259 TOM-10G-SR0 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-260.

Table 3-260 TOM-10G-SR0 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Receiver sensitivity	-9.9dBm
Receiver overload	-1.0dBm
Receiver wavelength	840nm to 860nm
Data rate	9.95328Gbps to 10.3125Gbps

The optical specifications for tributary port OUT are listed in Table 3-261.

Table 3-261 TOM-10G-SR0 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Multi-mode
Transmitter output power	-7.3dBm to -1.0dBm
Transmitter wavelength	840nm to 860nm
Data rate	9.95328Gbps to 10.3125Gbps

Interface Specifications

The tributary interface details are listed in Table 3-262.

Table 3-262 TOM-10G-SR0 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	10GbE LAN PHY	Fully transparent
	10GbE WAN PHY	
	10G Clear Channel	
	10.3G Clear Channel	
	10G Fibre Channel	

Tributary Optical Module 10G (TOM-10G-SR1)

Table 3-263 TOM-10G-SR1 Product Features

Product Ordering Name (PON)	Features
TOM-10G-SR1-A	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 SR-1 • ITU-T G.693 VSR2000-2R1 • 10GbE LAN: IEEE 802.3ae 10GBase-LR • 10GbE WAN: IEEE 802.3ae 10GBase-LW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-SR1, is a field-replaceable 10G Small Form Factor Pluggable (XFP) module. It converts client optical signals to and from serial electrical signals. TOM-10G-SR1s are hot-pluggable into any of the two sub-slots in the TAM (TAM-2-10G, TAM-2-10GR, TAM-2-10GT, and/or TAM-2-10GM) and are powered through the pluggable interface.

TOM-10G-SR1 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, 10G DTF, 10G Fibre Channel, OTU1e, OTU2, and/or OTU2e client signals. The optical interface complies with Telcordia GR-253-CORE OC-192 SR-1 for the OC-192 client signal, ITU-T G.693 VSR2000-2R1 for the STM-64 client signal, IEEE 802.3ae 10GBase-LR for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-LW for the 10GbE WAN client signal.

Note: The 10G DTF is only supported when the TOM is inserted in the TAM-2-10GT. For more information, see “Tributary Adapter Module 10GT (TAM-2-10GT)” on page 3-260.

TOM-10G-SR1 port status LEDs are located on the TAM as shown in Figure 3-88 on page 3-252.

Connectors

The TOM-10G-SR1 provides the optical interfaces to the client equipment through the ports as shown in Table 3-264.

Table 3-264 TOM-10G-SR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-265 lists the mechanical and electrical specifications for the TOM-10G-SR1.

Table 3-265 TOM-10G-SR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-266.

Table 3-266 TOM-10G-SR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-11.0dBm
Receiver overload	-1.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 3-267.

Table 3-267 TOM-10G-SR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-6.0dBm to -1.0dBm
Transmitter wavelength	1290nm to 1330nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 3-268.

Table 3-268 TOM-10G-SR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	10G DTF	
	10G Fibre Channel	
	OTU1e	
	OTU2	
	OTU2e	

Tributary Optical Module 10G (TOM-10G-IR2)

Table 3-269 TOM-10G-IR2 Product Features

Product Ordering Name (PON)	Features
TOM-10G-IR2-A	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 IR-2 • ITU-T G.959.1 P1S1-2D2b • 10GbE LAN: IEEE 802.3ae 10GBase-ER • 10GbE WAN: IEEE 802.3ae 10GBase-EW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-IR2, is a field-replaceable 10G Small Form Factor Pluggable (XFP) module. It converts client optical signals to and from serial electrical signals. TOM-10G-IR2s are hot-pluggable into any of the two sub-slots in the TAM (TAM-2-10G, TAM-2-10GR, TAM-2-10GT, and/or TAM-2-10GM) and are powered through the pluggable interface.

TOM-10G-IR2 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, 10G DTF, 10G Fibre Channel, OTU1e, OTU2, and/or OTU2e client signals. The optical interface complies with Telcordia GR-253-CORE OC-192 IR-2 for the OC-192 client signal, ITU G.959.1 P1S1-2D2b for the STM-64 client signal, IEEE 802.3ae 10GBase-ER for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-EW for the 10GbE WAN client signal.

Note: The 10G DTF is only supported when the TOM is inserted in the TAM-2-10GT. For more information, see "Tributary Adapter Module 10GT (TAM-2-10GT)" on page 3-260.

TOM-10G-IR2 port status LEDs are located on the TAM as shown in Figure 3-88 on page 3-252.

Connectors

The TOM-10G-IR2 provides the optical interfaces to the client equipment through the ports as shown in Table 3-270.

Table 3-270 TOM-10G-IR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-271 lists the mechanical and electrical specifications for the TOM-10G-IR2.

Table 3-271 TOM-10G-IR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-272.

Table 3-272 TOM-10G-IR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-14.0dBm
Receiver overload	-1.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 3-273.

Table 3-273 TOM-10G-IR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-1.0dBm to +2.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 3-274.

Table 3-274 TOM-10G-IR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	10G DTF	
	10G Fibre Channel	
	OTU1e	
	OTU2	
	OTU2e	

Tributary Optical Module 10G (TOM-10G-LR2)

Table 3-275 TOM-10G-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-10G-LR2	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 LR-2 • ITU-T G.959.1 P1L1-2D2 • 10GbE LAN: IEEE 802.3ae 10GBase-ER • 10GbE WAN: IEEE 802.3ae 10GBase-EW

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-LR2, is a field-replaceable 10G Small Form Factor Pluggable (XFP) module. It converts client optical signals to and from serial electrical signals. TOM-10G-LR2s are hot-pluggable into any of the two sub-slots in the TAM (TAM-2-10G, TAM-2-10GR, TAM-2-10GT, and/or TAM-2-10GM) and are powered through the pluggable interface.

TOM-10G-LR2 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, 10G DTF, 10G Fibre Channel, OTU1e, OTU2, and/or OTU2e client signals. The optical interface complies with Telcordia GR-253-CORE OC-192 LR-2 for the OC-192 client signal, ITU-T G.959.1 P1L1-2D2 for the STM-64 client signal, IEEE 802.3ae 10GBase-ER for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-EW for the 10GbE WAN client signal.

Note: The 10G DTF is only supported when the TOM is inserted in the TAM-2-10GT. For more information, see “Tributary Adapter Module 10GT (TAM-2-10GT)” on page 3-260.

TOM-10G-LR2 port status LEDs are located on the TAM as shown in Figure 3-88 on page 3-252.

Connectors

The TOM-10G-LR2 provides the optical interfaces to the client equipment through the ports as shown in Table 3-276.

Table 3-276 TOM-10G-LR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-277 lists the mechanical and electrical specifications for the TOM-10G-LR2.

Table 3-277 TOM-10G-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-278.

Table 3-278 TOM-10G-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-24.0dBm
Receiver overload	-7.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 3-279.

Table 3-279 TOM-10G-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	0.0dBm to +4.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	9.95Gbps to 11.1Gbps

Interface Specifications

The tributary interface details are listed in Table 3-280.

Table 3-280 TOM-10G-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	10G DTF	
	10G Fibre Channel	
	OTU1e	
	OTU2	
	OTU2e	

Tributary Optical Module 10G (TOM-10G-Dn-LR2)

Table 3-281 TOM-10G-Dn-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-10G-Dn-LR2 (n=18-37, 40-59)	10G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-192 LR-2 • ITU-T G.959.1 P1L1-2D2 • 10GbE LAN: IEEE 802.3ae 10GBase-ER Operating Frequency: • TOM-10G-D18-LR2: 191.8THz • TOM-10G-D19-LR2: 191.9THz • TOM-10G-D20-LR2: 192.0THz • TOM-10G-D21-LR2: 192.1THz • TOM-10G-D22-LR2: 192.2THz • TOM-10G-D23-LR2: 192.3THz • TOM-10G-D24-LR2: 192.4THz • TOM-10G-D25-LR2: 192.5THz • TOM-10G-D26-LR2: 192.6THz • TOM-10G-D27-LR2: 192.7THz • TOM-10G-D28-LR2: 192.8THz • TOM-10G-D29-LR2: 192.9THz • TOM-10G-D30-LR2: 193.0THz • TOM-10G-D31-LR2: 193.1THz • TOM-10G-D32-LR2: 193.2THz • TOM-10G-D33-LR2: 193.3THz • TOM-10G-D34-LR2: 193.4THz • TOM-10G-D35-LR2: 193.5THz • TOM-10G-D36-LR2: 193.6THz • TOM-10G-D37-LR2: 193.7THz • TOM-10G-D40-LR2: 194.0THz • TOM-10G-D41-LR2: 194.1THz • TOM-10G-D42-LR2: 194.2THz • TOM-10G-D43-LR2: 194.3THz • TOM-10G-D44-LR2: 194.4THz • TOM-10G-D45-LR2: 194.5THz • TOM-10G-D46-LR2: 194.6THz • TOM-10G-D47-LR2: 194.7THz • TOM-10G-D48-LR2: 194.8THz • TOM-10G-D49-LR2: 194.9THz • TOM-10G-D50-LR2: 195.0THz • TOM-10G-D51-LR2: 195.1THz • TOM-10G-D52-LR2: 195.2THz • TOM-10G-D53-LR2: 195.3THz • TOM-10G-D54-LR2: 195.4THz • TOM-10G-D55-LR2: 195.5THz • TOM-10G-D56-LR2: 195.6THz • TOM-10G-D57-LR2: 195.7THz • TOM-10G-D58-LR2: 195.8THz • TOM-10G-D59-LR2: 195.9THz

Functional Description

The Tributary Optical Module 10G, referred to as TOM-10G-Dn-LR2 (n=18-37,40-59), is a field-replaceable10G Small Form Factor Pluggable (XFP) module. It converts client optical signals to and from serial electrical signals. TOM-10G-Dn-LR2s are hot-pluggable into any of the sub-slots in the TAM (TAM-2-10G, TAM-2-10GR, TAM-2-10GT, and/or TAM-2-10GM) and are powered through the pluggable interface.

TOM-10G-Dn-LR2 supports OC-192, STM-64, 10G Clear Channel, 10.3G Clear Channel, 10GbE LAN, 10GbE WAN, 10G DTF, 10G Fibre Channel, OTU1e, OTU2, and/or OTU2 client signals. The optical interface complies with Telcordia GR-253-CORE OC-192 LR-2 for the OC-192 client signal, ITU-T G.959.1 P1L1-2D2 for the STM-64 client signal, IEEE 802.3ae 10GBase-ER for the 10GbE LAN client signal, and IEEE 802.3ae 10GBase-EW for the 10GbE WAN client signal.

Note: The 10G DTF is only supported when the TOM is inserted in the TAM-2-10GT. For more information, see “Tributary Adapter Module 10GT (TAM-2-10GT)” on page 3-260.

TOM-10G-Dn-LR2 port status LEDs are located on the TAM as shown in Figure 3-88 on page 3-252.

Connectors

The TOM-10G-Dn-LR2 provides the optical interfaces to equipment through the ports as described in Table 3-282.

Table 3-282 TOM-10G-Dn-LR2 Connectors

Connector	Type	Purpose
Tributary port IN	LC	Connects from the client equipment
Tributary port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-283 lists the mechanical and electrical specifications for the TOM-10G-Dn-LR2.

Table 3-283 TOM-10G-Dn-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.33 inches / 8.38mm
	Depth	3.07 inches / 77.98mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-284.

Table 3-284 TOM-10G-Dn-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-24.0dBm (-28.5dBm at $1x10^{-4}$ BER when FEC is enabled)
Receiver overload	-7.0dBm
Receiver wavelength	1270nm to 1600nm
Data rate	9.95Gbps to 11.1Gbps

The optical specifications for tributary port OUT are listed in Table 3-285.

Table 3-285 TOM-10G-Dn-LR2 Tributary Port OUT Optical Specifications

Type	Specification	
Outgoing fiber type	Single mode	
Transmitter output power	-1.0dBm to +3.0dBm	
Transmitter wavelength	• TOM-10G-D18-LR2: 1563.05nm • TOM-10G-D19-LR2: 1562.23nm • TOM-10G-D20-LR2: 1561.42nm • TOM-10G-D21-LR2: 1560.61nm • TOM-10G-D22-LR2: 1559.79nm • TOM-10G-D23-LR2: 1558.98nm • TOM-10G-D24-LR2: 1558.17nm • TOM-10G-D25-LR2: 1557.36nm • TOM-10G-D26-LR2: 1556.55nm • TOM-10G-D27-LR2: 1555.75nm • TOM-10G-D28-LR2: 1554.94nm • TOM-10G-D29-LR2: 1554.13nm • TOM-10G-D30-LR2: 1553.33nm • TOM-10G-D31-LR2: 1552.52nm • TOM-10G-D32-LR2: 1551.72nm • TOM-10G-D33-LR2: 1550.92nm • TOM-10G-D34-LR2: 1550.12nm • TOM-10G-D35-LR2: 1549.32nm • TOM-10G-D36-LR2: 1548.51nm • TOM-10G-D37-LR2: 1547.72nm	• TOM-10G-D40-LR2: 1545.32nm • TOM-10G-D41-LR2: 1544.53nm • TOM-10G-D42-LR2: 1543.73nm • TOM-10G-D43-LR2: 1542.94nm • TOM-10G-D44-LR2: 1542.14nm • TOM-10G-D45-LR2: 1541.35nm • TOM-10G-D46-LR2: 1540.56nm • TOM-10G-D47-LR2: 1539.77nm • TOM-10G-D48-LR2: 1538.98nm • TOM-10G-D49-LR2: 1538.19nm • TOM-10G-D50-LR2: 1537.40nm • TOM-10G-D51-LR2: 1536.61nm • TOM-10G-D52-LR2: 1535.82nm • TOM-10G-D53-LR2: 1535.04nm • TOM-10G-D54-LR2: 1534.25nm • TOM-10G-D55-LR2: 1533.47nm • TOM-10G-D56-LR2: 1532.68nm • TOM-10G-D57-LR2: 1531.90nm • TOM-10G-D58-LR2: 1531.12nm • TOM-10G-D59-LR2: 1530.33nm
Data rate	9.95Gbps to 11.1Gbps	

Interface Specifications

The interface details are listed in Table 3-286.

Table 3-286 TOM-10G-Dn-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-192	Fully transparent
	SDH STM-64	
	10G Clear Channel	
	10.3G Clear Channel	
	10GbE LAN PHY	
	10GbE WAN PHY	
	10G DTF	
	10G Fibre Channel	
	OTU1e	
	OTU2	
	OTU2e	

Tributary Optical Module 8G (TOM-8G-SM-LC-L)

Table 3-287 TOM-8G-SM-LC-L Product Features

Product Ordering Name (PON)	Features
TOM-8G-SM-LC-L	8G Tributary Optical Module Reach: • ANSI FC-PI-4

Functional Description

The Tributary Optical Module 8G (referred to as TOM-8G-SM-LC-L) is a field-replaceable 8G Small Form Factor Pluggable (SFP+) module. It converts client optical signals to and from serial electrical signals. TOM-8G-SM-LC-Ls are hot-pluggable into any of the eight sub-slots in the TAM-8-2.5GM and are powered through the pluggable interface.

The TOM-8G-SM-LC-L operates at the following data rates:

- 4.25Gbps—for support of 4G Clear Channel client signals
- 4.25Gbps—for support of 4G Fibre Channel client signals
- 8.5Gbps—for support of 8G Fibre Channel client signals

The optical interface is compliant with ANSI FC-PI-4 and SFF-8472, compatible with SFF-84322 and applicable portions of SFF-8431.

TOM-8G-SM-LC-L port status LEDs are located on the TAM-8-2.5GM as shown in Figure 3-98 on page 3-277.

Note: The TOM-8G-SM-LC-L must be configured on port 1 or 5 of a TAM-8-2.5GM.

Note: When configured for 4G Clear Channel, the data format carried by the TOM-8G-SM-LC-L must use 8B/10B encoding, such as 4G Fibre Channel.

Connectors

The TOM-8G-SM-LC-L provides the optical interfaces to the client equipment through the ports as described in Table 3-288.

Table 3-288 TOM-8G-SM-LC-L Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-289 lists the mechanical and electrical specifications for the TOM-8G-SM-LC-L.

Table 3-289 TOM-8G-SM-LC-L Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.54 inches / 13.70mm
	Width	0.33 inches / 8.50mm
	Depth	2.22 inches / 56.50mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-290.

Table 3-290 TOM-8G-SM-LC-L Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 4.25Gbps: -14.0dBm • 8.5Gbps: -12.0dBm
Receiver overload	• 4.25Gbps: -1.0dBm • 8.5Gbps: +0.5dBm
Receiver wavelength	1260nm to 1360nm
Data rate	4.25Gbps, 8.5Gbps

The optical specifications for tributary port OUT are listed in Table 3-291.

Table 3-291 TOM-8G-SM-LC-L Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	• 4.25Gbps: -8.4dBm to -1.0dBm • 8.5Gbps: -8.4dBm to +0.5dBm
Transmitter wavelength	1285nm to 1345nm
Data rate	4.25Gbps, 8.5Gbps

Interface Specifications

The tributary interface details are listed in Table 3-292.

Table 3-292 TOM-8G-SM-LC-L Tributary Facilities

Type	Parameter	Specification
Tributary protocols	4G Clear Channel	Fully transparent **NOTE:** When configured for 4G Clear Channel, the data format carried by the TOM-8G-SM-LC-L must use 8B/10B encoding, such as 4G Fibre Channel.
	4G Fibre Channel	Fully transparent
	8G Fibre Channel	

Note: The TOM-8G-SM-LC-L must be configured on port 1 or 5 of a TAM-8-2.5GM.

Tributary Optical Module 2.5G (TOM-2.5G-SR1)

Table 3-293 TOM-2.5G-SR1 Product Features

Product Ordering Name (PON)	Features
TOM-2.5G-SR1-A	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 SR-1 • ITU-T G.957 I-16

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-2.5G-SR1, is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5G-SR1s are hot-pluggable into any of the four sub-slots in the TAM (TAM-4-2.5G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-2.5G-SR1 supports OC-48, STM-16, and/or 2.5G Clear Channel client signals. The optical interface complies with Telcordia GR-253-CORE OC-48 SR-1 for the OC-48 client signal and ITU-T G.957 I-16 for the STM-16 client signal.

TOM-2.5G-SR1 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Connectors

The TOM-2.5G-SR1 provides the optical interfaces to the client equipment through the ports as shown in Table 3-294.

Table 3-294 TOM-2.5G-SR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-295 lists the mechanical and electrical specifications for the TOM-2.5G-SR1.

Table 3-295 TOM-2.5G-SR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-296.

Table 3-296 TOM-2.5G-SR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-18.0dBm
Receiver overload	-3.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	2.488Gbps

The optical specifications for tributary port OUT are listed in Table 3-297.

Table 3-297 TOM-2.5G-SR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-10.0dBm to -3.0dBm
Transmitter wavelength	1266nm to 1360nm
Data rate	2.488Gbps

Interface Specifications

The tributary interface details are listed in Table 3-298.

Table 3-298 TOM-2.5G-SR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SDH STM-16	Fully transparent
	2.5G Clear Channel	Fully transparent

Tributary Optical Module 2.5G (TOM-2.5G-IR1)

Table 3-299 TOM-2.5G-IR1 Product Features

Product Ordering Name (PON)	Features
TOM-2.5G-IR1-A	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 IR-1 • ITU-T G.957 S-16.1

Note: The TOM-2.5G-IR1 is generally no longer available but is still supported. The replacement TOM is: TOM-2.5GMR-IR1.

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-2.5G-IR1, is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5G-IR1s are hot-pluggable into any of the four sub-slots in the TAM (TAM-4-2.5G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-2.5G-IR1 supports OC-48, STM-16, and/or 2.5G Clear Channel client signals. The optical interface complies with Telcordia GR-253-CORE OC-48 IR-1 for the OC-48 client signal and ITU-T G.957 S-16.1 for the STM-16 client signal.

TOM-2.5G-IR1 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Connectors

The TOM-2.5G-IR1 provides the optical interfaces to the client equipment through the ports as shown in Table 3-300.

Table 3-300 TOM-2.5G-IR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-301 lists the mechanical and electrical data for the TOM-2.5G-IR1.

Table 3-301 TOM-2.5G-IR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-302.

Table 3-302 TOM-2.5G-IR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-18.0dBm
Receiver overload	0.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	2.5Gbps

The optical specifications for tributary port OUT are listed in Table 3-303.

Table 3-303 TOM-2.5G-IR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-5.0dBm to 0.0dBm
Transmitter wavelength	1260nm to 1360nm
Data rate	2.5Gbps

Interface Specifications

The tributary interface details are listed in Table 3-304.

Table 3-304 TOM-2.5G-IR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SDH STM-16	Fully transparent
	2.5G Clear Channel	Fully transparent

Tributary Optical Module 2.5G (TOM-2.5G-IR2)

Table 3-305 TOM-2.5G-IR2 Product Features

Product Ordering Name (PON)	Features
TOM-2.5G-IR2	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 IR-2 • ITU-T G.957 S-16.2

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-2.5G-IR2, is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5G-IR2s are hot-pluggable into any of the four sub-slots in the TAM (TAM-4-2.5G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-2.5G-IR2 supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1G Fibre Channel, 2G Fibre Channel, 1GbE, 1.25G Clear Channel, OTU1, ESCON 200M Clear Channel, InfiniBand 2.5G Clear Channel, Video HD1.485G, Video HD1.4835G, Video SD 270M, and/or Digital Video 6000 client signals. The optical interface complies with Telcordia GR-253-CORE OC-48 IR-2 for the OC-48 client signal and ITU-T G.957 S-16.2 for the STM-16 client signal.

TOM-2.5G-IR2 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-2.5G-IR2 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Note: The TOM-2.5G-IR2 only supports SONET OC-48, SDH STM-16, and 2.5G Clear Channel client interfaces when inserted into the TAM-4-2.5G.

Connectors

The TOM-2.5G-IR2 provides the optical interfaces to the client equipment through the ports as shown in Table 3-306.

Table 3-306 TOM-2.5G-IR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-307 lists the mechanical and electrical specifications for the TOM-2.5G-IR2.

Table 3-307 TOM-2.5G-IR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-308.

Table 3-308 TOM-2.5G-IR2 Tributary port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 2.67G: -18.0dBm • 2.5G: -18.0dBm • 2x FC: -19.0dBm • 1GbE: -19.0dBm • 622M: -23.0dBm • 155M: -23.0dBm
Receiver overload	• 2.67G: 0.0dBm • 2.5G: 0.0dBm • 2x FC: -3.0dBm • 1GbE: -3.0dBm • 622M: -8.0dBm • 155M: -8.0dBm
Receiver wavelength	1270nm to 1600nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

The optical specifications for tributary port OUT are listed in Table 3-309.

Table 3-309 TOM-2.5G-IR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-5.0dBm to 0.0dBm
Transmitter wavelength	1430nm to 1580nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

Interface Specifications

The tributary interface details are listed in Table 3-310.

Table 3-310 TOM-2.5G-IR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	InfiniBand 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 2.5G (TOM-2.5G-LR2)

Table 3-311 TOM-2.5G-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-2.5G-LR2	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 LR-2 • ITU-T G.957 L-16.2

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-2.5G-LR2, is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5G-LR2s are hot-pluggable into any of the four sub-slots in the TAM (TAM-4-2.5G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-2.5G-LR2 supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1G Fibre Channel, 2G Fibre Channel, 1GbE, 1.25G Clear Channel, OTU1, ESCON 200M Clear Channel, InfiniBand 2.5G Clear Channel, Video HD1.485G, Video HD1.4835G, Video SD 270M, and/or Digital Video 6000 client signals.

TOM-2.5G-LR2 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-2.5G-LR2 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Note: The TOM-2.5G-LR2 only supports SONET OC-48, SDH STM-16, and 2.5G Clear Channel client interfaces when inserted into the TAM-4-2.5G.

Connectors

The TOM-2.5G-LR2 provides the optical interfaces to the client equipment through the ports as shown in Table 3-312.

Table 3-312 TOM-2.5G-LR2 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-313 lists the mechanical and electrical specifications for the TOM-2.5G-LR2.

Table 3-313 TOM-2.5G-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-314.

Table 3-314 TOM-2.5G-LR2 Tributary Port In Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 2.67G: -28.0dBm • 2.5G: -28.0dBm • 2x FC: -28.0dBm • 1GbE: -28.0dBm • 622M: -28.0dBm • 155M: -30.0dBm
Receiver overload	• 2.67G -9.0dBm • 2.5G: -9.0dBm • 2x FC: -9.0dBm • 1GbE: -9.0dBm • 622M: -9.0dBm • 155M: -15.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

The optical specifications for tributary port OUT are listed in Table 3-315.

Table 3-315 TOM-2.5G-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-2.0dBm to +3.0dBm
Transmitter wavelength	1500nm to 1580nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

Interface Specifications

The tributary interface details are listed in Table 3-316.

Table 3-316 TOM-2.5G-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	InfiniBand 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 2.5G (TOM-2.5GCn-LR2)

Table 3-317 TOM-2.5GCn-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-2.5GCn-LR2 (n=47,49,51,53,55,57, 59,61)	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE • ITU-T G.695 Wavelength: • TOM-2.5GC47-LR2: 1471nm • TOM-2.5GC49-LR2: 1491nm • TOM-2.5GC51-LR2: 1511nm • TOM-2.5GC53-LR2: 1531nm • TOM-2.5GC55-LR2: 1551nm • TOM-2.5GC57-LR2: 1571nm • TOM-2.5GC59-LR2: 1591nm • TOM-2.5GC61-LR2: 1611nm

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-2.5GCn-LR2 (n=47,49,51,53,55,57,61), is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5GCn-LR2s are hot-pluggable into any of the sub-slots in the TAM (TAM-4-2.5G and/or TAM-8-1G) and are powered through the pluggable interface.

TOM-2.5GCn-LR2 complies with CWDM ITU-T G.695 and supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1GbE, and/or 1.25G Clear Channel client signals.

TOM-2.5GCn-LR2 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-2.5GCn-LR2 supports 1GbE client signals only when provisioned in a TAM-8-1G.

Note: The TOM-2.5GCn-LR2 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Connectors

The TOM-2.5GCn-LR2 provides the optical interfaces to the client equipment through the ports as described in Table 3-318.

Table 3-318 TOM-2.5GCn-LR2 Connectors

Connector	Type	Purpose
Tributary port IN	LC	Connects from the client equipment
Tributary port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-319 lists the mechanical and electrical specifications for the TOM-2.5GCn-LR2.

Table 3-319 TOM-2.5GCn-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.33 inches / 8.38mm
	Width	0.54 inches / 13.72mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-320.

Table 3-320 TOM-2.5GCn-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 2.5G: -28.0dBm • 1G: -28.0dBm • 622M: -28.0dBm • 155M: -28.0dBm
Receiver overload	• 2.5G: -9.0dBm • 1G: -9.0dBm • 622M: -9.0dBm • 155M: -10.0dBm
Receiver wavelength	1450nm to 1620nm
Data rate	2.5Gbps, 1Gbps, 622Mbps, 155Mbps user provisionable

The optical specifications for tributary port OUT are listed in Table 3-321.

Table 3-321 TOM-2.5GCn-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	0.0dBm to +5.0dBm
Transmitter wavelength	• TOM-2.5GC47-LR2: 1471nm • TOM-2.5GC49-LR2: 1491nm • TOM-2.5GC51-LR2: 1511nm • TOM-2.5GC53-LR2: 1531nm • TOM-2.5GC55-LR2: 1551nm • TOM-2.5GC57-LR2: 1571nm • TOM-2.5GC59-LR2: 1591nm • TOM-2.5GC61-LR2: 1611nm
Data rate	2.5Gbps, 1Gbps, 622Mbps, 155Mbps user provisionable

Interface Specifications

The tributary interface details are listed in Table 3-322.

Table 3-322 TOM-2.5GCn-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1GbE	
	1.25G Clear Channel	

Tributary Optical Module 2.5G (TOM-2.5GMR-SR1)

Table 3-323 TOM-2.5GMR-SR1 Product Features

Product Ordering Name (PON)	Features
TOM-2.5GMR-SR1	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 SR-1 • ITU-T G.957 I-16 • IEEE 802.3 1000Base-LX • ANSI FC-PI

Functional Description

The Tributary Optical Module Multi-rate 2.5G (referred to as TOM-2.5GMR-SR1) is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5GMR-SR1s are hot-pluggable into any of the sub-slots in the TAM (TAM-4-2.5G, TAM-8-1G, and/or TAM-8-2.5GM) and are powered through the pluggable interface.

The TOM-2.5GMR-SR1 operates at the following data rates:

- 2.5Gbps—for support of OC-48/STM-16 client signals
- 622Mbps—for support of OC-12/STM-4 client signals
- 155Mbps—for support of OC-3/STM-1 client signals
- 1.25Gbps—for support of 1GbE and 1.25G Clear Channel client signals
- 200Mbps—for support of ESCON client signals
- 1.0625Gbps—for support of 1G Fibre Channel client signals
- 2.12Gbps—for support of 2G Fibre Channel client signals
- 2.5Gbps—for support of 2.5G Infiniband client signals
- 2.7Gbps—for support of OTU1 client signals
- 1.435Gbps and/or 1.485Gbps—for support of HD-SDI client signals
- 270Mbps—for support of SDI/DVB client signals

The optical interface complies with Telcordia GR-253-CORE OC-48 SR-1 for the OC-48 client signal, ITU-T G.957 I-16 for the STM-16 client signal, IEEE 802.3 1000Base-LX for the 1GbE client signal, and ANSI FC-PI for the Fibre Channel client signal.

TOM-2.5GMR-SR1 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-2.5GMR-SR1 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Connectors

The TOM-2.5GMR-SR1 provides the optical interfaces to the client equipment through the ports as shown in Table 3-324.

Table 3-324 TOM-2.5GMR-SR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-325 lists the mechanical and electrical specifications for the TOM-2.5GMR-SR1.

Table 3-325 TOM-2.5GMR-SR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.27mm
	Width	0.33 inches / 8.46mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-326.

Table 3-326 TOM-2.5GMR-SR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 2.67G: -18.0dBm • 2.5G: -18.0dBm • 2x FC: -19.0dBm • 1GbE: -19.0dBm • 622M: -23.0dBm • 155M: -23.0dBm
Receiver overload	• 2.67G: -3.0dBm • 2.5G: -3.0dBm • 2x FC:-3.0dBm • 1GbE: -3.0dBm • 622M: -8.0dBm • 155M: -8.0dBm
Receiver wavelength	1270nm to 1600nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

The optical specifications for tributary port OUT are listed in Table 3-327.

Table 3-327 TOM-2.5GMR-SR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-9.5dBm to -3.0dBm
Transmitter wavelength	1270nm to 1360nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

Interface Specifications

The tributary interface details are listed in Table 3-328.

Table 3-328 TOM-2.5GMR-SR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	Infiniband 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 2.5G (TOM-2.5GMR-IR1)

Table 3-329 TOM-2.5GMR-IR1 Product Features

Product Ordering Name (PON)	Features
TOM-2.5GMR-IR1	2.5G Tributary Optical Module Reach: • Telcordia GR-253-CORE OC-48 IR-1 • ITU-T G.957 S-16.1 • ANSI T1.105/Telcordia GR-253-CORE

Functional Description

The Tributary Optical Module Multi-rate 2.5G, referred to as TOM-2.5GMR-IR1, is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-2.5GMR-IR1s are hot-pluggable into any of the sub-slots in the TAM (TAM-4-2.5G, TAM-8-1G, and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-2.5GMR-IR1 supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1G Fibre Channel, 2G Fibre Channel, 1GbE, 1.25G Clear Channel, OTU1, ESCON 200M Clear Channel, InfiniBand 2.5G Clear Channel, Video HD1.485G, Video HD1.4835G, Video SD 270M, and/or Digital Video 6000 client signals. The optical interface complies with Telcordia GR-253-CORE OC-48 IR-1 for the OC-48 client signal and ITU-T G.957 S-16.1 for the STM-16 client signal.

TOM-2.5GMR-IR1 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-2.5GMR-IR1 supports 1GbE client signals only when provisioned in a TAM-8-1G.

Note: The TOM-2.5GMR-IR1 always uses the transmit characteristics of OC-48 IR-1 or STM-16, even when set to the lower OC-3/OC-12 or STM-1/STM-4 rates. Span engineering should take this into consideration and optical attenuators should be applied, if appropriate.

Connectors

The TOM-2.5GMR-IR1 provides the optical interfaces to the client equipment through the ports as shown in Table 3-330.

Table 3-330 TOM-2.5GMR-IR1 Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-331 lists the mechanical and electrical specifications for the TOM-2.5GMR-IR1.

Table 3-331 TOM-2.5GMR-IR1 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-332.

Table 3-332 TOM-2.5GMR-IR1 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	• 2.67G: -18.0dBm • 2.5G: -18.0dBm • 2x FC: -19.0dBm • 1GbE: -19.0dBm • 622M: -23.0dBm • 155M: -23.0dBm
Receiver overload	• 2.67G: 0.0dBm • 2.5G: 0.0dBm • 2x FC: -3.0dBm • 1GbE: -3.0dBm • 622M: -8.0dBm • 155M: -8.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

The optical specifications for tributary port OUT are listed in Table 3-333.

Table 3-333 TOM-2.5GMR-IR1 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-5.0dBm to 0.0dBm
Transmitter wavelength	1260nm to 1360nm
Data rate	2.7Gbps, 2.5Gbps, 2.12Gbps, 1.485Gbps, 1.435Gbps, 1.25Gbps, 1.0625Gbps, 622Mbps, 270Mbps, 200Mbps, and 155Mbps

Interface Specifications

The tributary interface details are listed in Table 3-334.

Table 3-334 TOM-2.5GMR-IR1 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	InfiniBand 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 2.5G (TOM-MR-Dn-LR2)

Table 3-335 TOM-MR-Dn-LR2 Product Features

Product Ordering Name (PON)	Features	
TOM-MR-Dn-LR2 (n=18-37, 40-59)	2.5G Tributary Optical Module Reach: • GR 253 CORE OC48 LR-2 • ITU-T G.957 L-16.2 Operating frequency/wavelength:	
	• TOM-MR-D18-LR2: 191.8THz, 1563.05nm	• TOM-MR-D40-LR2: 194.0THz, 1545.32nm
	• TOM-MR-D19-LR2: 191.9THz, 1562.23nm	• TOM-MR-D41-LR2: 194.1THz, 1544.53nm
	• TOM-MR-D20-LR2: 192.0THz, 1561.42nm	• TOM-MR-D42-LR2: 194.2THz, 1543.73nm
	• TOM-MR-D21-LR2: 192.1THz, 1560.61nm	• TOM-MR-D43-LR2: 194.3THz, 1542.94nm
	• TOM-MR-D22-LR2: 192.2THz, 1559.79nm	• TOM-MR-D44-LR2: 194.4THz, 1542.14nm
	• TOM-MR-D23-LR2: 192.3THz, 1558.98nm	• TOM-MR-D45-LR2: 194.5THz, 1541.35nm
	• TOM-MR-D24-LR2: 192.4THz, 1558.17nm	• TOM-MR-D46-LR2: 194.6THz, 1540.56nm
	• TOM-MR-D25-LR2: 192.5THz, 1557.36nm	• TOM-MR-D47-LR2: 194.7THz, 1539.77nm
	• TOM-MR-D26-LR2: 192.6THz, 1556.55nm	• TOM-MR-D48-LR2: 194.8THz, 1538.98nm
	• TOM-MR-D27-LR2: 192.7THz, 1555.75nm	• TOM-MR-D49-LR2: 194.9THz, 1538.19nm
	• TOM-MR-D28-LR2: 192.8THz, 1554.94nm	• TOM-MR-D50-LR2: 195.0THz, 1537.40nm
	• TOM-MR-D29-LR2: 192.9THz, 1554.13nm	• TOM-MR-D51-LR2: 195.1THz, 1536.61nm
	• TOM-MR-D30-LR2: 193.0THz, 1553.33nm	• TOM-MR-D52-LR2: 195.2THz, 1535.82nm
	• TOM-MR-D31-LR2: 193.1THz, 1552.52nm	• TOM-MR-D53-LR2: 195.3THz, 1535.04nm
	• TOM-MR-D32-LR2: 193.2THz, 1551.72nm	• TOM-MR-D54-LR2: 195.4THz, 1534.25nm
	• TOM-MR-D33-LR2: 193.3THz, 1550.92nm	• TOM-MR-D55-LR2: 195.5THz, 1533.47nm
	• TOM-MR-D34-LR2: 193.4THz, 1550.12nm	• TOM-MR-D56-LR2: 195.6THz, 1532.68nm
	• TOM-MR-D35-LR2: 193.5THz, 1549.32nm	• TOM-MR-D57-LR2: 195.7THz, 1531.90nm
	• TOM-MR-D36-LR2: 193.6THz, 1548.51nm	• TOM-MR-D58-LR2: 195.8THz, 1531.12nm
	• TOM-MR-D37-LR2: 193.7THz, 1547.72nm	• TOM-MR-D59-LR2: 195.9THz, 1530.33nm

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-MR-Dn-LR2 (n=18-37,40-59), is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client side optical signals to and from serial electrical signals. TOM-MR-Dn-LR2s are hot-pluggable into any of the sub-slots in the TAM (TAM-4-2.5G, TAM-8-1G, and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-MR-Dn-LR2 supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1G Fibre Channel, 2G Fibre Channel, 1GbE, 1.25G Clear Channel, OTU1, ESCON 200M Clear Channel, InfiniBand 2.5G Clear Channel, Video HD1.485G, Video HD1.4835G, Video SD 270M, and/or Digital Video 6000 client signals.

TOM-MR-Dn-LR2 port status LEDs are located on the TAM-4 as shown in Figure 3-96 on page 3-271.

Note: The TOM-MR-Dn-LR2 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Connectors

The TOM-MR-Dn-LR2 provides the optical interfaces to the client equipment through the ports as described in Table 3-336.

Table 3-336 TOM-MR-Dn-LR2 Connectors

Connector	Type	Purpose
Tributary port IN	LC	Connects from the client equipment
Tributary port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-337 lists the mechanical and electrical specifications for the TOM-MR-Dn-LR2.

Table 3-337 TOM-MR-Dn-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-338.

Table 3-338 TOM-MR-Dn-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-29.0dBm
Receiver overload	-9.0dBm
Receiver wavelength	1520nm to 1565nm
Data rate	155Mbps to 2.7Gbps

The optical specifications for tributary port OUT are listed in Table 3-339.

Table 3-339 TOM-MR-Dn-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Link distance	Complies with: • GR-253 CORE OC-48 LR-2 • ITU-T G.957 L-16.2
Transmitter output power	0.0dBm to +3.5dBm
Transmitter wavelength	DWDM, see Table 3-335 on page 3-355
Data rate	155Mbps to 2.7Gbps

Interface Specifications

The interface details are listed in Table 3-340.

Table 3-340 TOM-MR-Dn-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	InfiniBand 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 2.5G (TOM-MR-Cn-LR2)

Table 3-341 TOM-MR-Cn-LR2 Product Features

Product Ordering Name (PON)	Features
TOM-MR-Cn-LR2 n=47,49,51,53,55,57, 59,61	2.5G Tributary Optical Module Reach: • CWDM 2.5Gbps SONET/SDH • CWDM 120km 2.5G Ethernet Operating frequency/wavelength: • TOM-MR-C47-LR2: 203.94THz, 1471nm • TOM-MR-C49-LR2: 201.21THz, 1491nm • TOM-MR-C51-LR2: 198.54THz, 1511nm • TOM-MR-C53-LR2: 195.95THz, 1531nm • TOM-MR-C55-LR2: 193.42THz, 1551nm • TOM-MR-C57-LR2: 190.96THz, 1571nm • TOM-MR-C59-LR2: 188.56THz, 1591nm • TOM-MR-C61-LR2: 186.22THz, 1611nm

Functional Description

The Tributary Optical Module 2.5G, referred to as TOM-MR-Cn-LR2 (n=47,49,51,53,55,57,59,61), is a field-replaceable 2.5G Small Form Factor Pluggable (SFP) module. It converts client side optical signals to and from serial electrical signals. TOM-MR-Cn-LR2s are hot-pluggable into any of the sub-slots in the TAM (TAM-4-2.5G, TAM-8-1G, and/or TAM-8-2.5GM), and are powered through the pluggable interface.

TOM-MR-Cn-LR2 supports OC-48, OC-12, OC-3, STM-16, STM-4, STM-1, 2.5G Clear Channel, 1G Fibre Channel, 2G Fibre Channel, 1GbE, 1.25G Clear Channel, OTU1, ESCON 200M Clear Channel, InfiniBand 2.5G Clear Channel, Video HD1.485G, Video HD1.4835G, Video SD 270M, and/or Digital Video 6000 client signals.

TOM-MR-Cn-LR2 port status LEDs are located on the TAM as shown in Figure 3-96 on page 3-271.

Note: The TOM-MR-Cn-LR2 has fixed launch power and receiver sensitivity levels specified for this TOM at the OC-48/STM-16 rate, even when set to the lower bit rates (for example, OC-3/STM-1, 2GFC, and/or 1GbE). Launch power and receiver sensitivity should be taken into consideration when connecting to interfaces at lower rates; an optical attenuator may be required.

Connectors

The TOM-MR-Cn-LR2 provides the optical interfaces to the client equipment through the ports as described in Table 3-342.

Table 3-342 TOM-MR-Cn-LR2 Connectors

Connector	Type	Purpose
Tributary port IN	LC	Connects from the client equipment
Tributary port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-343 lists the mechanical and electrical specifications for the TOM-MR-Cn-LR2.

Table 3-343 TOM-MR-Cn-LR2 Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.72 inches / 18.29mm
	Width	0.34 inches / 8.64mm
	Depth	3.10 inches / 78.74mm
	Weight	0.1lb (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-344.

Table 3-344 TOM-MR-Cn-LR2 Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-28.0dBm
Receiver overload	-9.0dBm
Receiver wavelength	1200nm to 1625nm
Data rate	155Mbps to 2.7Gbps

The optical specifications for tributary port OUT are listed in Table 3-345.

Table 3-345 TOM-MR-Cn-LR2 Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Link distance	Complies with: • CWDM 2.5Gbps SONET/SDH • CWDM 120km 2.5G Ethernet
Transmitter output power	1.0dBm to 5.0dBm
Transmitter wavelength	CWDM, see Table 3-341 on page 3-359
Data rate	155Mbps to 2.7Gbps

Interface Specifications

The interface details are listed in Table 3-346.

Table 3-346 TOM-MR-Cn-LR2 Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SONET OC-48	Fully transparent
	SONET OC-12	
	SONET OC-3	
	SDH STM-16	
	SDH STM-4	
	SDH STM-1	
	2.5G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	
	1GbE	
	1.25G Clear Channel	
	OTU1	
	ESCON 200M Clear Channel	
	InfiniBand 2.5G Clear Channel	
	Video HD 1.485G	
	Video HD 1.4835G	
	Video SD 270M	
	Digital Video 6000 (2.38G)	

Tributary Optical Module 1G (TOM-1G-SX)

Table 3-347 TOM-1G-SX Product Features

Product Ordering Name (PON)	Features
TOM-1G-SX-A	1G Tributary Optical Module Reach: • 1.25GbE: IEEE 802.3z 1000Base-SX

Functional Description

The Tributary Optical Module 1G, referred to as TOM-1G-SX, is a field-replaceable 1G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-1G-SXs are hot-pluggable into any of the eight sub-slots in the TAM (TAM-8-1G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-1G-SX supports 1GbE, 1.25G Clear Channel, 1G Fibre Channel, and/or 2G Fibre Channel client signals. The optical interface complies with IEEE 802.3z 1000Base-SX for 1GbE client signals.

TOM-1G-SX port status LEDs are located on the TAM as shown in Figure 3-100 on page 3-282.

Note: 1G and 2G Fibre Channel interfaces are supported on the TAM-8-2.5GM only

Connectors

The TOM-1G-SX provides the optical interfaces to the client equipment through the ports as shown in Table 3-348.

Table 3-348 TOM-1G-SX Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-349 lists the mechanical and electrical specifications for the TOM-1G-SX.

Table 3-349 TOM-1G-SX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-350.

Table 3-350 TOM-1G-SX Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Multi-mode
Receiver sensitivity	-17.0dBm
Receiver overload	0.0dBm
Receiver wavelength	770nm to 860nm
Data rate	1.25Gbps

The optical specifications for tributary port OUT are listed in Table 3-351.

Table 3-351 TOM-1G-SX Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Multi-mode
Transmitter output power	-9.5dBm to -3.0dBm
Transmitter wavelength	830nm to 860nm
Data rate	1.25Gbps

Interface Specifications

The tributary interface details are listed in Table 3-352.

Table 3-352 TOM-1G-SX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	1GbE	Fully transparent
	1.25G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	

Tributary Optical Module 1G (TOM-1G-LX)

Table 3-353 TOM-1G-LX Product Features

Product Ordering Name (PON)	Features
TOM-1G-LX-A	1G Tributary Optical Module Reach: • 1.25GbE: IEEE 802.3z 1000Base-LX

Functional Description

The Tributary Optical Module 1G, referred to as TOM-1G-LX, is a field-replaceable 1G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-1G-LXs are hot-pluggable into any of the eight sub-slots in the TAM (TAM-8-1G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-1G-LX supports 1GbE, 1.25G Clear Channel, 1G Fibre Channel, and/or 2G Fibre Channel client signals. The optical interface complies with IEEE 802.3z 1000Base-LX for 1GbE client signals.

TOM-1G-LX port status LEDs are located on the TAM as shown in Figure 3-100 on page 3-282.

Connectors

The TOM-1G-LX provides the optical interfaces to the client equipment through the ports as shown in Table 3-354.

Table 3-354 TOM-1G-LX Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-355 lists the mechanical and electrical specifications for the TOM-1G-LX.

Table 3-355 TOM-1G-LX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-356.

Table 3-356 TOM-1G-LX Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-19.0dBm
Receiver overload	-3.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	1.25Gbps

The optical specifications for tributary port OUT are listed in Table 3-357.

Table 3-357 TOM-1G-LX Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	-9.5dBm to -3.0dBm
Transmitter wavelength	1270nm to 1355nm
Data rate	1.25Gbps

Interface Specifications

The tributary interface details are listed in Table 3-358.

Table 3-358 TOM-1G-LX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	1GbE	Fully transparent
	1.25G Clear Channel	
	1G Fibre Channel	
	2G Fibre Channel	

Tributary Optical Module 1G (TOM-1G-ZX)

Table 3-359 TOM-1G-ZX Product Features

Product Ordering Name (PON)	Features
TOM-1G-ZX	1G Tributary Optical Module Reach: • 1.25GbE: IEEE 802.3 1000Base-ZX

Functional Description

The Tributary Optical Module 1G, referred to as TOM-1G-ZX, is a field-replaceable 1G Small Form Factor Pluggable (SFP) module. It converts client optical signals to and from serial electrical signals. TOM-1G-ZXs are hot-pluggable into any of the eight sub-slots in the TAM (TAM-8-1G and/or TAM-8-2.5GM) and are powered through the pluggable interface.

TOM-1G-ZX supports 1GbE and 1.25G Clear Channel client signals. The optical interface complies with IEEE 802.3 1000Base-ZX for 1GbE client signals.

TOM-1G-ZX port status LEDs are located on the TAM as shown in Figure 3-100 on page 3-282.

Connectors

The TOM-1G-ZX provides the optical interfaces to the client equipment through the ports as shown in Table 3-360.

Table 3-360 TOM-1G-ZX Connectors

Connector	Type	Purpose
Trib port IN	LC	Connects from the client equipment
Trib port OUT	LC	Connects to the client equipment

Technical Specifications

Table 3-361 lists the mechanical and electrical specifications for the TOM-1G-ZX.

Table 3-361 TOM-1G-ZX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.52 inches / 13.21mm
	Width	0.33 inches / 8.38mm
	Depth	2.23 inches / 56.64mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Optical Specifications

The optical specifications for tributary port IN are listed in Table 3-362.

Table 3-362 TOM-1G-ZX Tributary Port IN Optical Specifications

Type	Specification
Incoming fiber type	Single mode
Receiver sensitivity	-22.0dBm
Receiver overload	-3.0dBm
Receiver wavelength	1260nm to 1580nm
Data rate	1.25Gbps

The optical specifications for tributary port OUT are listed in Table 3-363.

Table 3-363 TOM-1G-ZX Tributary Port OUT Optical Specifications

Type	Specification
Outgoing fiber type	Single mode
Transmitter output power	0.0dBm to +5.0dBm
Transmitter wavelength	1530nm to 1565nm
Data rate	1.25Gbps

Interface Specifications

The tributary interface details are listed in Table 3-364.

Table 3-364 TOM-1G-ZX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	1GbE	Fully transparent
	1.25G Clear Channel	

Tributary Optical Module HD-SDI (TOM-1.485HD-RX)

Table 3-365 TOM-1.485HD-RX Product Features

Product Ordering Name (PON)	Features
TOM-1.485HD-RX	1.485G high-definition (HD) receive (RX) video TOM Multiple protocol support: • SMPTE 259 M • SMPTE 292 M

Functional Description

The Tributary Optical Module HD-SDI (referred to as TOM-1.485HD-RX) is a field-replaceable Small Form Factor Pluggable (SFP) module. It is used in the add direction (unidirectional) for add/drop access of client digital video signals:

- Receives digital video signals from the client network
- Converts the client signals to serial electrical signals for mapping into the Infinera DTF path for transport to another location

TOM-1.485HD-RXs are hot-pluggable into any of the eight sub-slots in the TAM-8-2.5GM and are powered through the pluggable interface. TOM-1.485HD-RX operates at the following data rates:

- 1.485Gbps—for support of high-definition serial digital interface (HD-SDI) client signals
- 270Mbps—for support of serial digital interface (SDI) client signals

The electrical interface complies with SMPTE 292 M for 1.485Gbps client signals and SMPTE 259 M for 270Mbps client signals.

TOM-1.485HD-RX port status LEDs are located on the TAM-8-2.5GM as shown in Figure 3-98 on page 3-277.

Note: A maximum of four (4) video TOMs can be inserted in the TAM-8-2.5GM. The TOM slot(s) next to the video TOM must be left open to avoid mechanical interference. Mechanical interference can cause difficulties in inserting and removing the adjacent TOMs, which may result in damage to the TAM/TOMs.

Connectors

The TOM-1.485HD-RX provides the electrical interfaces to the client equipment through the ports as shown in Table 3-366.

Table 3-366 TOM-1.485HD-RX Connectors

Connector	Type	Purpose
Trib port IN	BNC	Connects from the client equipment

Technical Specifications

Table 3-367 lists the mechanical and electrical specifications for the TOM-1.485HD-RX.

Table 3-367 TOM-1.485HD-RX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.53 inches / 13.40mm
	Width	0.33 inches / 8.50mm
	Depth	2.22 inches / 56.50mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Electrical Specifications

The electrical specifications for tributary port IN are listed in Table 3-368.

Table 3-368 TOM-1.485HD-RX Tributary Port IN Electrical Specifications

Type	Specification
Incoming cable type	75 Ohms, BNC coaxial
Data rate	270Mbps, 1.485Gbps

Interface Specifications

The tributary interface details are listed in Table 3-369.

Table 3-369 TOM-1.485HD-RX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SMPTE 259 M	Fully transparent
	SMPTE 292 M	Fully transparent

Tributary Optical Module HD-SDI (TOM-1.485HD-TX)

Table 3-370 TOM-1.485HD-TX Product Features

Product Ordering Name (PON)	Features
TOM-1.485HD-TX	1.485G high-definition (HD) transmit (TX) video TOM Multiple protocol support: • SMPTE 259 M • SMPTE 292 M

Functional Description

The Tributary Optical Module HD-SDI (referred to as TOM-1.485HD-TX) is a field-replaceable Small Form Factor Pluggable (SFP) module. It is used in the drop direction (unidirectional) for add/drop access of client digital video signals:

- Receives the serial electrical signals carried by the Infinera DTF path
- Transmits the digital video signals (serial electrical) into the client network

TOM-1.485HD-TXs are hot-pluggable into any of the eight sub-slots in the TAM-8-2.5GM and are powered through the pluggable interface. TOM-1.485HD-TX operates at the following data rates:

- 1.485Gbps—for support of high-definition serial digital interface (HD-SDI) client signals
- 270Mbps—for support of serial digital interface (SDI) client signals

The electrical interface complies with SMPTE 292 M for 1.485Gbps client signals and SMPTE 259 M for 270Mbps client signals.

TOM-1.485HD-TX port status LEDs are located on the TAM-8-2.5GM as shown in Figure 3-98 on page 3-277.

Note: A maximum of four (4) video TOMs can be inserted in the TAM-8-2.5GM. The TOM slot(s) next to the video TOM must be left open to avoid mechanical interference. Mechanical interference can cause difficulties in inserting and removing the adjacent TOMs, which may result in damage to the TAM/TOMs.

Connectors

The TOM-1.485HD-TX provides the electrical interfaces to the client equipment through the ports as shown in Table 3-371.

Table 3-371 TOM-1.485HD-TX Connectors

Connector	Type	Purpose
Trib port OUT	BNC	Connects to the client equipment

Technical Specifications

Table 3-372 lists the mechanical and electrical specifications for the TOM-1.485HD-TX.

Table 3-372 TOM-1.485HD-TX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.53 inches / 13.40mm
	Width	0.33 inches / 8.50mm
	Depth	2.22 inches / 56.50mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Electrical Specifications

The electrical specifications for tributary port OUT are listed in Table 3-373.

Table 3-373 TOM-1.485HD-TX Tributary Port OUT Electrical Specifications

Type	Specification
Outgoing cable type	75 Ohms, BNC coaxial
Data rate	270Mbps, 1.485Gbps

Interface Specifications

The tributary interface details are listed in Table 3-374.

Table 3-374 TOM-1.485HD-TX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SMPTE 259 M	Fully transparent
	SMPTE 292 M	Fully transparent

Tributary Optical Module HD-SDI (TOM-1.4835HD-RX)

Table 3-375 TOM-1.4835HD-RX Product Features

Product Ordering Name (PON)	Features
TOM-1.4835HD-RX	1.4835G high-definition (HD) receive (RX) video TOM Multiple protocol support: • SMPTE 259 M • SMPTE 292 M

Functional Description

The Tributary Optical Module HD-SDI (referred to as TOM-1.4835HD-RX) is a field-replaceable Small Form Factor Pluggable (SFP) module. It is used in the add direction (unidirectional) for add/drop access of client digital video signals:

- Receives digital video signals from the client network
- Converts the client signals to serial electrical signals for mapping into the Infinera DTF path for transport to another location

TOM-1.485HD-RXs are hot-pluggable into any of the eight sub-slots in the TAM-8-2.5GM and are powered through the pluggable interface. TOM-1.4835HD-RX operates at the following data rates:

- 1.4835Gbps—for support of high-definition serial digital interface (HD-SDI) client signals
- 270Mbps—for support of serial digital interface (SDI) client signals

The electrical interface complies with SMPTE 292 M for 1.4835Gbps client signals and SMPTE 259 M for 270Mbps client signals.

TOM-1.4835HD-RX port status LEDs are located on the TAM-8-2.5GM as shown in Figure 3-98 on page 3-277.

Note: A maximum of four (4) video TOMs can be inserted in the TAM-8-2.5GM. The TOM slot(s) next to the video TOM must be left open to avoid mechanical interference. Mechanical interference can cause difficulties in inserting and removing the adjacent TOMs, which may result in damage to the TAM/TOMs.

Connectors

The TOM-1.4835HD-RX provides the electrical interfaces to the client equipment through the ports as shown in Table 3-376.

Table 3-376 TOM-1.4835HD-RX Connectors

Connector	Type	Purpose
Trib port IN	BNC	Connects from the client equipment

Technical Specifications

Table 3-377 lists the mechanical and electrical specifications for the TOM-1.4835HD-RX.

Table 3-377 TOM-1.4835HD-RX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.53 inches / 13.40mm
	Width	0.33 inches / 8.50mm
	Depth	2.22 inches / 56.50mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Electrical Specifications

The electrical specifications for tributary port IN are listed in Table 3-378.

Table 3-378 TOM-1.4835HD-RX Tributary Port IN Electrical Specifications

Type	Specification
Incoming cable type	75 Ohms, BNC coaxial
Data rate	270Mbps, 1.4835Gbps

Interface Specifications

The tributary interface details are listed in Table 3-379.

Table 3-379 TOM-1.4835HD-RX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SMPTE 259 M	Fully transparent
	SMPTE 292 M	Fully transparent

Tributary Optical Module HD-SDI (TOM-1.4835HD-TX)

Table 3-380 TOM-1.4835HD-TX Product Features

Product Ordering Name (PON)	Features
TOM-1.4835HD-TX	1.4835G high-definition (HD) transmit (TX) video TOM Multiple protocol support: • SMPTE 259 M • SMPTE 292 M

Functional Description

The Tributary Optical Module HD-SDI (referred to as TOM-1.4835HD-TX) is a field-replaceable Small Form Factor Pluggable (SFP) module. It is used in the drop direction (unidirectional) for add/drop access of client digital video signals:

- Receives the serial electrical signals carried by the Infinera DTF path
- Transmits the digital video signals (serial electrical) into the client network

TOM-1.4835HD-TXs are hot-pluggable into any of the eight sub-slots in the TAM-8-2.5GM and are powered through the pluggable interface. TOM-1.4835HD-TX operates at the following data rates:

- 1.4835Gbps—for support of high-definition serial digital interface (HD-SDI) client signals
- 270Mbps—for support of serial digital interface (SDI) client signals

The electrical interface complies with SMPTE 292 M for 1.4835Gbps client signals and SMPTE 259 M for 270Mbps client signals.

TOM-1.4835HD-TX port status LEDs are located on the TAM-8-2.5GM as shown in Figure 3-98 on page 3-277.

Note: A maximum of four (4) video TOMs can be inserted in the TAM-8-2.5GM. The TOM slot(s) next to the video TOM must be left open to avoid mechanical interference. Mechanical interference can cause difficulties in inserting and removing the adjacent TOMs, which may result in damage to the TAM/TOMs.

Connectors

The TOM-1.4835HD-TX provides the electrical interfaces to the client equipment through the ports as shown in Table 3-381.

Table 3-381 TOM-1.4835HD-TX Connectors

Connector	Type	Purpose
Trib port OUT	BNC	Connects to the client equipment

Technical Specifications

Table 3-382 lists the mechanical and electrical specifications for the TOM-1.4835HD-TX.

Table 3-382 TOM-1.4835HD-TX Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.53 inches / 13.40mm
	Width	0.33 inches / 8.50mm
	Depth	2.22 inches / 56.50mm
	Weight	0.1lb / 0.04kg (approximately)
Electrical specifications	Power consumption	Included as part of the TAM; see Table 3-1 on page 3-4

Electrical Specifications

The electrical specifications for tributary port OUT are listed in Table 3-383.

Table 3-383 TOM-1.4835HD-TX Tributary Port OUT Electrical Specifications

Type	Specification
Outgoing cable type	75 Ohms, BNC coaxial
Data rate	270Mbps, 1.4835Gbps

Interface Specifications

The tributary interface details are listed in Table 3-384.

Table 3-384 TOM-1.4835HD-TX Tributary Facilities

Type	Parameter	Specification
Tributary protocols	SMPTE 259 M	Fully transparent
	SMPTE 292 M	Fully transparent

Blank Circuit Packs

Whenever a circuit pack is removed, the blank space must be occupied by the corresponding blank circuit pack. Blank circuit packs serve three important functions:

- Prevents exposure to hazardous voltage and currents inside the chassis
- Contains any electromagnetic interference (EMI) that might affect other equipment
- Directs the flow of cooling air through the chassis

Table 3-385 lists the corresponding blank circuit packs.

Table 3-385 DTC/MTC Blank Circuit Packs

Product Ordering Name (PON)	Description
MCM-BLANK-A	Management Control Module (MCM) blank
BMM-BLANK-A	Band Multiplexing Module (BMM) blank
DLM-BLANK-A	Digital Line Module (DLM) blank
TAM-BLANK-A	Tributary Adapter Module (TAM) blank

Note: When slots 3, 4, 5, or 6 are not occupied by either a line module and/or TEM, the DLM blank will be used.

CHAPTER 4

Infinera Optical Line Amplifier

The Infinera Optical Line Amplifier, referred to as the Optical Line Amplifier, is a bidirectional inline amplifier network element used to extend the optical reach between DTNs. Refer to the *Infinera DTN and DTN-X System Description Guide* for a detailed functional description and application of the Optical Line Amplifier.

The Optical Line Amplifier is comprised of one or more Optical Transport Chassis (OTCs) and optionally, a Dispersion Management Chassis (DMC) for housing Dispersion Compensation Modules (DCMs). See "Infinera Dispersion Management Chassis" on page 5-1 for details on the DMC.

This chapter provides a hardware description for the Optical Line Amplifier including a functional description of the hardware, block diagram of the internal signal flow (where applicable), and technical specifications. This chapter includes the following sections:

For Optical Line Amplifier installation procedures, refer to the *Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide.* For Optical Line Amplifier turn-up and test procedures, refer to the *Infinera DTN and DTN-X Turn-up and Test Guide.*

For a description of module Light Emitting Diode (LED) status indicators, refer to the *Infinera GNM Fault Management and Diagnostics Guide*.

OTC System Specifications

This section contains system specifications for the OTC and includes the following:

- "OTC Power Consumption and Configuration Rules" on page 4-2
- "OTC Compliancy" on page 4-5
- "OTC Technical Specifications" on page 4-6

OTC Power Consumption and Configuration Rules

Power consumption numbers for the OTC are presented as two values:

- Typical Power Draw—characterizes average power usage under normal operating system conditions and can be used for estimating average power consumption over time (ongoing operational cost for power consumption)
- Maximum Power Draw—is worst-case power draw under severe equipment, environmental, and network conditions

Table 4-1 provides typical and maximum power draw numbers for supported OTC system components.

Table 4-1 OTC Power Consumption Numbers

Configuration	Typical Power Draw (Watts)	Maximum Power Draw at 40º C (Watts)	Maximum Power Draw at 55º C (Watts)
Base OTC (1 OMM, 2 PEMs, IAP, and 2 Fan Trays)	72	99	128
OMM (both OMMs in chassis)	22	26	28
OAM (all OAM types; OAM-CXH1-MS measured)	26	53	53
RAM-1	35	68	68
RAM-2-OR	45	105	105
REM-2	45	105	105
ORM-CXH1-MS	65	100	100
ORM-CXH1-MS-LL	65	100	100
ORM-CXH1	51	75	84
ORM-CXH1-LL	51	75	84
SCM	25	30	45
DSE	26	34	34

Maximum Power Draw

The OTC requires two 10A feeds and these feeds provide power to the system through the PEMs. In some instances, it may be possible to configure the system in such a way that the maximum amperage draw could exceed 10A for the OTC.

The user can configure the system software to calculate per-chassis worst-case power draw based on shelf configuration, and escalate a standing condition for an OTC when this configuration is exceeded. This power draw limit is compared against the total estimated power draw for all of the equipment provisioned (or pre-provisioned) in the chassis.

The chassis raises an alarm if the sum of the power values for the provisioned/pre-provisioned equipment in the chassis exceeds the user configured maximum power draw value. This raised alarm does not indicate actual power draw, but indicates that the system is configured in such a way that should all environmental, network and system conditions be worst-case—that this is the potential total maximum power draw of the system under those conditions.

Inrush Current

Inrush current refers to the maximum, instantaneous current drawn by the OTC at initial system power up (or by a module inserted into an OTC already powered up). The inrush current for the OTC will not exceed the worst-case power consumption current for the particular shelf configuration (or module) within the appropriate ambient selected (normal or short-term operation). For example:

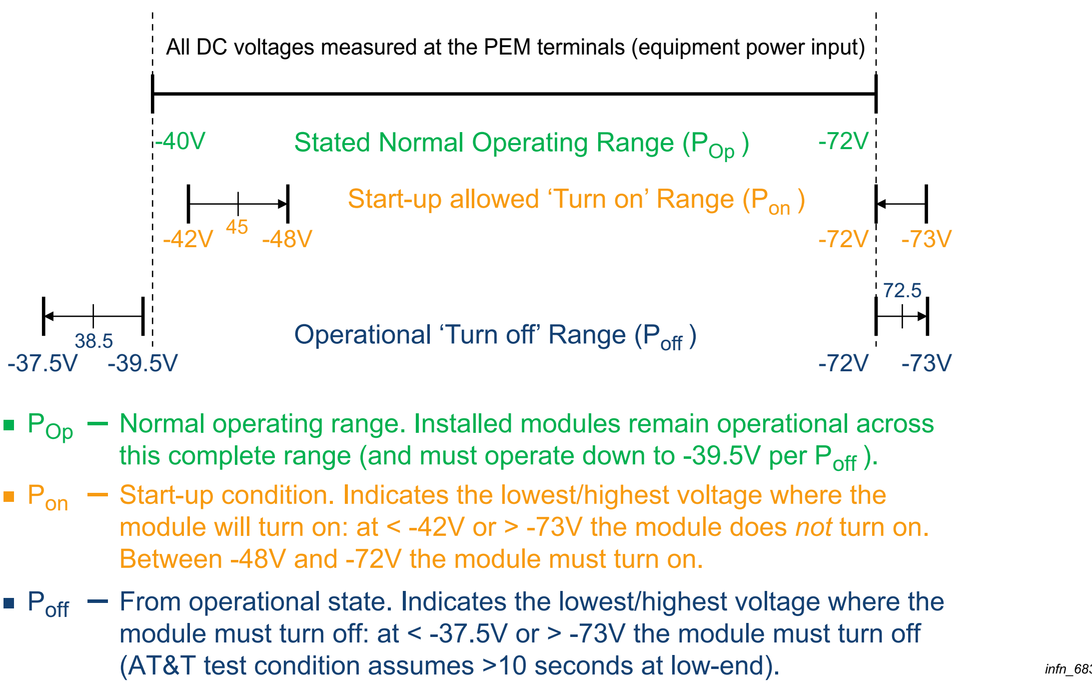
- For environments under 40º C (normal operation), the inrush current will not exceed that for the 40º C worst-case power consumption
- For environments under 55º C (short-term operation), the inrush current will not exceed that for the 55º C worst-case power consumption

Input Voltage Operating Range and Thresholds

The OTC DC input voltage operating range and thresholds are shown in Figure 4-1. Each module implements the voltage thresholds independently and may turn on/off at different voltages within the specified range. The thresholds comply with the ATT-TP-76200 standard.

The thresholds shown in Figure 4-1 do not apply to fan trays which operate over a wider voltage range.

Figure 4-1 Input Voltage Operating Range and Thresholds



OTC Compliancy

The OTC complies with many Industry standard specifications as described in Table 4-2.

Table 4-2 OTC Hardware Compliancy

Category	Approval Agency / Requirement
Safety Certifications	• IEC/EN/UL 60950: Safety of Information Technology Equipment • CAN/CSA C22.2 No. 60950: Safety of Information Technology Equipment • AS/NZS 60950: Approval & Test specification - Safety of Information Technology Equipment • UL Class II: Fire Safety (air filters)

NEBS/ETSI Compliancy	• NEBS Level 1/3
	  • GR-63-CORE: Network Equipment Building Systems - Physical Protection
	  • GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety - Generic requirement for Network Telecommunications Equipment
	• ETS 300 386
	• ETS 300 019-2-1, 2, 3, and 4 A1 (earthquake test methods)
	• ETS 300 753

EMC Emissions	• CISPR 22/EN55022 Class A, FCC-A, VCCI-A
EMC Immunity	• CISPR 24/EN55024

Laser Safety	• IEC/EN 60825 Series: Safety of Laser Products
	  • IEC/EN 60825-1: 2007
	  • IEC/EN 60825-2: 2004+A1
	• FDA 21 CFR 1040: Performance Standard of Light Emitting Products

General Compliancy	• ETSI ETS 300 119-2 • ETSI ETS 300 119-4 • GR-78-CORE • GR-253-CORE • GR-1209-CORE • GR-1221-CORE • ANSI T1.315 • ANSI T1.304 • ATT-TP-76200

OTC Technical Specifications

Table 4-3 provides electrical and environmental specifications for the OTC, common components, and all supported circuit packs.

Table 4-3 OTC Technical Specifications

Type	Parameter	Specification
Electrical specifications	Power consumption	Typical: 192W (approximately) Maximum: 400W See Table 4-1 on page 4-2 for module level power consumption numbers
	Input voltage range	-40V DC to -72V DC (Worldwide except for Australia/New Zealand) IEC/EN/UL/CSA 60950 See Figure 4-1 on page 4-4 for detailed information regarding the input voltage operating range and thresholds
		-40V DC to -60V DC (Australia/New Zealand only) ANZ60950-1
Environmental specifications	Operating temperature range	Normal operation (including system power up): 5º C to 40º C Short term operation: -5º C to 55º C
	Storage temperature range	-40º C to 70º C
	High relative humidity	90% non-condensing

OTC Overview

Note: Unless specifically noted otherwise, all references to the RAM will refer to either the RAM-1, RAM-2-OR, or REM-2 interchangeably.

Table 4-4 provides a list of OTC components and field-replaceable circuit packs.

Table 4-4 OTC Common Components and Supported Circuit Packs

Name	Description
Rack Mounting Ears	See page 4-13
Power Entry Module (PEM)	See page 4-15
Input/Output Alarm Panel (IAP)	See page 4-18
Fan Tray	See page 4-28
Air Filter	See page 4-29
Card Cage	See page 4-30
Optical Management Module (OMM)	See page 4-31
Optical Amplification Module (OAM)	See page 4-34
Raman Amplifier Module (RAM)	See page 4-47
Optical Raman Module (ORM)	See page 4-61
Submarine Control Module (SCM)	See page 4-76
Dynamic Spectrum Equalizer (DSE)	See page 4-86
Blank Circuit Packs	See page 4-92

Chassis Type Identification

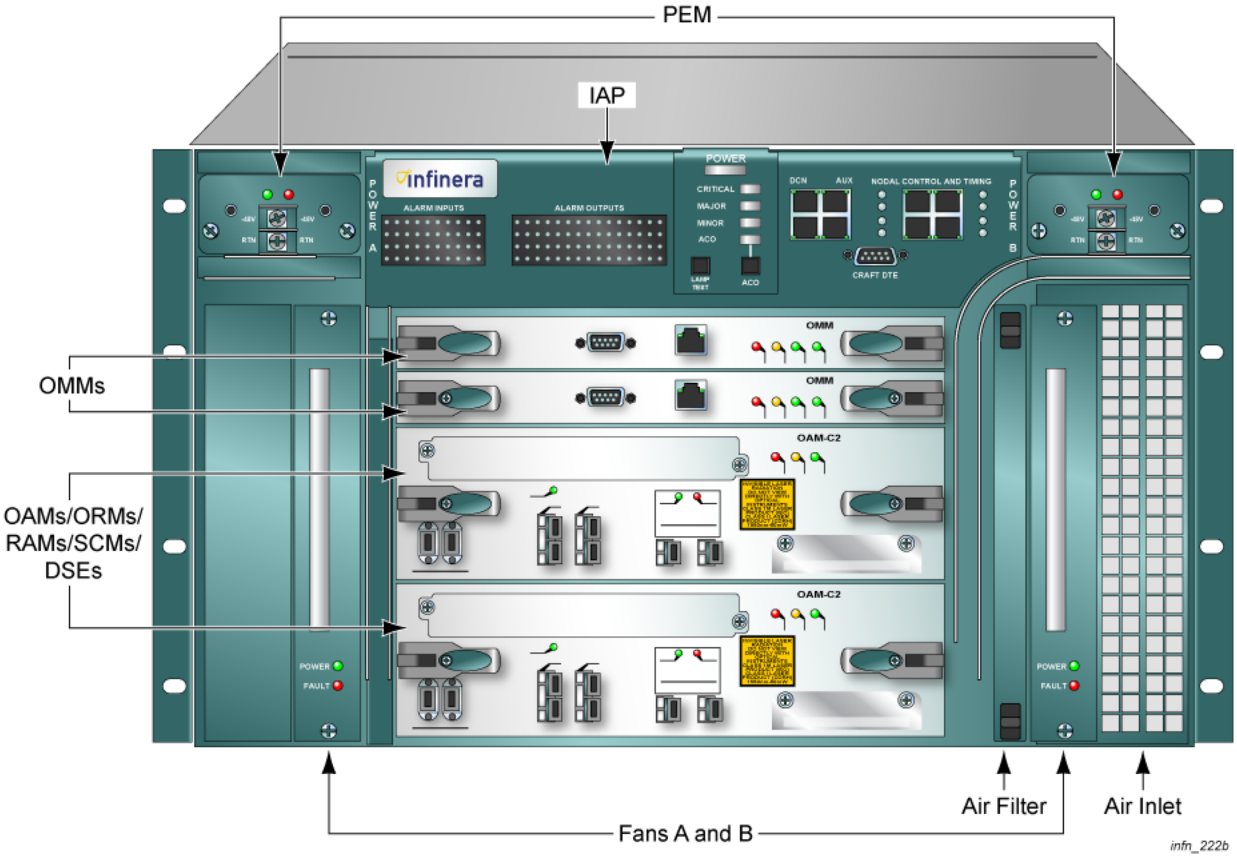
The OTC is available as an ANSI or ETSI chassis type and can be identified as follows:

- A product label located on the right side of the chassis identifies the chassis type as ANSI or ETSI
- The jumper termination value used for ITU Building Integrated Timing Supply (BITS) is set to 100 Ohms for ANSI or 120 Ohms for ETSI. This value is preset at the factory and not field-upgradeable
- An internal serial EEPROM setting identifies the chassis type as ANSI or ETSI

Front View

A front view of the OTC with chassis components and circuit packs is shown in Figure 4-2.

Figure 4-2 OTC Front View



OTC Thermal Loading

Table 4-5 provides typical heat release information for the OTC housed in a 23-inch frame.

Table 4-5 OTC Typical Heat Release

OTC Typical Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	192								
Frame Depth (feet)	1.00								
Frame Width (feet)	2.17								
Equipment Height (feet)	1.02								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
	Heat Release (Watts/ft^2)								
1.0	43.4	38.6	34.7	31.6	29.0	26.7	24.8	23.2	21.7
1.5	38.6	34.7	31.6	29.0	26.7	24.8	23.2	21.7	20.4
2.0	34.7	31.6	29.0	26.7	24.8	23.2	21.7	20.4	19.3
2.5	31.6	29.0	26.7	24.8	23.2	21.7	20.4	19.3	18.3
3.0	29.0	26.7	24.8	23.2	21.7	20.4	19.3	18.3	17.4
3.5	26.7	24.8	23.2	21.7	20.4	19.3	18.3	17.4	16.5
4.0	24.8	23.2	21.7	20.4	19.3	18.3	17.4	16.5	15.8
4.5	23.2	21.7	20.4	19.3	18.3	17.4	16.5	15.8	15.1
5.0	21.7	20.4	19.3	18.3	17.4	16.5	15.8	15.1	14.5

Table 4-6 provides maximum heat release information for the OTC housed in a 23-inch frame.

Table 4-6 OTC Maximum Heat Release

OTC Maximum Heat Release Calculation for 23-inch (600mm) Frame									
Power Consumption (Watts)	400								
Frame Depth (feet)	1.00								
Frame Width (feet)	2.17								
Equipment Height (feet)	1.02								
Maintenance Aisle (feet)	**Wiring Aisle (feet)**								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	
	Heat Release (Watts/ft^2)								
1.0	56.9	50.6	45.5	41.4	37.9	35.0	32.5	30.4	28.5
1.5	50.6	45.5	41.4	37.9	35.0	32.5	30.4	28.5	26.8
2.0	45.5	41.4	37.9	35.0	32.5	30.4	28.5	26.8	25.3
2.5	41.4	37.9	35.0	32.5	30.4	28.5	26.8	25.3	24.0
3.0	37.9	35.0	32.5	30.4	28.5	26.8	25.3	24.0	22.8
3.5	35.0	32.5	30.4	28.5	26.8	25.3	24.0	22.8	21.7
4.0	32.5	30.4	28.5	26.8	25.3	24.0	22.8	21.7	20.7
4.5	30.4	28.5	26.8	25.3	24.0	22.8	21.7	20.7	19.8
5.0	28.5	26.8	25.3	24.0	22.8	21.7	20.7	19.8	19.0

OTC Product Details

Table 4-7 lists the name and a brief description of each of the supported OTCs.

Table 4-7 OTC Product Details

Product Ordering Name (PON)	Description
OTC-ANSI-A	Optical Transport Chassis ANSI
OTC-ETSI-A	Optical Transport Chassis ETSI

Functional Description

The Optical Transport Chassis, referred to as OTC, performs bidirectional optical amplification of the signal. In addition, each OTC:

- Performs optical multiplexing and demultiplexing of the C-Band
- Implements up to one hundred sixty 10Gbps channels in the C-Band channel plan
- Can be installed in an ETSI (300mm) cabinet, ETSI (600mm) rack, 23-inch rack, or 19-inch rack
- Can be deployed as a Main Chassis or Expansion Chassis within an Optical Line Amplifier
    - Optical Line Amplifiers can be configured as a multi-chassis node (separate from a DTN). Multi-chassis Optical Line Amplifiers can be configured with up to 4 OTCs (with optional control module redundancy on each chassis) with 2 OAM/ORMs on the Main Chassis and up to 2 Raman modules or 2 DSEs on each Expansion Chassis. Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis). Optical Line Amplifiers do not support DTCs/MTCs as Expansion Chassis
- Can be deployed as an Expansion Chassis within a DTN
    - Each OTC Expansion Chassis can house up to 2 Raman modules or 2 DSEs (with optional control module redundancy on any chassis). Additionally, an OTC Expansion Chassis can house OAM/ORMs when these modules are connected to BMM2Ps (installed in a DTC Main or DTC Expansion Chassis)

The OTC is composed of the following components (see Figure 4-2 on page 4-8 for an illustration):

- "Rack Mounting Ears" on page 4-13
- "Power Entry Module (PEM)" on page 4-15
- "Input/Output (I/O) Alarm Panel (IAP)" on page 4-18
- "Fan Tray" on page 4-28
- "Air Filter" on page 4-29
- "Card Cage" on page 4-30

Configuration Guidelines

Note: Configuring an Optical Line Amplifier as a Gateway Network Element (GNE) is not supported.

- Supported configurations for OTCs configured as a Main Chassis are described as follows:
  - Two OAMs can provisioned in the same OTC
  - Two ORMs can be provisioned in the same OTC
  - One OAM and one ORM can be provisioned in the same OTC
- Supported configurations for OTCs configured as an Expansion Chassis are described as follows:
  - Two RAM-1s can be provisioned in the same OTC
  - One RAM-1 and one RAM-2-OR can be provisioned in the same OTC
  - Two RAM-2-ORs can be provisioned in the same OTC
  - One RAM-2-OR and one REM-2 can be provisioned in the same OTC
  - One OAM (OAM-CXH1-MS only) and one ORM can be provisioned in the same OTC when configured with BMM2Ps (DTN with an OAM/ORM preamplifier configuration)
  - One OAM (OAM-CXH1-MS only) can be provisioned (in slot 2 or 3) of the OTC when configured with an ORM-CXH1 (Optical Line Amplifier with an OAM booster configuration)
  - Two DSEs can be provisioned in the same OTC
  - One DSE and one RAM-1 or RAM-2-OR module can be provisioned in the same OTC
  - One DSE and either one OAM (OAM-CXH1-MS only) or one ORM (ORM-CXH1-MS only) can be provisioned in the same OTC when configured with BMM2Ps (DTN with an OAM/ORM preamplifier configuration)
  - One DSE and one OAM (OAM-CXH1-MS only) can be provisioned in the same OTC when configured with an ORM-CXH1 (Optical Line Amplifier with an OAM booster configuration)
  - RAM-1 and REM-2 modules cannot be provisioned in the same OTC. An Equipment Mismatch alarm will be reported by the management interfaces for the second (RAM-1 or REM-2) module that is installed
  - Two REM-2 modules cannot be provisioned in the same OTC. An Equipment Mismatch alarm will be reported by the management interfaces for the second REM-2 module that is installed
  - DSE and REM-2 modules cannot be provisioned in the same OTC. An Equipment Mismatch alarm will be reported by the management interfaces for the second module that is installed
  - SCMs can be provisioned in slots 2 and/or 3 of an OTC and can reside in the same chassis as an OAM, ORM, DSE, Raman module, or with another SCM. However, the SCM cannot be directly connected to the DSE, nor can the SCM be configured on the same link with an ORM or a Raman module.

Mechanical Specifications

Table 4-8 provides the mechanical specifications for the OTC.

Table 4-8 OTC Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	12.20 inches / 309.88mm (7 RU)
	Width	19.50 inches / 495.30mm
	Depth	9.30 inches / 236.22mm
	Weight	49.5lb / 22.4kg
Mounting height	23-inch chassis plus mounting kit	7 RU or 12.44 SU
	19-inch chassis plus mounting kit	13 RU or 23.11 SU

The OTC contains four electrical grounding points. Two sets of two 1/4-20 press-nuts are located on the chassis at the rear bottom position and one set on each side of the chassis.

Rack Mounting Ears

Each OTC includes integrated rack mounting ears used to flush mount the chassis in an ETSI (300mm) cabinet or ETSI (600mm) rack. Separate rack mounting ears are provided to mount the chassis on a 23-inch rack in flush, 5-inch forward, or 6-inch forward mount positions. An optional rack mounting kit is available for installing the OTC on a 19-inch rack (vertically mounted).

Table 4-9 lists the rack mounting kits available for the OTC.

Table 4-9 OTC Rack Mounting Kits

Product Ordering Name (PON)	Description
O-MOUNTING-B1	OTC 23-inch Mounting Kit
O-MOUNTING19-B1	OTC 19-inch Mounting Kit

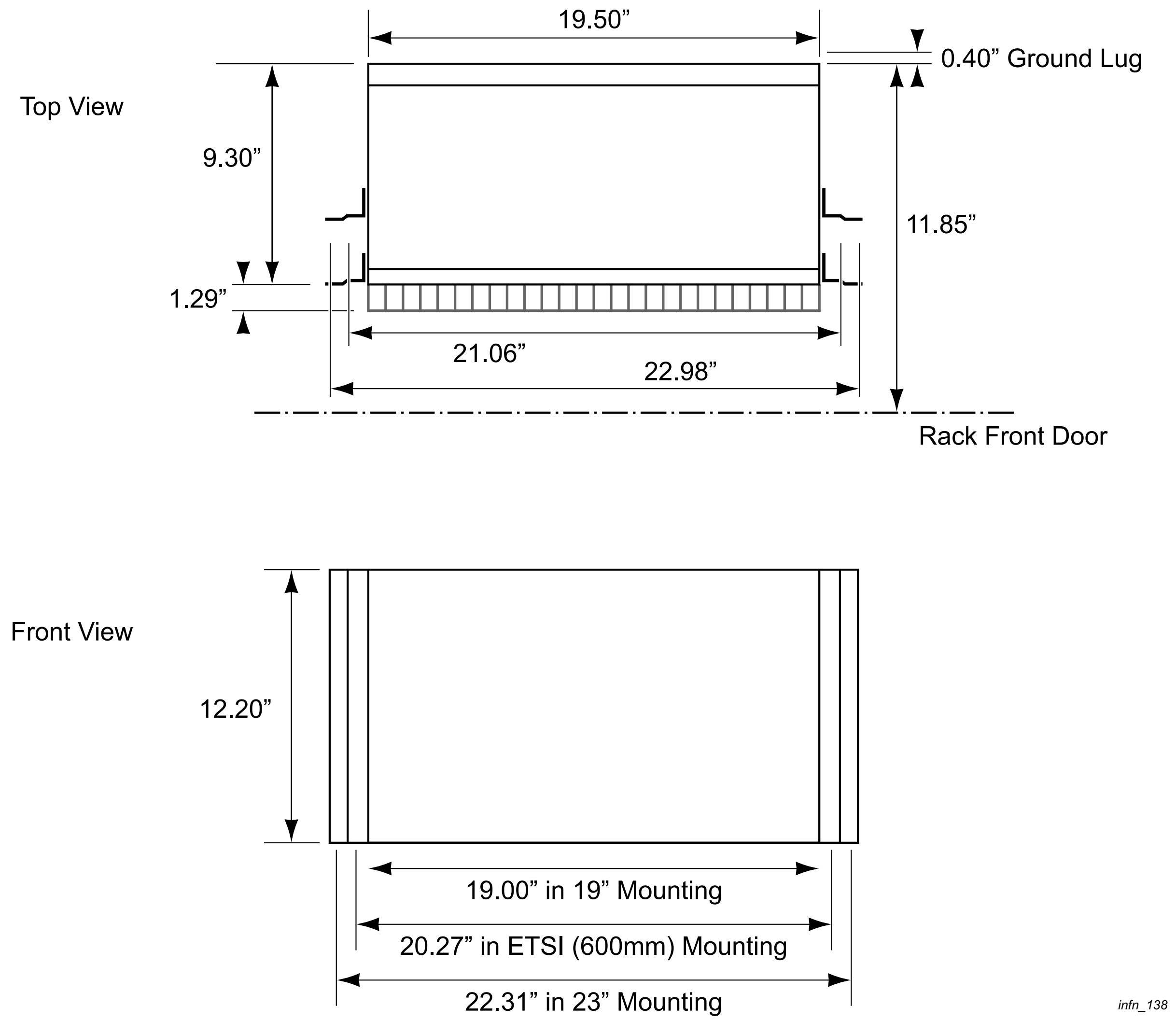
When the rack mounting ears are in the 5-inch back and 6-inch back positions for a forward mount configuration, the OTC uses slack managers to route the fiber-optic cables. The slack managers on each side of the OTC maximizes valuable rack space and help to eliminate the pinching of cable in addition to providing correct cable bend radius. This ensures the system’s continual integrity and protection against signal loss or degradation.

Vertical Hole Spacing

- For ANSI rack mounting ears, the spacing between each hole is: 1.5 inches (38.1mm)
- For ETSI rack mounting ears, the spacing between each hole is: 75mm

The OTC top and front dimensions of the chassis are provided in Figure 4-3.

Figure 4-3 OTC Dimensions



Power Entry Module (PEM)

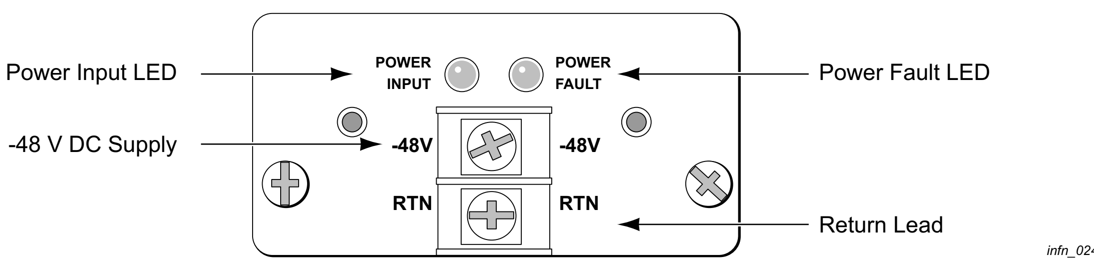
Table 4-10 PEM Product Details

Product Ordering Name (PON)	Description
O-PEM-A	Power Entry Module, 10A

The top position of the OTC accommodates two PEMs (PEM A and PEM B) for redundant power feeds. The PEM is a pluggable module. The power feeds into the PEM from each side of the chassis. See Figure 4-4 for the display details.

External Indicators

Figure 4-4 OTC PEM Faceplate



Power LEDs

The PEMs located on top of the chassis provide two status LEDs: POWER INPUT and POWER FAULT. The significance of a lit LED is described in Table 4-11. There are two PEMs per OTC for redundancy.

Table 4-11 OTC PEM Visual Alarm Indicators

POWER INPUT (Green)	POWER FAULT (Red)	Description
ON	OFF	Input lead is receiving power Power output from the PEM as per specifications
ON	ON	Input lead is receiving power Power output from the PEM not to specifications
OFF	ON	Input lead is not receiving power No power output from the PEM as per specifications
OFF	OFF	Input lead is not receiving power No power to either PEM

Connectors

Each PEM is provided with a terminal block with two wire clamps. One wire clamp is for connection to -48V DC Power and the second to its Return. A plastic safety cover is provided to prevent inadvertent contact with the terminals once installed.

CAUTION

To prevent damage to the PEM, all compression lugs used must fit a #6-32 block screw, and the lug width must not exceed 0.31 inch.

Technical Specifications

Table 4-12 provides the mechanical and electrical specifications for the OTC PEM.

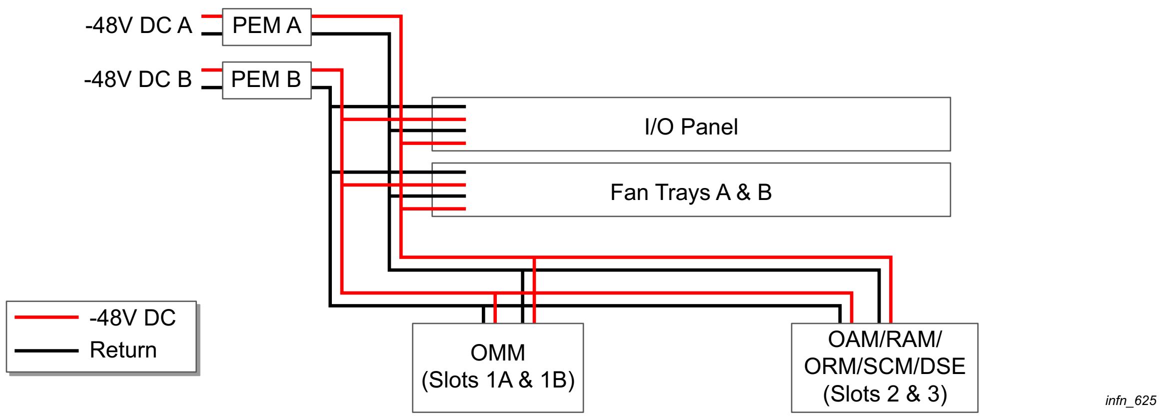
Table 4-12 OTC PEM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.50 inches / 38.10mm
	Width	2.20 inches / 55.88mm
	Depth	8.53 inches / 216.66mm
	Weight	0.5lb / 0.2kg
Electrical specifications	Power consumption	Included as part of base OTC system; see Table 4-1 on page 4-2

Power Distribution Architecture

PEM A and PEM B, which provide redundant power to the OTC, distribute power to the power connectors of the backplane. The backplane feeds the power supply from each PEM to the circuit packs as shown in Figure 4-5.

Figure 4-5 OTC Power Distribution Diagram



The OTC hardware modules combine the power feed by diode-ORing. The -48V DC inputs are individually fused on the circuit packs, the IAP, and fan trays to protect it from overcurrent conditions. The fuse is not field-replaceable. The status of each fuse is monitored before the ORing diodes. A diode and a transient voltage suppression (TVS) diode are provided to protect against reverse polarity and transient overvoltage conditions.

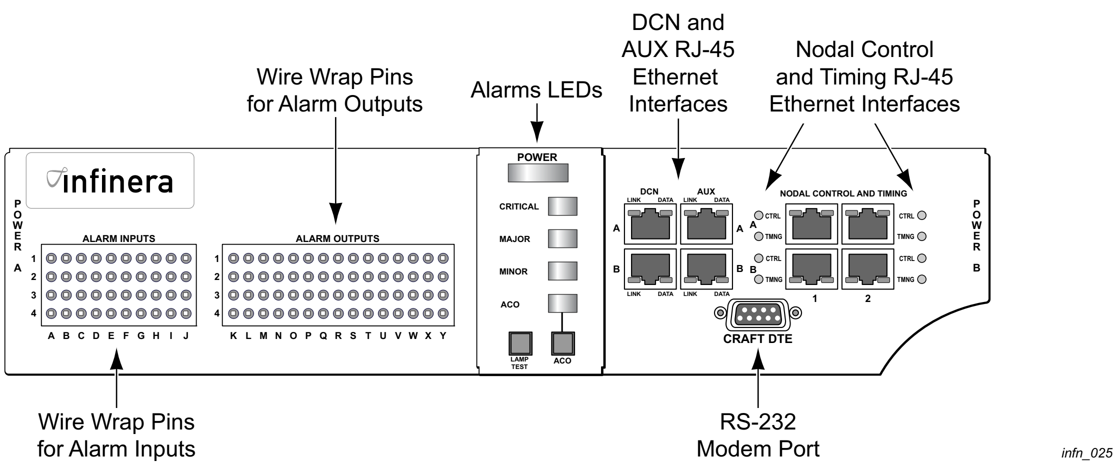
Input/Output (I/O) Alarm Panel (IAP)

The IAP is located at the top of the OTC. The IAP houses the management and operations interfaces and environmental alarm input and output contacts as shown in Figure 4-6 and enumerated below:

- Two 10/100Mbps auto-negotiating Data Communication Network (DCN) RJ-45 Ethernet interfaces, labeled as DCN. This interface provides ports for Ethernet network connectivity
- Two 10/100Mbps auto-negotiating Administrative Inter-LAN RJ-45 Ethernet interfaces, labeled as AUX. This interface provides ports for Datawire services
- Four 10/100Mbps auto-negotiating inter-chassis interconnect RJ-45 Ethernet interfaces, labeled as Nodal Control and Timing (NCT). This interface provides ports for a multi-chassis configuration
- Craft RS-232 Modem port labeled as Craft DTE
- Chassis level alarm LED (Power, Critical, Major, and Minor)
- One Lamp Test button
- One Alarm Cutoff (ACO) button
- One ACO LED
- Environmental alarm contacts through wire wrap pins

External Indicators

Figure 4-6 OTC IAP Front View



Chassis Level Alarm LEDs

The IAP provides five chassis level alarm LEDs. Each chassis has an Alarm Cutoff (ACO) button on the alarm panel which controls the reporting of audible alarms. The significance of a lit LED is described in Table 4-13.

Table 4-13 OTC Visual Alarm Indicators - Chassis Level

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply within the specified operating range to the chassis
CRITICAL	Red	Indicates the presence (lit) or absence (dimmed) of at least one Critical alarm in the chassis
MAJOR	Red	Indicates the presence (lit) or absence (dimmed) of at least one Major alarm in the chassis
MINOR	Yellow	Indicates the presence (lit) or absence (dimmed) of at least one Minor alarm in the chassis
ACO	Yellow	Indicates the presence (lit) or absence (dimmed) of the Alarm Cutoff function

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding chassis level LED functions. The OTC does not provide bay level indicators; instead, the bay LEDs on the power distribution unit (PDU) must be used to indicate the bay level alarm status.

Lamp Test

The IAP panel contains a lamp test button for testing the LEDs. When the lamp test button is pressed, all LEDs on the IAP panel and the circuit packs on the chassis are lit (power LEDs illuminate Green and fault LEDs illuminate Red) and bi-color LEDs will toggle between two colors (Green and Yellow) until the lamp test button is released. Once the lamp test button is released, all LEDs will return to the previous condition.

Alarm Cutoff (ACO) Indicators

The IAP contains one ACO button and an ACO LED. The ACO feature allows muting of the external audible alarms. When the ACO button is pressed, all current critical, major, and minor audio alarms are muted and the ACO LED is lit. See Table 4-14 for the description of the alarm state and the ACO LED state.

Table 4-14 OTC Audio Alarm Conditions - Chassis Level

Condition	ACO LED State	Audio Alarm
There are no external alarms on the chassis	OFF	Not present
An external alarm is raised on the chassis	OFF	Present
ACO button is pressed	ON	Muted
An external alarm is cleared	OFF	Not present

I/O Connectors

The IAP contains external connectors for input and output dry alarm contacts. They are 0.045sq. inch pins accessible from the front of IAP for easy interconnection. These contacts are used for integration with existing environmental alarm systems.See Table 4-15 for connectors on the IAP.

Table 4-15 OTC IAP Connectors

Connector	Type	Purpose
ALARM INPUTS	0.045sq. inch wire wrap pins	Environmental alarm inputs
ALARM OUTPUTS	0.045sq. inch wire wrap pins	Environmental alarm output and office alarm output contacts
DCN A, DCN B	10/100Base-Tx Auto-MDIX RJ-45	Two connectors with redundancy for remote management through DCN
AUX A, AUX B	10/100Base-Tx Auto-MDIX RJ-45	Two connectors with redundancy for datawire service to carry customer management traffic
NODAL CONTROL AND TIMING (NCT)	10/100Base-Tx Auto-MDIX RJ-45	Four connectors for Inter-chassis communication for uplink and downlink with A and B connectors for redundancy
CRAFT DTE	9600 baud RS-232 DTE DB-9 Male	For remote management through external modem

Note: NCT ports are used for multi-chassis interconnection.

Note: In a multi-chassis configuration the DCN and AUX ports on the Main chassis are active. The DCN and AUX ports on the Expansion Chassis are disabled.

DCN and AUX Port LEDs

The I/O panel provides DCN and AUX port visual indicators: a DATA and a LINK LED. The significance of an illuminated LED is described in Table 4-16.

Table 4-16 OTC Visual Alarm Indicators on the DCN and AUX Ports

DATA (Green)	LINK (Green)	Description
ON	ON	• Link established • The port is active
OFF	OFF	• Link not established
OFF	ON	• Link established • The port is not active

NCT Port LEDs

The I/O panel provides NCT port visual indicators: a Control (CTRL) and a Timing (TMNG) LED. The significance of an illuminated LED is described in Table 4-17.

Table 4-17 OTC Visual Alarm Indicators on the NCT Ports

LED	Color	Description
CTRL	Tri-color	• ON (Green)—Link is established, rapid spanning tree protocol (RSTP) is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established
TMNG	Tri-color	• ON (Green)—Link is established, RSTP is in the Forwarding state • ON (Red)—Fault on the NCT port • ON (Yellow)—Link is established, Standby mode • OFF—Link is not established

Chassis Level Audio Indicators

The IAP provides output alarm contacts for CRITICAL, MAJOR, and MINOR audio alarms. Audio alert is triggered when an alarm is raised on the chassis.

Technical Specifications

The environmental alarm contacts have electrical ratings as described in Table 4-18.

Table 4-18 OTC Alarm Relay Contact Specifications

Parameter	Value
Maximum voltage	250V AC, 220V DC
Maximum current	2A
Rated load	0.5A @ 125V AC, 2A @ 30V DC
Wire size	24 AWG min.
Maximum surge voltage between contact and coil	2,500V

Alarm Input Contact Pin Assignments

Table 4-19 specifies the assignment of alarm input contact pins for the OTC. One alarm contact is predefined. There are sixteen user-defined alarm contacts useful for generation of customized alarms which can be triggered remotely through network management.

Note: Input contacts 17, 18, and 19 are not supported on the OTC.

Table 4-19 OTC Alarm Input Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	A	Alarm Input Contact 1	User defined
1	B	Alarm Input Contact 1	User defined
1	C	Alarm Input Contact 5	User defined
1	D	Alarm Input Contact 5	User defined
1	E	Alarm Input Contact 9	User defined
1	F	Alarm Input Contact 9	User defined
1	G	Alarm Input Contact 13	User defined
1	H	Alarm Input Contact 13	User defined
1	I	Alarm Input Contact 17	Not supported

Table 4-19 OTC Alarm Input Contact Pin Assignments

Pin		Description	Function
1	J	Alarm Input Contact 17	Not supported
2	A	Alarm Input Contact 2	User defined
2	B	Alarm Input Contact 2	User defined
2	C	Alarm Input Contact 6	User defined
2	D	Alarm Input Contact 6	User defined
2	E	Alarm Input Contact 10	User defined
2	F	Alarm Input Contact 10	User defined
2	G	Alarm Input Contact 14	User defined
2	H	Alarm Input Contact 14	User defined
2	I	Alarm Input Contact 18	Not supported
2	J	Alarm Input Contact 18	Not supported
3	A	Alarm Input Contact 3	User defined
3	B	Alarm Input Contact 3	User defined
3	C	Alarm Input Contact 7	User defined
3	D	Alarm Input Contact 7	User defined
3	E	Alarm Input Contact 11	User defined
3	F	Alarm Input Contact 11	User defined
3	G	Alarm Input Contact 15	User defined
3	H	Alarm Input Contact 15	User defined
3	I	Alarm Input Contact 19	Not supported
3	J	Alarm Input Contact 19	Not supported
4	A	Alarm Input Contact 4	User defined
4	B	Alarm Input Contact 4	User defined
4	C	Alarm Input Contact 8	User defined
4	D	Alarm Input Contact 8	User defined
4	E	Alarm Input Contact 12	User defined
4	F	Alarm Input Contact 12	User defined
4	G	Alarm Input Contact 16	User defined
4	H	Alarm Input Contact 16	User defined
4	I	Reserved for Alarm Cutoff[a]	Predefined
4	J	Reserved for Alarm Cutoff[a]	Predefined

a. ACO can be enabled using the input contact pins in addition to the ACO push button and the Infinera GNM user interface.

Alarm Output Contact Pin Assignments

Table 4-20 lists the assignment of alarm output contact pins for the OTC. Ten alarm contacts are pre-defined in the system and the remaining ten contacts can be customized by the users to monitor the environmental alarms.

Table 4-20 OTC Alarm Output Contact Pin Assignments

Pin		Description	Function
Row	Column		
1	K	Alarm Output Contact 1, RETURN	User defined
1	L	Alarm Output Contact 1, NORMALLY OPEN	User defined
1	M	Alarm Output Contact 1, NORMALLY CLOSED	User defined
1	N	Alarm Output Contact 5, RETURN	User defined
1	O	Alarm Output Contact 5, NORMALLY OPEN	User defined
1	P	Alarm Output Contact 5, NORMALLY CLOSED	User defined
1	Q	Alarm Output Contact 9, RETURN	User defined
1	R	Alarm Output Contact 9, NORMALLY OPEN	User defined
1	S	Alarm Output Contact 9, NORMALLY CLOSED	User defined
1	T	Minor Audio Alarm, RETURN	Predefined
1	U	Minor Audio Alarm, NORMALLY OPEN	Predefined
1	V	Minor Audio Alarm, NORMALLY CLOSED	Predefined
1	W	Power Fault Bay Alarm, RETURN	Predefined
1	X	Power Fault Bay Alarm, NORMALLY OPEN[a]	Predefined

Table 4-20 OTC Alarm Output Contact Pin Assignments

Pin		Description	Function
1	Y	Power Fault Bay Alarm, NORMALLY CLOSED[a]	Predefined
2	K	Alarm Output Contact 2, RETURN	User defined
2	L	Alarm Output Contact 2, NORMALLY OPEN	User defined
2	M	Alarm Output Contact 2, NORMALLY CLOSED	User defined
2	N	Alarm Output Contact 6, RETURN	User defined
2	O	Alarm Output Contact 6, NORMALLY OPEN	User defined
2	P	Alarm Output Contact 6, NORMALLY CLOSED	User defined
2	Q	Alarm Output Contact 10, RETURN	User defined
2	R	Alarm Output Contact 10, NORMALLY OPEN	User defined
2	S	Alarm Output Contact 10, NORMALLY CLOSED	User defined
2	T	Critical Visual Alarm, RETURN	Predefined
2	U	Critical Visual Alarm, NORMALLY OPEN	Predefined
2	V	Critical Visual Alarm, NORMALLY CLOSED	Predefined
2	W	Critical Bay Alarm, RETURN	Predefined
2	X	Critical Bay Alarm, NORMALLY OPEN	Predefined
2	Y	Critical Bay Alarm, NORMALLY CLOSED	Predefined
3	K	Alarm Output Contact 3, RETURN	User defined

Table 4-20 OTC Alarm Output Contact Pin Assignments

Pin		Description	Function
3	L	Alarm Output Contact 3, NORMALLY OPEN	User defined
3	M	Alarm Output Contact 3, NORMALLY CLOSED	User defined
3	N	Alarm Output Contact 7, RETURN	User defined
3	O	Alarm Output Contact 7, NORMALLY OPEN	User defined
3	P	Alarm Output Contact 7, NORMALLY CLOSED	User defined
3	Q	Critical Audio Alarm, RETURN	Predefined
3	R	Critical Audio Alarm, NORMALLY OPEN	Predefined
3	S	Critical Audio Alarm, NORMALLY CLOSED	Predefined
3	T	Major Visual Alarm, RETURN	Predefined
3	U	Major Visual Alarm, NORMALLY OPEN	Predefined
3	V	Major Visual Alarm, NORMALLY CLOSED	Predefined
3	W	Major Bay Alarm, RETURN	Predefined
3	X	Major Bay Alarm, NORMALLY OPEN	Predefined
3	Y	Major Bay Alarm, NORMALLY CLOSED	Predefined
4	K	Alarm Output Contact 4, RETURN	User defined
4	L	Alarm Output Contact 4, NORMALLY OPEN	User defined
4	M	Alarm Output Contact 4, NORMALLY CLOSED	User defined

Table 4-20 OTC Alarm Output Contact Pin Assignments

Pin		Description	Function
4	N	Alarm Output Contact 8, RETURN	User defined
4	O	Alarm Output Contact 8, NORMALLY OPEN	User defined
4	P	Alarm Output Contact 8, NORMALLY CLOSED	User defined
4	Q	Major Audio Alarm, RETURN	Predefined
4	R	Major Audio Alarm, NORMALLY OPEN	Predefined
4	S	Major Audio Alarm, NORMALLY CLOSED	Predefined
4	T	Minor Visual Alarm, RETURN	Predefined
4	U	Minor Visual Alarm, NORMALLY OPEN	Predefined
4	V	Minor Visual Alarm, NORMALLY CLOSED	Predefined
4	W	Minor Bay Alarm, RETURN	Predefined
4	X	Minor Bay Alarm, NORMALLY OPEN	Predefined
4	Y	Minor Bay Alarm, NORMALLY CLOSED	Predefined

a. When there is no power fault condition, the Normally Open contact is closed and the Normally Closed contact is open. When both PEM A and PEM B have power fault condition, the Normally Open contact is open and Normally Closed contact is closed. The power fault is defined as when the power input into PEM A or PEM B is out of working range.

Fan Tray

The OTC contains two removable fan trays, one on the left and one on the right of the chassis. Each fan tray consists of an individually controlled fan. The thermal system employs a push-pull approach to move air through the system, with airflow entering from the front of the chassis near the right side and exiting from the rear of the chassis near the left side (or from the front and rear for ETSI). The fan on the left side of the chassis is referred to as Fan Tray A, and the fan on the right side is referred to as Fan Tray B, when looking at the front of the OTC.

If one of the fan trays fails, the OTC system can operate indefinitely in an environment up to 50ºC. An alarm will be generated that indicates one of the fans has failed. Although the system can run reliably with one fan tray failed, the user should change the fan tray at the earliest convenience to ensure against a second fan tray failure.

The failed fan tray should be kept installed inside the OTC system until the new fan tray is ready to replace it. If a fan tray is completely removed from the OTC system, the system should be able to run without failure in an ambient up to 45ºC as long as the air filter is clean.

The fan trays should never be partially removed from the system unless performing air filter maintenance (when performing air filter maintenance, the fan trays should not be removed from the system for more than one minute).

Fan Tray LEDs

The fan trays have two status LEDs: POWER and FAULT LEDs are provided on each fan tray. The significance of a lit LED is described in Table 4-21.

Table 4-21 OTC Visual Alarm Indicators on the Fan Tray

LED	Color	Description
POWER	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the fan tray
FAULT	Red	Indicates the presence (lit) or absence (dimmed) of a fault condition with the fan tray. Flashing Red indicates that the fan is not under control of the active OMM (for example, the active OMM has been reset or physically removed from the system)

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding fan tray LED functions.

Technical Specifications

Table 4-22 provides the mechanical and electrical specifications for the OTC fan tray.

Table 4-22 OTC Fan Tray Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	7.75 inches / 196.85mm
	Width	1.23 inches / 31.24mm
	Depth	8.10 inches / 205.74mm
	Weight	2.5lb / 1.1kg
Electrical specifications	Power consumption	Included as part of base OTC system; see Table 4-1 on page 4-2

Air Filter

A replaceable air filter is necessary to filter out dust particles at the air intake of the OTC. Air is filtered at 80% dust arrestance. To ensure adequate cooling of the OTC the air filter must be inspected at regular intervals and possibly replaced. Infinera recommends inspecting the air filter once every six months.

Mechanical Specifications

Table 4-23 provides the mechanical specifications for the OTC air filter.

Table 4-23 OTC Air Filter Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	0.65 inches / 16.51mm
	Width	8.75 inches / 222.25mm
	Depth	8.60 inches / 218.44mm
	Weight	Less than 0.5lb / 0.2kg
	Dust arrestance	80%

Card Cage

The OTC contains a single card cage consisting of three chassis slots which house the circuit packs that provide the optical and digital transport functions of the system as shown in Figure 4-7.

Slot 1 is divided into two half-height slots (1A and 1B) reserved for OMMs, and slots 2 and 3 are full-height slots reserved for OAM/RAM/ORM/SCM/DSEs. OAM/ORMs are supported on OTCs configured as a Main Chassis while RAM/SCM/DSEs are supported on OTCs configured as an Expansion Chassis.

The card cage houses the circuit packs horizontally. Table 4-24 outlines the OTC card slot assignments.

Figure 4-7 OTC Card Cage

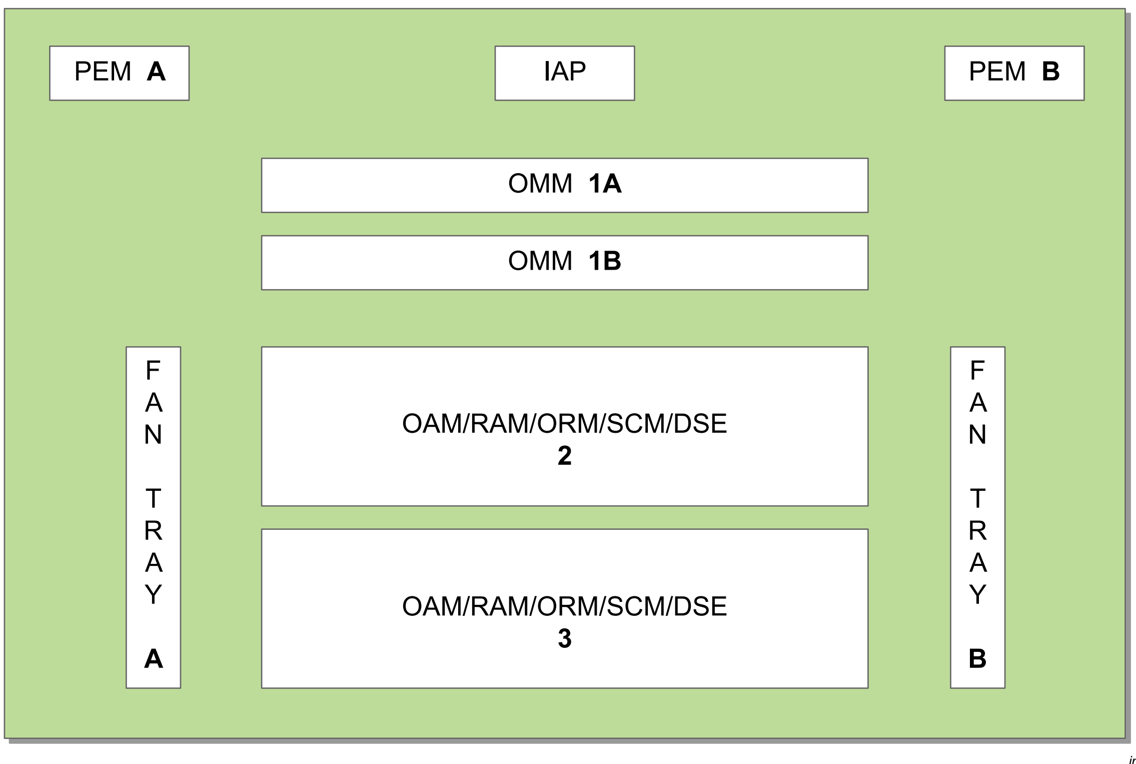


Table 4-24 OTC Card Slot Assignments

Slot Number	Module Type
1A	OMM
1B	
2	OAM/RAM/ORM/SCM/DSE
3	OAM/RAM/ORM/SCM/DSE

Optical Management Module (OMM)

Table 4-25 OMM Product Details

Product Ordering Name (PON)	Description
OMM-A	Optical Management Module

Functional Description

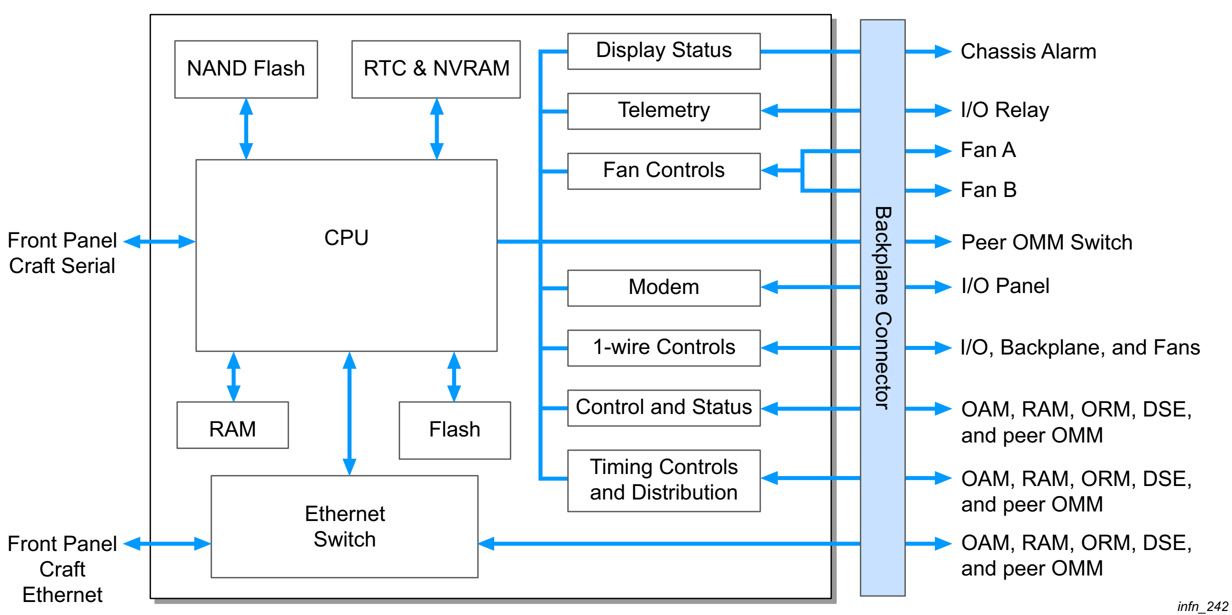
The Optical Management Module, referred to as OMM, is a half-height module that occupies reserved slot 1A and/or slot 1B of the OTC and provides shelf controller functionality for all modules resident within the chassis. The OMM contains the system software and configuration database for the Optical Line Amplifier and provides management gateway functions to the external DCN. OMMs in an expansion chassis do not maintain a copy of the configuration database. Each Optical Line Amplifier must have at least one OMM.

For high-availability, redundant OMMs can be deployed in each OTC. One OMM actively performs the node/shelf control functions while the other OMM is in the standby mode.

The OMM supports the local craft interfaces for local management access.

Block Diagram

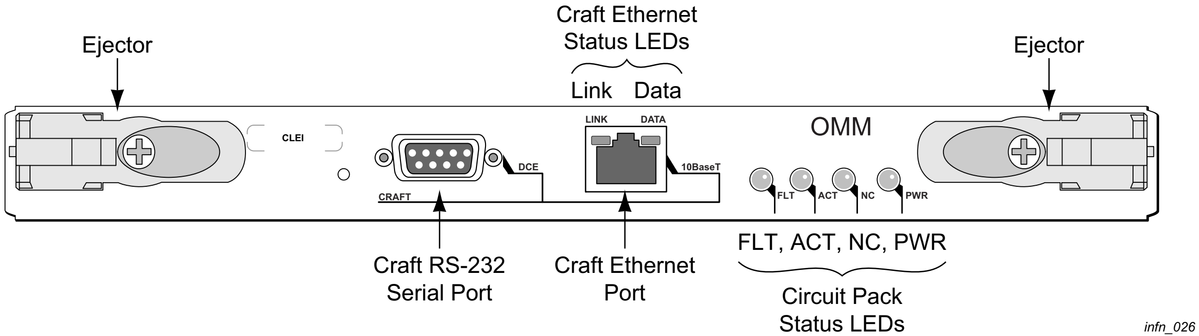
Figure 4-8 OMM Functional Block Diagram



External Indicators and Connectors

The OMM provides the circuit pack status LED indicators and craft Ethernet/serial port connectors on the front panel as shown in Figure 4-9.

Figure 4-9 OMM Faceplate



Circuit Pack Level LEDs

The OMM provides four LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-26.

Table 4-26 OMM Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (off) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Active/In-service (Green) or Standby (Yellow). Flashing Yellow indicates switchover or Make Standby operation in progress
NC (Node Controller)	Green	Indicates the circuit pack function: Active (Green) or Standby (off). Flashing Green indicates circuit pack is up but the management planes are not up
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the OMM

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions. The OMM circuit pack LED states are determined by controller configuration: Node Controller (NC) Active OMM, NC Standby OMM, Shelf Controller (SC) Active OMM, and SC Standby OMM.

Port Indicators

The craft Ethernet port on the front panel of the OMM has the craft Ethernet status LEDs: DATA and LINK. The LED illumination is as shown in Table 4-27.

Table 4-27 Port Visual Alarm Indicators on the OMM

LINK (Green)	DATA (Green)	Description
ON	ON	• Link established • Port is active
OFF	OFF	• Link not established
ON	OFF	• Link established • Port is not active

Connectors

The OMM provides craft Ethernet and craft serial ports for management purposes as listed in Table 4-28.

Table 4-28 OMM Connectors

Connector	Type	Purpose
CRAFT10Base-T	10Mbps RJ-45	Used by maintenance personnel for managing the network element locally
CRAFT DCE	9600 RS-232 DCE DB-9 Female	Used by maintenance personnel for initial commissioning of a network element during turn-up and test. Also used for field-debugging

Technical Specifications

Table 4-29 provides the mechanical and electrical specifications for the OMM.

Table 4-29 OMM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	1.03 inches / 26.16mm
	Depth	8.53 inches / 216.66mm
	Weight	2.5lb / 1.1kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Amplification Module (OAM)

There are several different types of OAMs supported on the OTC, all of which provide EDFA gain and some accommodating mid-stage access for dispersion compensation. Table 4-30 lists the name and a brief description of the supported OAMs.

Table 4-30 OAM Product Details

Product Ordering Name (PON)	Description
OAMs that Support up to 160 Channels	
OAM-CXH1	OAM, high power, C-Band, supports span losses from 0 to 20 dB, with VOA, without mid-stage access
OAM-CXH1-MS	OAM, high power, C-Band, low gain, longer reach, supports span losses from 5 to 22dB, with VOA, with mid-stage access. The OAM-CXH1-MS can be used as a pre-amplifier at a DTN site or as a booster at an Optical Line Amplifier site for longer reach
OAM-CXH1-MS-B	OAM, high power, C-Band, low gain, longer reach, supports span losses from 5 to 22dB, with VOA, with mid-stage access. Improved reach over OAM-CXH1-MS
OAM-CXH2-MS	OAM, high power, C-Band, supports span losses from 19 dB to 26.5 dB, with mid-stage access
OAM-CXH3-MS	OAM, high power, C-Band, supports span losses from 25 dB to 30.5 dB, with mid-stage access
OAMs that Support up to 40 Channels	
OAM-C1-A	OAM, C/L-Band, supports span losses from 0 to 20 dB, with VOA, without mid-stage access
OAM-C1-B	OAM, C/L-Band, supports span losses from 0 to 20 dB, with VOA, without mid-stage access
OAM-CX1-A	OAM, C-Band, supports span losses from 0 to 20 dB, with VOA, without mid-stage access
OAM-C2-MS-A[a]	OAM, C/L-Band, supports span losses from 19 dB to 26 dB, with mid-stage access
OAM-C2-MS-B[a]	OAM, C/L-Band, supports span losses from 19 dB to 26 dB, with mid-stage access
OAM-CX2-MS-B	OAM, C/L-Band, supports span losses from 19 dB to 26.5 dB, with mid-stage access
OAM-C3-MS-A[a]	OAM, C/L-Band, supports span losses from 25 dB to 30 dB, with mid-stage access
OAM-C3-MS-B[a]	OAM, C/L-Band, supports span losses from 25 dB to 30dB, with mid-stage access
OAM-CX3-MS-A	OAM, C-Band, supports span losses from 25 dB to 30.5dB, with mid-stage access

a. This OAM is generally no longer available but is still supported.

Note: The OAM-CXH1-MS-B cannot be used as a replacement module for an OAM-CXH1-MS that is currently configured with a PSE-1. However, if an OAM-CXH1-MS is not configured with a PSE-1, then an OAM-CXH1-MS-B can be used as a replacement module.

Functional Description

The Optical Amplification Module, referred to as OAM, can be equipped in slot 2 and/or 3 of the OTC (Main Chassis only).

Note: Two OAMs are required in an OTC to perform bidirectional optical amplification.

An OAM performs the following functions:

- Provides optical insertion and extraction of the 1510nm Optical Supervisory Channel (OSC) by using a 1510nm optical filter
- Provides unidirectional inline optical amplification of the transmitted and received signals by using either an optical booster or a pre-amplifier
- Amplifies in the C-Band with L-Band expansion capability on some OAM versions

Note: When deploying an OAM-Cn-A that has mid-stage access, if the DCM is between 0 and 800 ps/nm, the addition of a 5dB optical attenuator is required for normal operations. If the DCM is above 800 ps/nm then there is no requirement for the 5dB optical attenuator.

- Terminates the OSC for processing control and in-band management traffic
- Manages Infinera’s Automated Gain Control (AGC)
- Provides higher power for 80-channel and 160-channel systems
- Provides the following optical spectrum analyzer (OSA) ports for test purposes:
  - OSA port for the receive EDFA output
  - OSA port for the aggregate line output
- Provides user-configurable launch power offset from -10.0dB to +10.0dB to configure the launch power from the EDFA in the transmit direction
- Provides user-configurable gain tilt offset from -0.5dB to +0.5dB across the C-Band. Gain tilt offset is not supported on fixed gain OAM types (OAM-C1, OAM-CX1-A, and OAM-CXH1)

Note: Do not configure the gain tilt offset unless consulted to do so by an Infinera Technical Assistance Center (TAC) resource.

- Support for manually configuring the receive EDFA gain. The receive EDFA gain is an absolute value, not an offset value

Note: Do not configure the receive EDFA gain unless consulted to do so by an Infinera TAC resource.

- Detects a break in the transmission fiber and performs Automatic Laser Shutdown (ALS) to minimize potential laser radiation exposure to field personnel; ALS can be disabled by the user from any of the management interfaces for a provisionable period of time (1 to 480 minutes)

Note: ALS cannot be disabled for OAM (OAM-CXH1-MS) booster and/or OAM/ORM (OAM-CXH1-MS/ORM-CXH1-MS/ORM-CXH1) preamplifier configurations.

- Accommodates mid-stage access for DCMs and/or DSEs. The maximum mid-stage supported loss is 10.5dB (for all OAM types)

Note: As a precaution during initial system turn-up, the Dispersion Compensation Fiber (DCF) Optical Loss of Light (OLOS) alarm is generated if the measured mid-stage loss is out of tolerance relative to the provisioned expected mid-stage loss. If there is no DCF fiber connected (for example, no DCF input), then a DCF OLOS alarm will be reported. If there is a DCF fiber connected and the mid-stage loss is high, then a DCF OOR Low (Out of Range, Low) alarm will be reported.

The maximum gain and span loss ranges for the different OAM types are listed in Table 4-31.

Table 4-31 OAM Maximum Gain and Span Loss Specifications

OAM Type	Maximum Gain (dB)	OAM Span Loss Range (dB)
OAM-C1-A	20.0	0.0 to 20.0
OAM-C1-B	20.0	0.0 to 20.0
OAM-C2-MS-A	26.5	19.0 to 26.0
OAM-C2-MS-B	26.5	19.0 to 26.0
OAM-C3-MS-A	30.5	25.0 to 30.0
OAM-C3-MS-B	30.5	25.0 to 30.0
OAM-CX1-A	20.0	0.0 to 20.0
OAM-CX2-MS-B	26.5	19.0 to 26.5
OAM-CX3-MS-A	30.5	25.0 to 30.5
OAM-CXH1	20.0	0.0 to 20.0
OAM-CXH1-MS	22.0	5.0 to 22.0
OAM-CXH1-MS-B	22.0	5.0 to 22.0

Table 4-31 OAM Maximum Gain and Span Loss Specifications

OAM Type	Maximum Gain (dB)	OAM Span Loss Range (dB)
OAM-CXH2-MS	26.5	19.0 to 26.5
OAM-CXH3-MS	30.5	25.0 to 30.5

Line System Configurations

Line system configurations are supported to provide a longer reach across digital spans by improving the optical add/drop multiplexer (OADM) performance of the Infinera Digital Optical Network.

Table 4-32 lists the required modules for an Optical Line Amplifier with a booster configuration and a DTN and with a preamplifier configuration.

Table 4-32 Line System Configurations Supported

Node Type	Main Module	Booster Module	Preamplifier Modules
Optical Line Amplifier	ORM-CXH1	OAM-CXH1-MS	Not supported
DTN	BMM2P-8-CH1-MS	Not supported	Any one of the following: • OAM-CXH1-MS • ORM-CXH1-MS • ORM-CXH1

Note: Booster modules must be associated with the main module (from the management interfaces) to provide booster functions for the required digital span(s). Otherwise, Infinera's AGC will not function along the span(s).

Note: The ORM-CXH1-MS and ORM-CXH1 can be configured as preamplifiers. When configured as a preamplifier, these ORMs can be provisioned in an OTC Expansion Chassis of a DTN.

Block Diagrams

This section provides the OAM control and data plane block diagrams as follows:

- OAM control plane block diagram as shown in Figure 4-10
- OAM-A and OAM-B data plane block diagram as shown in Figure 4-11 on page 4-39
- OAM-CX-A and OAM-CXH-A data plane block diagram as shown in Figure 4-12 on page 4-40

Figure 4-10 OAM Control Plane Block Diagram

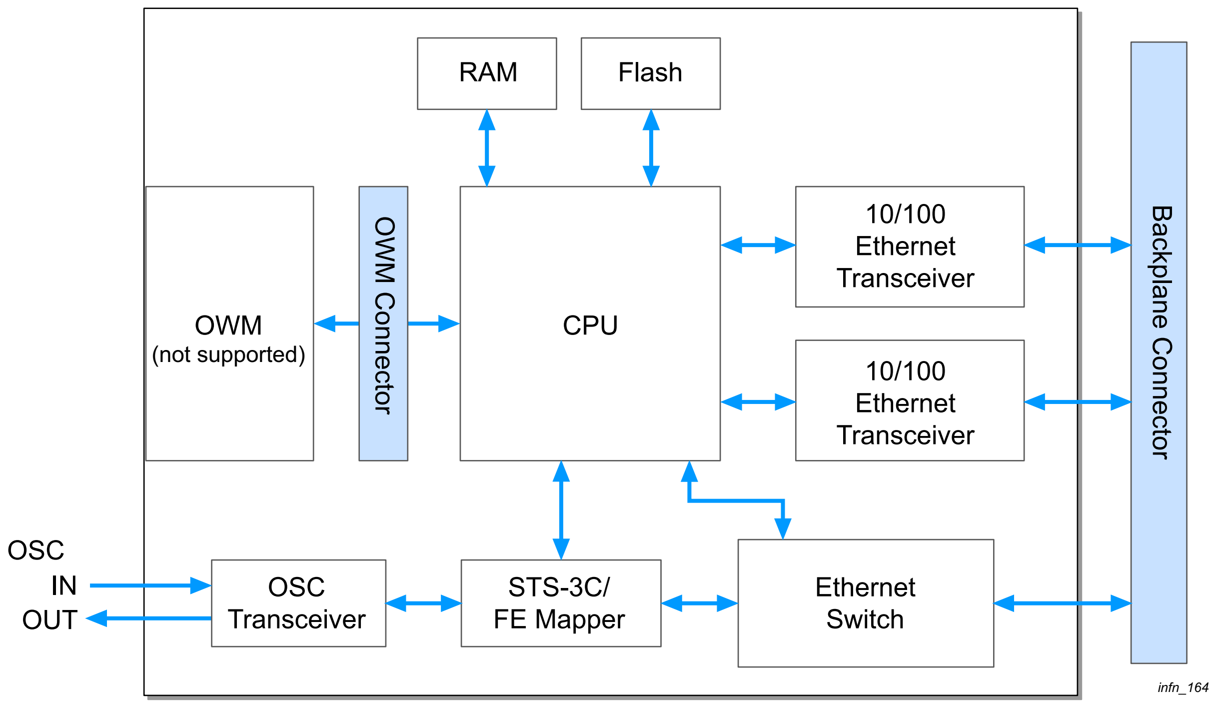


Figure 4-11 OAM-A and OAM-B Data Plane Block Diagram

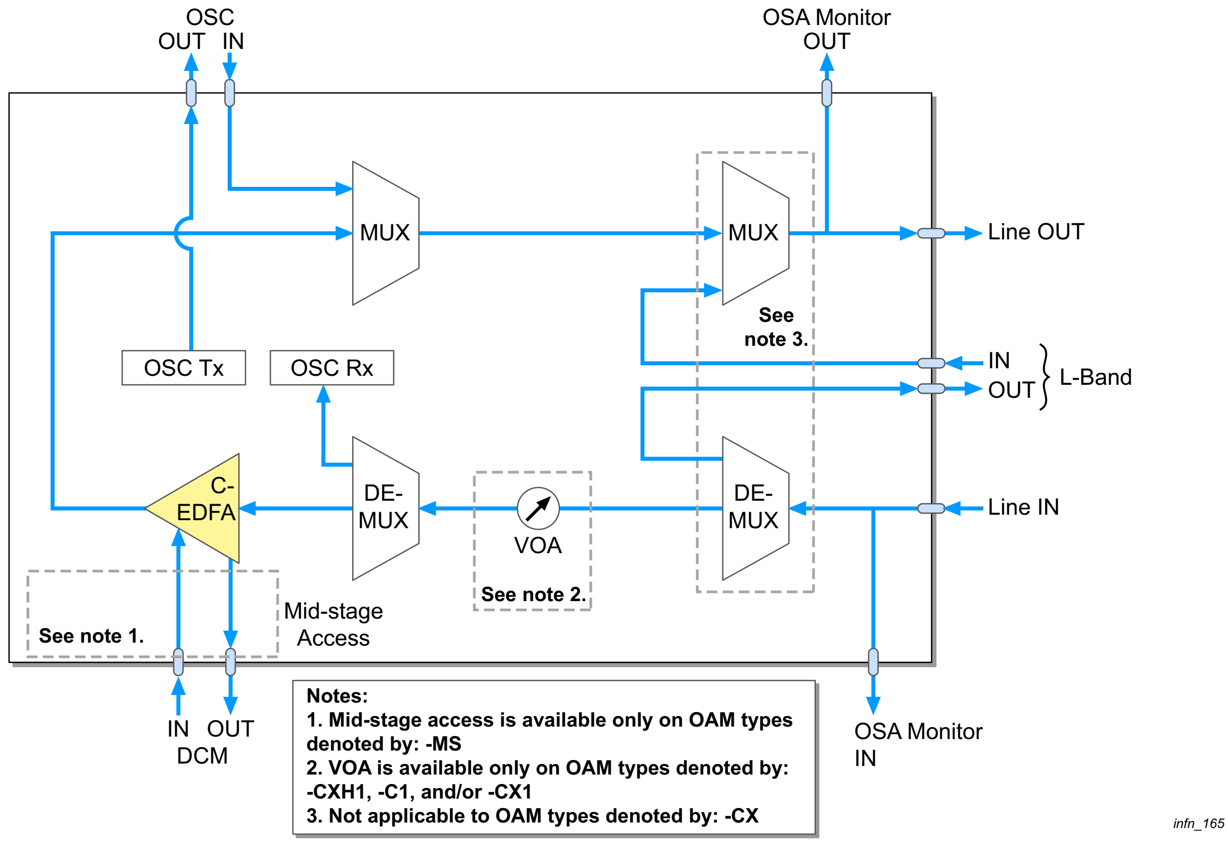
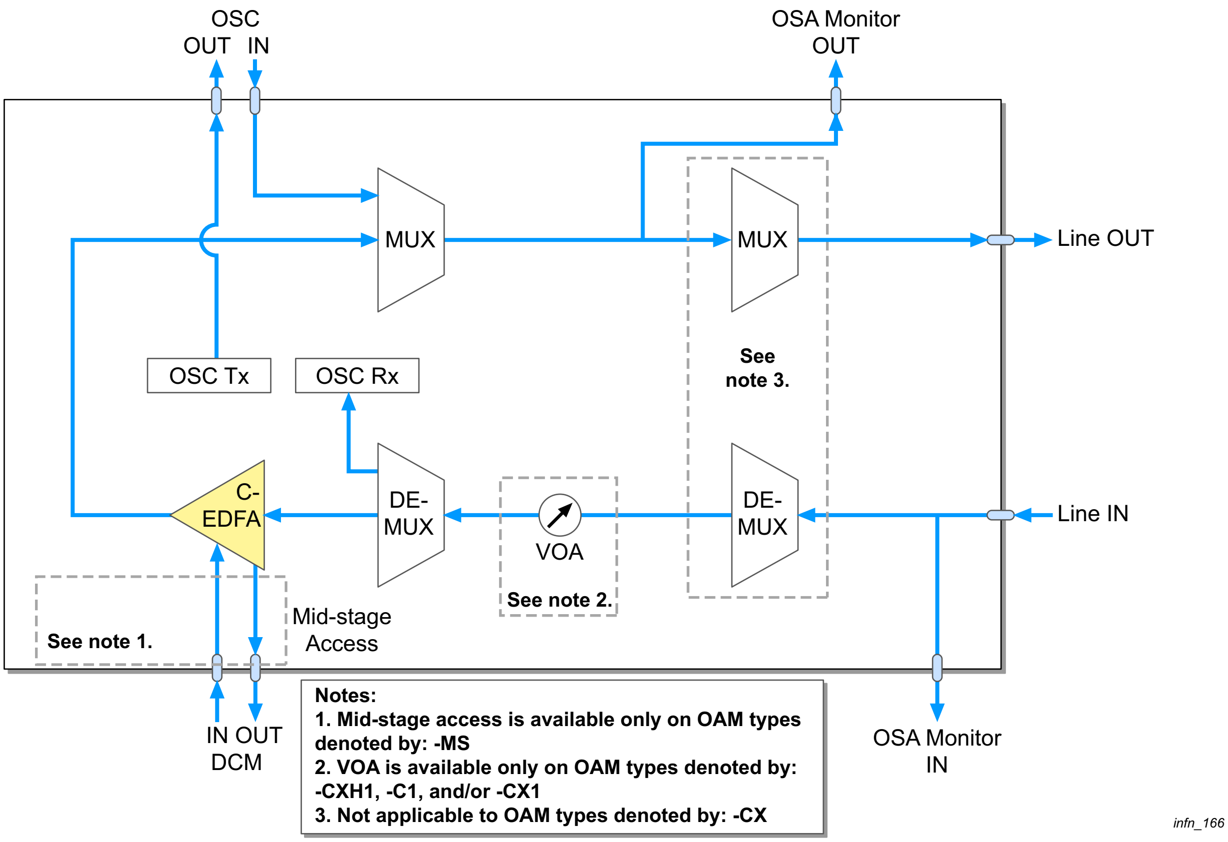


Figure 4-12 OAM-CX-A and OAM-CXH-A Data Plane Block Diagram



Note: VOA will not be present on C2 and C3 versions of an OAM.

External Indicators and Connectors

The OAM provides the circuit pack status/port LED indicators, and line/port connectors as follows:

- OAM-A and OAM-B as shown in Figure 4-13
- OAM-CX-A as shown in Figure 4-14 on page 4-42
- OAM-CXH-A as shown in Figure 4-15 on page 4-43

Figure 4-13 OAM-A and OAM-B Faceplate

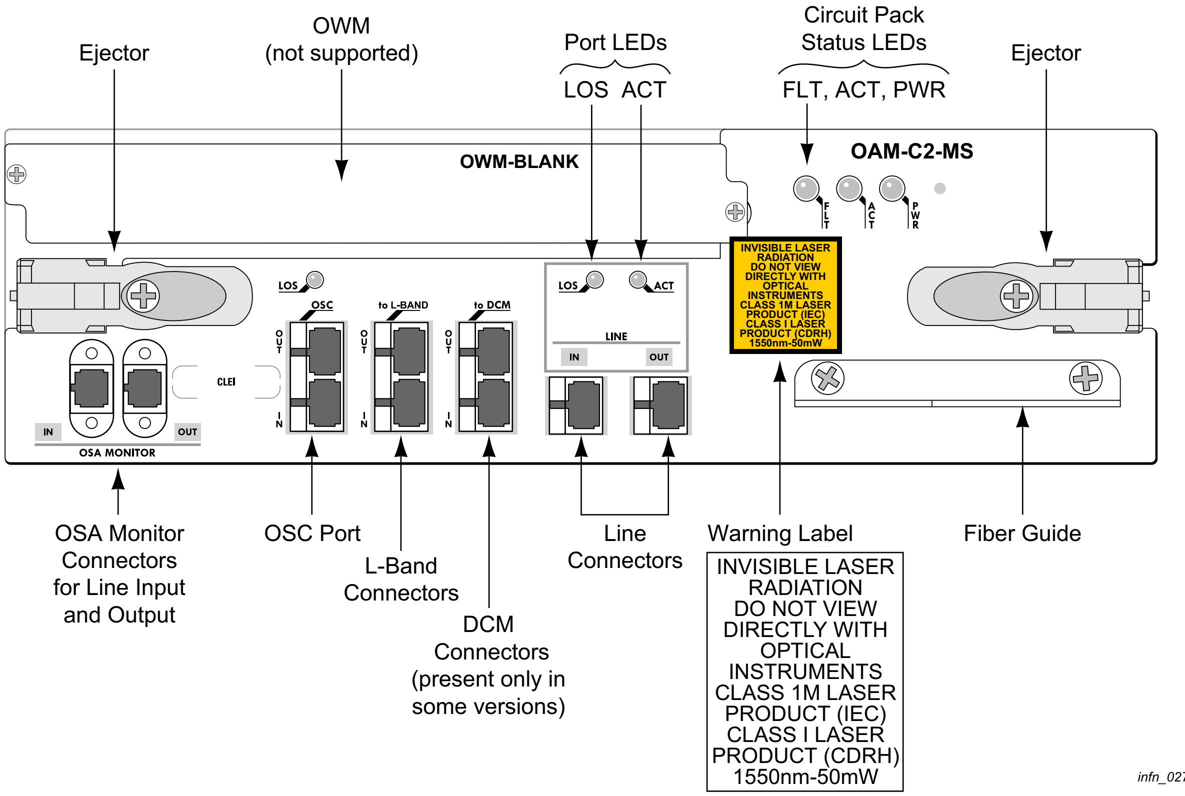
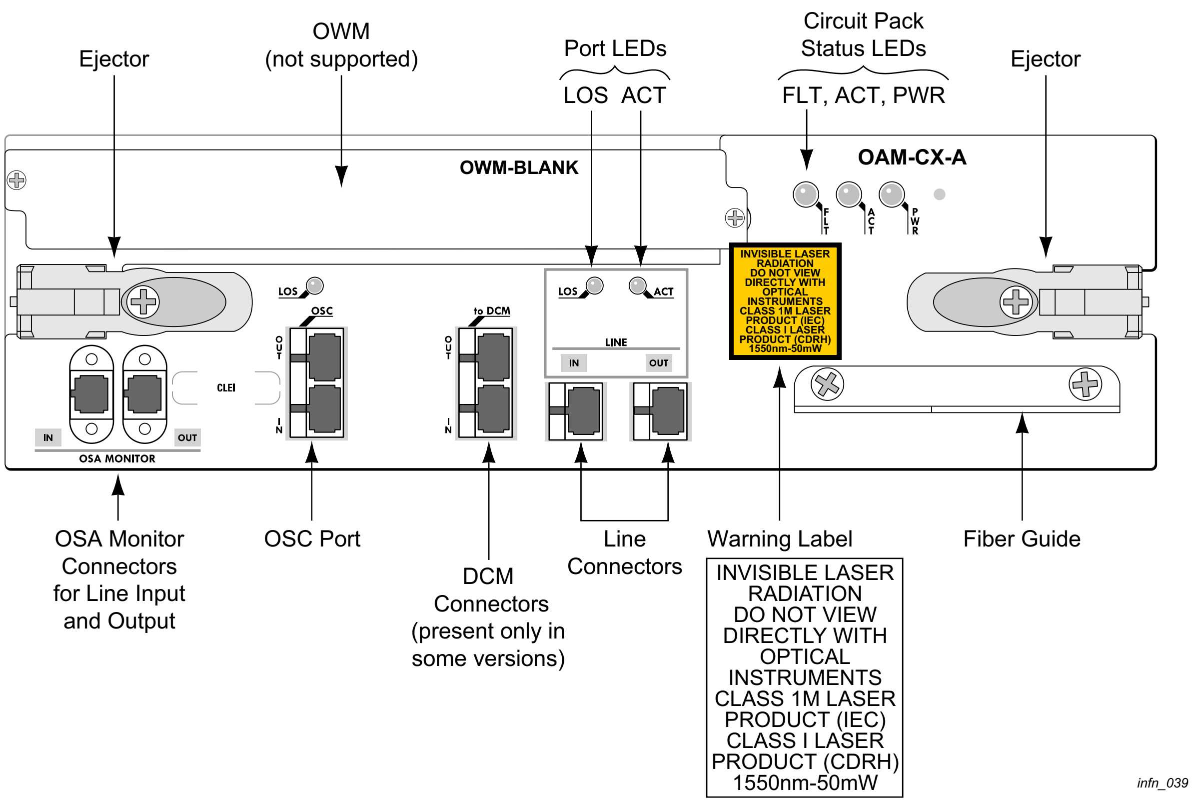
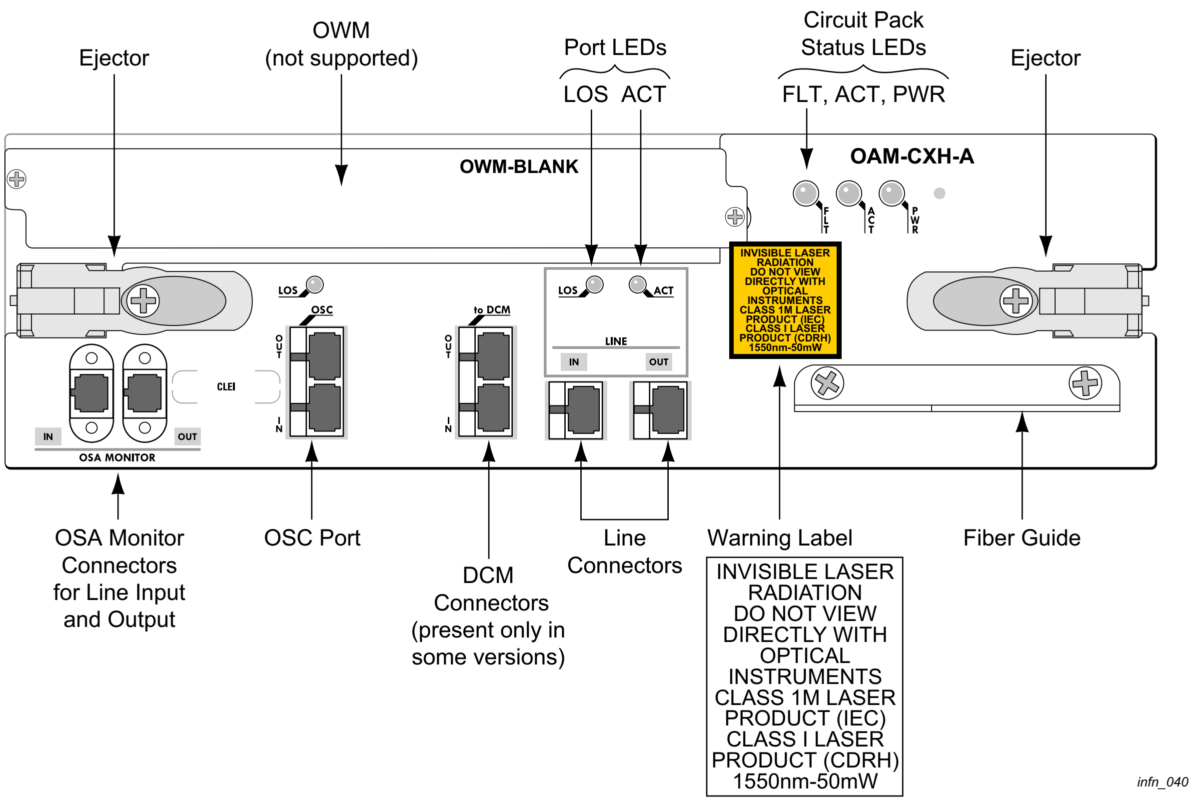


Figure 4-14 OAM-CX-A Faceplate



Note: The faceplate for the OAM-CX-A does not have L-Band connectors.

Figure 4-15 OAM-CXH-A Faceplate



Note: The faceplate for the OAM-CXH-A does not have L-Band connectors.

Circuit Pack Level LEDs

The OAM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-33.

Table 4-33 OAM Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Green (Active, In-service), flashing Yellow (In Maintenance), or dimmed (Locked state)
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the OAM

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the OAM to indicate the line port status. The significance of a lit LED is described in Table 4-34.

Table 4-34 Port Visual Alarm Indicators on the OAM

LED	State	Description
ACT (Active)	Green / Yellow	Indicates the line port administrative status: Solid Green (Active), flashing Green (ALS is disabled), flashing Yellow (Locked), or dimmed (during OTS LOS, C-Band LOS, or EDFA is locked)
LOS (Loss Of Signal)	Red	Indicates the status of the incoming signal. During an OTS Loss of Signal (LOS) or C-Band LOS condition, this indicator will be lit. When dimmed, indicates that power is being received

Connectors

The OAM provides connectors for the external fiber plant and management and control traffic. Table 4-35 lists the connector information for OAM-A and OAM-B.

Table 4-35 OAM-A and OAM-B Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Ports to monitor line output
OSC IN	SC, Front access	OSC port connects to the OSC OUT of the other OAM
OSC OUT	SC, Front access	OSC port connects to the OSC IN of the other OAM
L-Band IN	SC, Front access	Port used to pass L-Band channels
L-Band OUT	SC, Front access	Port used to pass L-Band channels
DCM IN	SC, Front access	Connects from a DCM or DSE (not present on OAM-C1-x)
DCM OUT	SC, Front access	Connects to a DCM or DSE (not present on OAM-C1-x)
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers

Table 4-36 lists the connector information for OAM-CX-A and OAM-CXH-A.

Table 4-36 OAM-CX-A and OAM-CXH-A Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Ports to monitor line output
OSC IN	SC, Front access	OSC port connects to the OSC OUT of the other OAM
OSC OUT	SC, Front access	OSC port connects to the OSC IN of the other OAM
DCM IN	SC, Front access	Connects from a DCM or DSE (not present on OAM-CX1-A)
DCM OUT	SC, Front access	Connects to a DCM or DSE (not present on OAM-CX1-A)
Line IN	SC, Front access	Connects from the line side fibers
Line OUT	SC, Front access	Connects to the line side fibers

Technical Specifications

Table 4-37 provides the mechanical and electrical specifications for the OAM.

Table 4-37 OAM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	3.20 inches / 81.28mm
	Depth	8.53 inches / 216.66mm
	Weight	8.0lb / 3.6kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Specifications

Table 4-38 provides the optical specifications for the OAM-Cn and OAM-CXn.

Table 4-38 OAM-Cn and OAM-CXn Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	100GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

Table 4-39 provides the optical specifications for the OAM-CXH.

Table 4-39 OAM-CXH Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	50GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
OSC	Wavelength	1510nm
	Format	OC-3c

Raman Amplifier Module (RAM)

Note: Unless specifically noted otherwise, all references to the RAM will refer to either the RAM-1, RAM-2-OR, or REM-2 interchangeably.

The RAM is used to increase a single span reach between two network elements where BMM/OAMs cannot meet the requirements of larger span distances. RAMs are optical pump modules that couple high power pump light onto the transmission fiber to provide Raman amplification to the signal channels within the Infinera Digital Optical Network.

RAMs can be deployed in the following types of applications:

- Festoon Application—deployed when there is a need for a repeater-less configuration involving underwater fiber which demands a longer reach of transmission per single span
- Terrestrial Application—deployed to extend reach by enabling transmission over more spans per link and/or longer spans in a link, or to enable extra long spans making it possible to skip amplification huts

Table 4-40 lists the name and a brief description of each of the supported RAMs.

Table 4-40 RAM Product Details

Product Ordering Name (PON)	Description
RAM-1	• Raman Amplifier Module—2 pump RAM providing medium counter propagating Raman gain
RAM-2-OR	• Raman Amplifier Module—4 pump RAM providing high counter propagating Raman gain • Regenerates OSC
REM-2	• Raman Extender Module—4 pump REM providing co-propagating Raman gain

Functional Description

Note: Provisioning a RAM in an OTC configured as the Main Chassis is not supported. RAMs can be provisioned only in an OTC configured as an Expansion Chassis.

Note: Mixing of REM-2s with DSEs in the same OTC is not supported.

The Raman Amplifier Module, referred to as RAM, can be equipped in slot 2 and/or 3 of the OTC (Expansion Chassis only) and performs the following functions:

- Generates pump power at specific wavelengths and couples the power onto the transmission fiber
- Determines the required pump power at each wavelength given the provisioned fiber type (to set the Raman gain)
- Maintains the required pump power over the life of the laser
- Provides a mechanism via all management interfaces for adjusting the pump power to accommodate point losses at turn up
- Provides temperature control for each pump laser
- Detects a break in the transmission fiber and performs Automatic Laser Shutdown (ALS) to minimize potential laser radiation exposure to field personnel
- Detects the repair of a fiber break and automatically returns the laser to normal operation
- RAM-1 and REM-2 each pass OSC traffic transparently and allow the OSC link to close on all Raman-enabled spans
- RAM-2-OR regenerates OSC traffic on all Raman-enabled spans
- Monitors optical performance parameters and maintains PM history
- Detects and isolates faults and reports status to network management

The amount of gain provided by the different RAM types is listed in Table 4-41.

Table 4-41 RAM Maximum Gain

RAM Type	Fiber Type	Default Gain (dB)	Tx and Rx Losses (dB)	Net Gain (dB)
RAM-1	SMF-28, LEAF, ELEAF, TW-C, TW-RS, TW-Plus, LS, DSF	10.0	1.7 to 3.4	6.6 to 8.3
	PSCF	9.0	1.7 to 3.4	5.6 to 7.3
RAM-2-OR	SMF-28, LEAF, ELEAF, TW-C, TW-RS, TW-Plus, LS, DSF, PSCF	18.0	1.9 to 3.8	14.2 to 16.1
REM-2 (20 channels)	SMF-28, PSCF	13.0	0.2 to 0.8	12.2 to 12.8
REM-2 (40 channels)	SMF-28, PSCF	11.0	0.2 to 0.8	10.2 to 10.8
REM-2 (80 channels)	SMF-28, PSCF	8.5	0.2 to 0.8	7.7 to 8.3
REM-2 (160 channels)	SMF-28, PSCF	8.5	0.2 to 0.8	7.7 to 8.3

The amount of gain flatness provided by the different RAM types is listed in Table 4-42.

Table 4-42 RAM Gain Flatness

RAM Type	Fiber Type	Gain Flatness (dB)
RAM-1	SMF-28, LEAF, ELEAF	0.9
	TW-C, TW-RS, TW-Plus	1.3
	PSCF	1.5
RAM-2-OR	SMF-28, LEAF, ELEAF	0.9
	TW-C, TW-RS, TW-Plus, LS	1.4
	PSCF	2.0
REM-2	SMF-28	2.3
	PSCF	2.8

Block Diagrams

This section provides the RAM control and data plane block diagrams as follows:

- RAM control plane block diagram as shown in Figure 4-16
- RAM-1 data plane block diagram as shown in Figure 4-17 on page 4-51
- RAM-2-OR data plane block diagram as shown in Figure 4-18 on page 4-51
- REM-2 data plane block diagram as shown in Figure 4-19 on page 4-52

Figure 4-16 RAM Control Plane Block Diagram

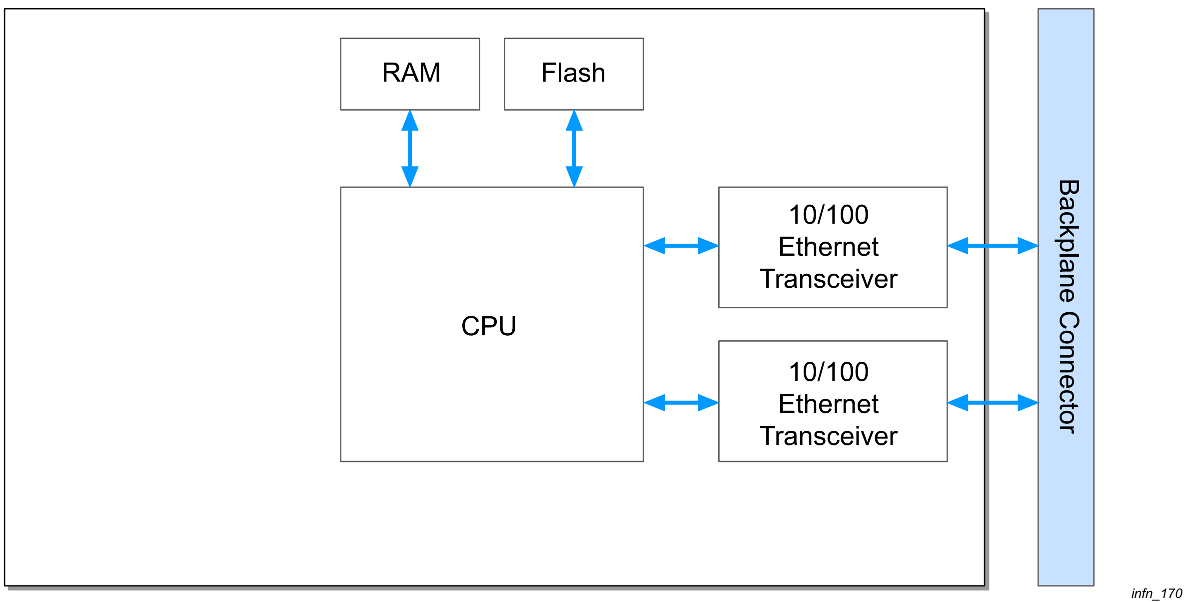


Figure 4-17 RAM-1 Data Plane Block Diagram

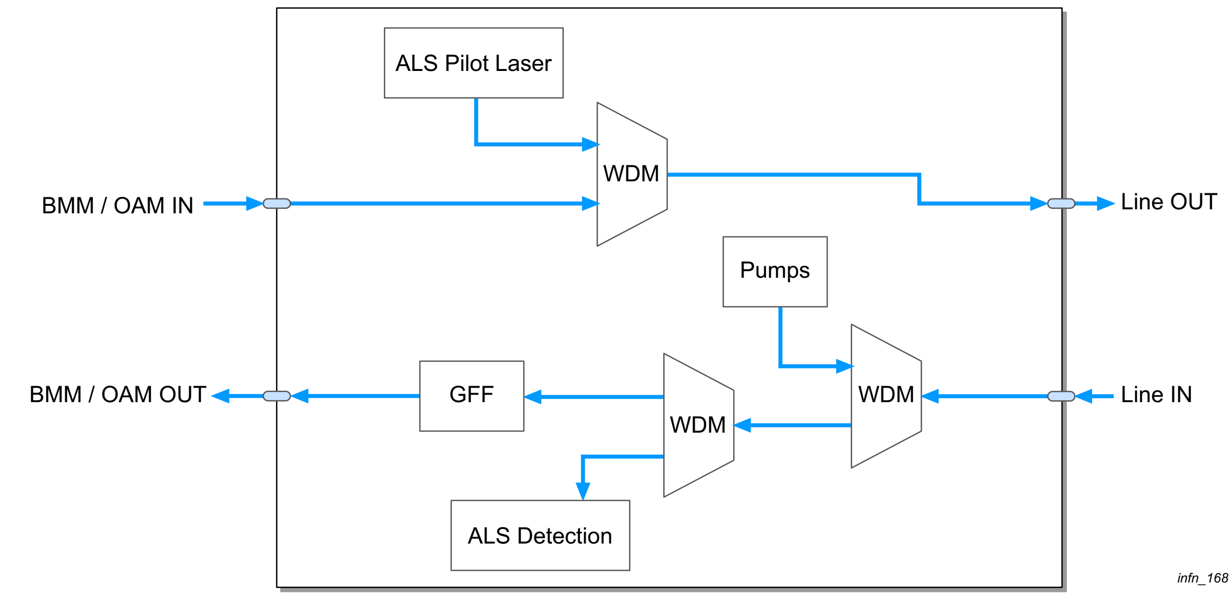


Figure 4-18 RAM-2-OR Data Plane Block Diagram

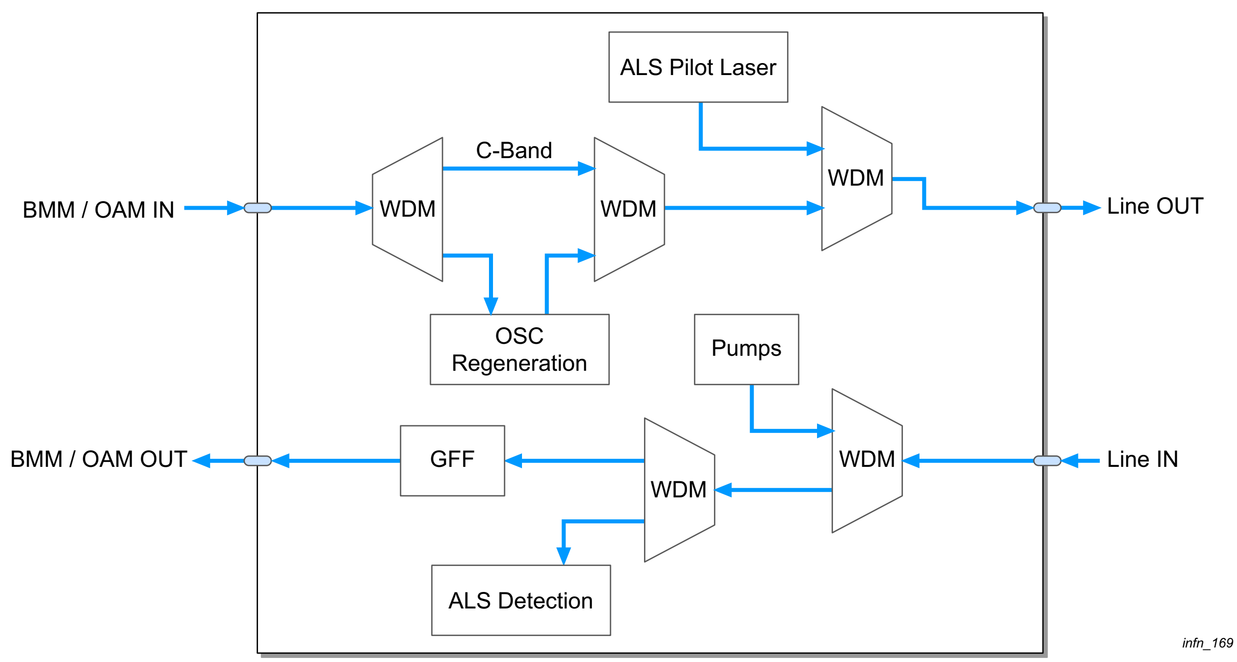
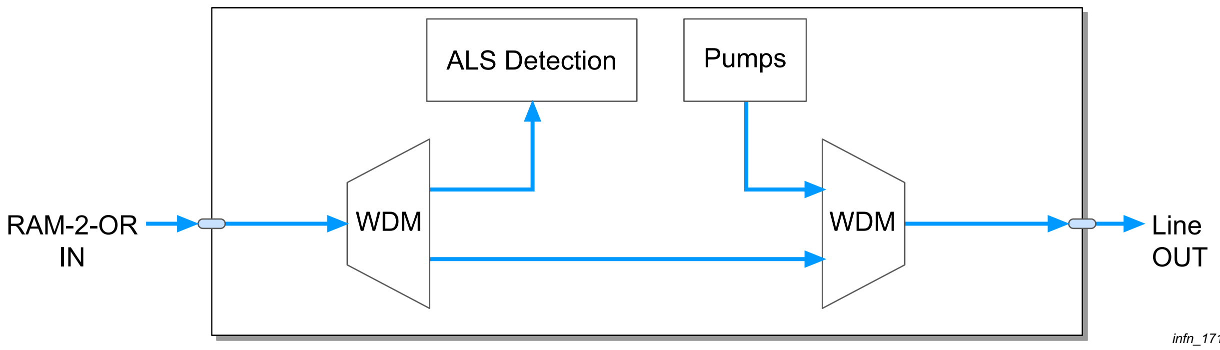


Figure 4-19 REM-2 Data Plane Block Diagram



External Indicators and Connectors

The RAM provides the circuit pack status/port LED indicators, and line/port connectors as follows:

- RAM-1 as shown in Figure 4-20
- RAM-2-OR as shown in Figure 4-21 on page 4-54
- REM-2 as shown in Figure 4-22 on page 4-55

Figure 4-20 RAM-1 Faceplate

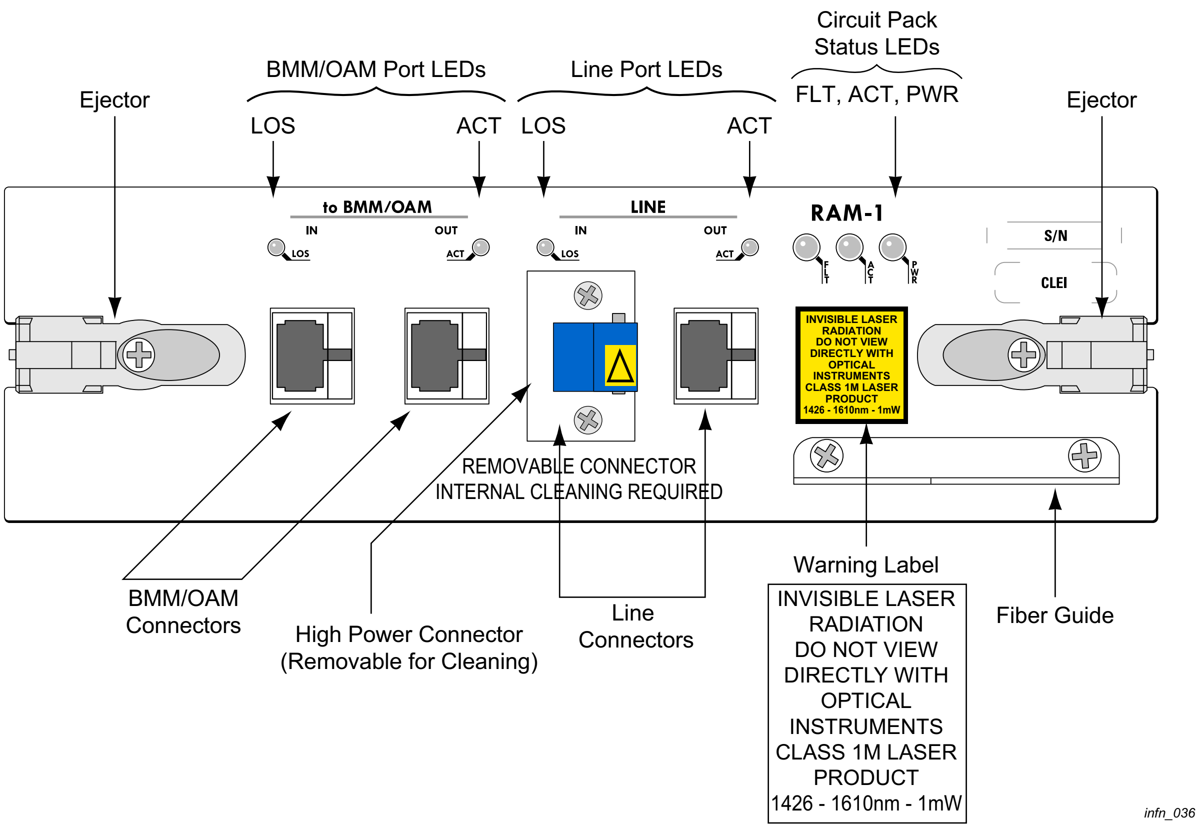


Figure 4-21 RAM-2-OR Faceplate

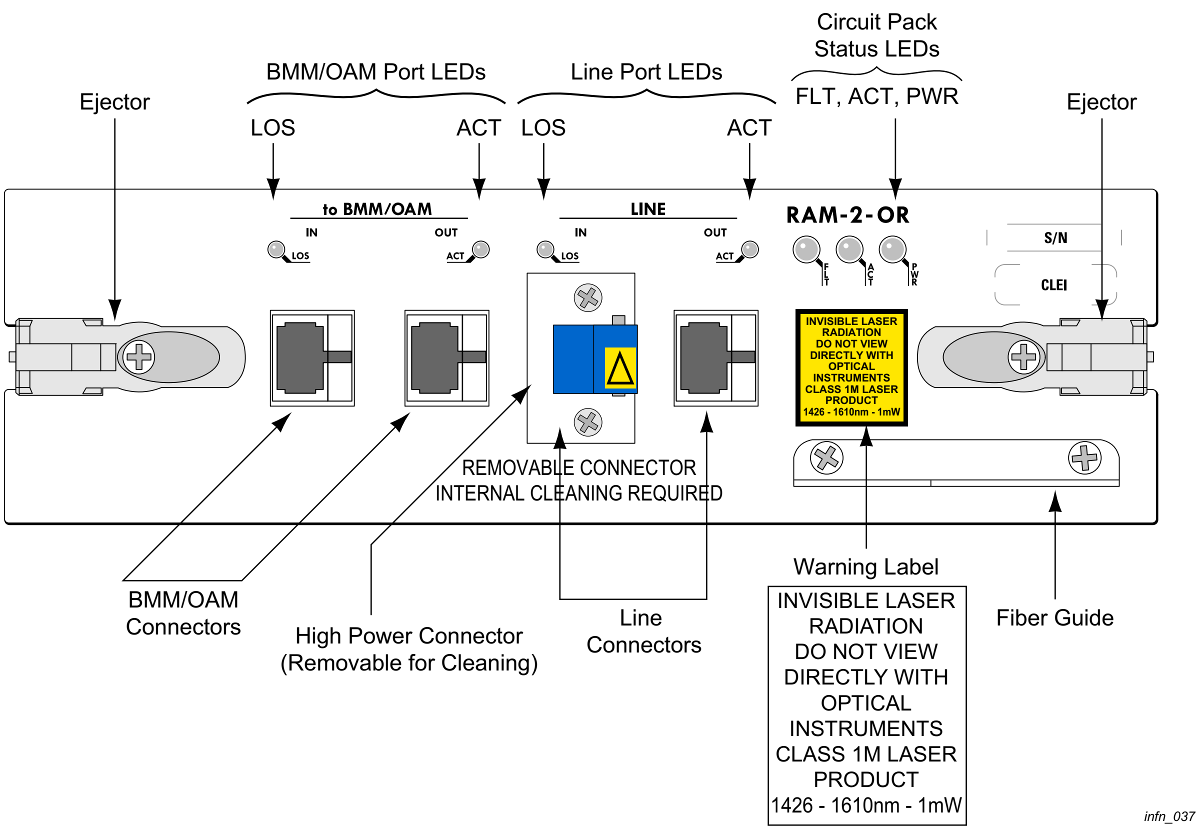
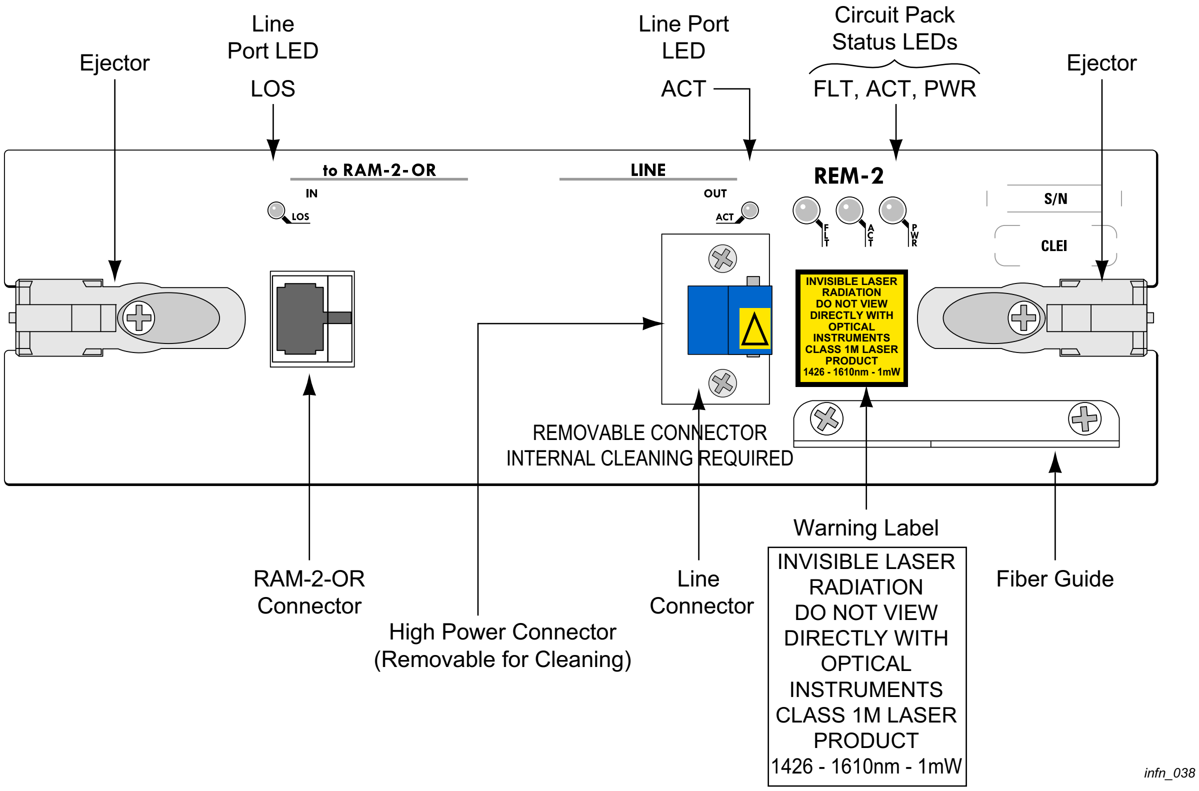


Figure 4-22 REM-2 Faceplate



Circuit Pack Level LEDs

The RAM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-43.

Table 4-43 RAM Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an equipment alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Green (Active, In-service) or flashing Yellow (In Maintenance)
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the RAM

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are four LEDs: ACTIVE and LOS for the RAM-1/RAM-2-OR to indicate the line and BMM/OAM port status. The significance of a lit LED is described in Table 4-44.

Table 4-44 Port Visual Alarm Indicators on the RAM-1/RAM-2-OR

LED	State	Description
LINE ACT (Active)	Green / Yellow	Indicates the line port administrative status: • Solid Green (Active) • Flashing Green indicates that ALS is disabled • Flashing Yellow indicates that the Raman pumps are shutdown and the module is in Locked state • OFF indicates C-Band/OTS LOS
LINE LOS (Loss Of Signal)	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit
BMM/OAM ACT (Active)	Green	Indicates the BMM/OAM port administrative status: • ON indicates C-Band/OTS signal presence • OFF indicates C-Band LOS
BMM/OAM LOS (Loss Of Signal)	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit

There are two LEDs: ACTIVE and LOS for the REM-2 to indicate the line port status. The significance of a lit LED is described in Table 4-45.

Table 4-45 Port Visual Alarm Indicators on the REM-2

LED	State	Description
LINE ACT (Active)	Green / Yellow	Indicates the line port administrative status: • Solid Green (Active) • Flashing Green indicates that ALS is disabled • Flashing Yellow indicates that the Raman pumps are shutdown and the module is in Locked state • OFF indicates C-Band/OTS LOS
RAM-2-OR LOS (Loss Of Signal)	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit

Connectors

The RAM provides connectors for the external fiber plant and management and control traffic.

Table 4-46 lists the connector information for RAM-1.

Table 4-46 RAM-1 Connectors

Connector	Type	Purpose
LINE IN	SC, Front access	Connects the input of the RAM-1 to the line side fiber (receive side)
LINE OUT	SC, Front access	Connects the output of the RAM-1 to the line side fiber (transmit side)
BMM/OAM IN	SC, Front access	Connects the output of the associated BMM/OAM located in the same node to the input of the RAM-1
BMM/OAM OUT	SC, Front access	Connects the output of the RAM-1 to the input of the associated BMM/OAM located in the same node

Table 4-47 lists the connector information for a stand-alone RAM-2-OR.

Table 4-47 RAM-2-OR Connectors (Stand-alone Configuration)

Connector	Type	Purpose
LINE IN	SC, Front access	Connects the input of the RAM-1 to the line side fiber (receive side)
LINE OUT	SC, Front access	Connects the output of the RAM-2-OR to the line side fiber (transmit side)
BMM/OAM IN	SC, Front access	Connects the output of the associated BMM/OAM located in the same node to the input of the RAM-2-OR
BMM/OAM OUT	SC, Front access	Connects the output of the RAM-2-OR to the input of the associated BMM/OAM located in the same node

Table 4-48 lists the connector information for RAM-2-OR with REM-2 configuration.

Table 4-48 RAM-2-OR Connectors (with REM-2 Configuration)

Connector	Type	Purpose
LINE IN	SC, Front access	Connects the input of the RAM-2-OR to the line side fiber (receive side)
LINE OUT	SC, Front access	Connects the output of the RAM-2-OR to the input of the REM-2
BMM/OAM IN	SC, Front access	Connects the output of the associated BMM/OAM located in the same node to the input of the RAM-2-OR
BMM/OAM OUT	SC, Front access	Connects the output of the RAM-2-OR to the input of the associated BMM/OAM located in the same node

Table 4-49 lists the connector information for REM-2.

Table 4-49 REM-2 Connectors

Connector	Type	Purpose
LINE OUT	SC, Front access	Connects the output of the REM-2 to the line side fiber (transmit side)
RAM-2-OR IN	SC, Front access	Connects the RAM-2-OR LINE OUT port located in the same node to the input of the REM-2

Technical Specifications

Table 4-50 provides the mechanical and electrical specifications for the RAM.

Table 4-50 RAM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	3.20 inches / 81.28mm
	Depth	8.53 inches / 216.66mm
	Weight	10.0lb / 4.5kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Specifications

Table 4-51 provides the optical specifications for the RAM-1.

Table 4-51 RAM-1 Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength range	1530nm to 1565nm
Raman pumps	Wavelength	1426nm and 1453nm
	Maximum total pump power	0.5W
OSC	Wavelength	1510nm
	Format	OC-3c
ALS pilot signal	Wavelength	1610nm
	Output power range	-1.5dBm to +1.5dBm

Table 4-52 provides the optical specifications for the RAM-2-OR.

Table 4-52 RAM-2-OR Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength range	1530nm to 1565nm
Raman pumps	Wavelength	1426nm and 1453nm
	Maximum total pump power	1W
OSC	Wavelength	1510nm
	Format	OC-3c
ALS pilot signal	Wavelength	1610nm
	Output power range	-1.5dBm to +1.5dBm

Table 4-53 provides the optical specifications for the REM-2.

Table 4-53 REM-2 Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength range	1530nm to 1565nm
Raman pumps	Wavelength	1426nm and 1453nm
	Maximum total pump power	1W
OSC	Wavelength	1510nm
	Format	OC-3c
ALS pilot signal	Wavelength	1610nm
	Output power range	-1.5dBm to +1.5dBm

Optical Raman Module (ORM)

The ORM is used to increase a single span reach between two network elements where BMM/OAMs cannot meet the requirements of larger ultra long haul (ULH) span distances. ORMs are hybrid Raman and EDFA optical pump modules that couple high power pump light onto the transmission fiber to provide Raman assisted EDFA amplification to the signal channels within the Infinera Digital Optical Network. The ORM accommodates mid-stage access for dispersion compensation.

Table 4-54 lists the name and a brief description of the ORM.

Table 4-54 ORM Product Details

Product Ordering Name (PON)	Description
ORM-CXH1-MS	• Optical Raman Module—hybrid, counter-pumped Raman and EDFA, 4 pump ORM providing high counter propagating Raman assisted EDFA gain • Regenerates OSC • Accommodates mid-stage access for DCMs and/or DSEs. • Provides longer reach when used in a pre-amplifier configuration at a DTN and/or Optical Line Amplifier site
ORM-CXH1	• Optical Raman Module—hybrid, counter-pumped Raman and EDFA, 4 pump ORM providing high counter propagating Raman assisted EDFA gain • Regenerates OSC • No mid-stage access • Supports higher span loss range • Provides longer reach when used in a pre-amplifier configuration at a DTN and/or Optical Line Amplifier site
ORM-CXH1-MS-LL	• Optical Raman Module—hybrid, counter-pumped Raman and EDFA, 4 pump ORM providing high counter propagating Raman assisted EDFA gain • Regenerates OSC • Accommodates mid-stage access for DCMs and/or DSEs. • Supports higher span loss range • Used specifically for low latency applications
ORM-CXH1-LL	• Optical Raman Module—hybrid, counter-pumped Raman and EDFA, 4 pump ORM providing high counter propagating Raman assisted EDFA gain • Regenerates OSC • No mid-stage access • Supports higher span loss range • Used specifically for low latency applications

Functional Description

The Optical Raman Module, referred to as ORM, can be equipped in slot 2 and/or 3 of the OTC (Main Chassis only) and performs the following functions:

- Generates pump power at specific wavelengths and couples the power onto the transmission fiber
- Determines the required pump power at each wavelength given the provisioned fiber type (to set the Raman gain)
- Maintains the required pump power over the life of the laser
- Provides a mechanism via all management interfaces for adjusting the pump power to accommodate point losses at turn up
- Provides temperature control for each pump laser
- Provides optical insertion and extraction of the 1510nm Optical Supervisory Channel (OSC) by using a 1510nm optical filter
- Terminates the OSC for processing control and in-band management traffic
- Provides user-configurable gain tilt offset across the C-Band as follows:
  - ORM-CXH1-MS: -0.5dB to +0.5dB
  - ORM-CXH1-MS-LL: -0.5dB to +0.5dB
  - ORM-CXH1: -0.5dB to +1.0dB
  - ORM-CXH1-LL: not user-configurable

Note: Do not configure the gain tilt offset unless consulted to do so by an Infinera Technical Assistance Center (TAC) resource.

- Detects a break in the transmission fiber and performs Automatic Laser Shutdown (ALS) to minimize potential laser radiation exposure to field personnel

Note: ALS cannot be disabled for OAM (OAM-CXH1-MS) booster and/or OAM/ORM (OAM-CXH1-MS/ORM-CXH1-MS/ORM-CXH1) preamplifier configurations.

- Detects the repair of a fiber break and automatically returns the laser to normal operation
- Monitors optical performance parameters and maintains PM history
- Detects and isolates faults and reports status to network management
- Provides the following optical spectrum analyzer (OSA) ports for test purposes:
  - OSA port for the EDFA input
  - OSA port for the EDFA output
- Provides user-configurable launch power offset from -10.0dB to +10.0dB

- Accommodates mid-stage access for DCMs and/or DSEs (ORM-CXH1-MS and ORM-CXH1-MS-LL only). The maximum mid-stage supported loss is 8.5dB

Note: As a precaution during initial system turn-up, the Dispersion Compensation Fiber (DCF) Optical Loss of Light (OLOS) alarm is generated if the measured mid-stage loss is out of tolerance relative to the provisioned expected mid-stage loss. If there is no DCF fiber connected (for example, no DCF input), then a DCF OLOS alarm will be reported. If there is a DCF fiber connected and the mid-stage loss is high, then a DCF OOR Low (Out of Range, Low) alarm will be reported.

Table 4-55 lists the amount of Raman and EDFA gain provided by the ORM and the supported span loss range based on fiber type.

Table 4-55 ORM Maximum Gain and Span Loss Support

ORM Type	Fiber Type	Raman Gain (dB)	EDFA Gain (dB)	Total ORM Gain Range (dB)	Span Loss Range (dB)
ORM-CXH1-MS	SMF-28, PSCF	5.0 to 11.0	11.0 to 14.0	16.0 to 25.0	16.0 to 25.0
	LEAF	5.0 to 14.0	11.0 to 14.0	16.0 to 28.0	16.0 to 28.0
	TW-C, TW-RS, LS, DSF	7.0 to 16.0	11.0 to 14.0	18.0 to 30.0	18.0 to 30.0
ORM-CXH1-MS-LL	SMF-28, PSCF	5.0 to 11.0	11.0 to 14.0	16.0 to 25.0	16.0 to 25.0
	LEAF	5.0 to 14.0	11.0 to 14.0	16.0 to 28.0	16.0 to 28.0
	TW-C, TW-RS, LS, DSF	7.0 to 16.0	11.0 to 14.0	18.0 to 30.0	18.0 to 30.0
ORM-CXH1	SMF-28, PSCF	5.0 to 11.0	11.0 to 16.0	16.0 to 27.0	16.0 to 27.0
	LEAF	5.0 to 14.0	11.0 to 16.0	16.0 to 30.0	16.0 to 30.0
	TW-C, TW-RS, LS, DSF	7.0 to 16.0	11.0 to 16.0	18.0 to 32.0	18.0 to 32.0
ORM-CXH1-LL	SMF-28, PSCF	5.0 to 11.0	11.0 to 13.0	18.0 to 24.0	18.0 to 24.0
	LEAF	5.0 to 14.0	11.0 to 13.0	18.0 to 27.0	18.0 to 27.0
	TW-C, TW-RS, LS, DSF	7.0 to 16.0	11.0 to 13.0	20.0 to 29.0	20.0 to 29.0

Line System Configurations

Line system configurations are supported to provide a longer reach across digital spans by improving the optical add/drop multiplexer (OADM) performance of the Infinera Digital Optical Network.

Table 4-56 lists the required modules for an Optical Line Amplifier with a booster configuration and a DTN and with a preamplifier configuration.

Table 4-56 Line System Configurations Supported

Node Type	Main Module	Booster Module	Preamplifier Modules
Optical Line Amplifier	ORM-CXH1	OAM-CXH1-MS	Not supported
DTN	BMM2P-8-CH1-MS	Not supported	Any one of the following: • OAM-CXH1-MS • ORM-CXH1-MS • ORM-CXH1

Note: Booster modules must be associated with the main module (from the management interfaces) to provide booster functions for the required digital span(s). Otherwise, Infinera's Automated Gain Control (AGC) will not function along the span(s).

Note: The ORM-CXH1-MS and ORM-CXH1 can be configured as preamplifiers. When configured as a preamplifier, these ORMs can be provisioned in an OTC Expansion Chassis of a DTN.

Block Diagrams

This section provides the ORM control and data plane block diagrams as follows:

- ORM control plane block diagram as shown in Figure 4-23
- ORM-CXH1-MS and ORM-CXH1-MS-LL data plane block diagram as shown in Figure 4-24 on page 4-66
- ORM-CXH1 data plane block diagram as shown in Figure 4-25 on page 4-67
- ORM-CXH1-LL data plane block diagram as shown in Figure 4-26 on page 4-68

Figure 4-23 ORM Control Plane Block Diagram

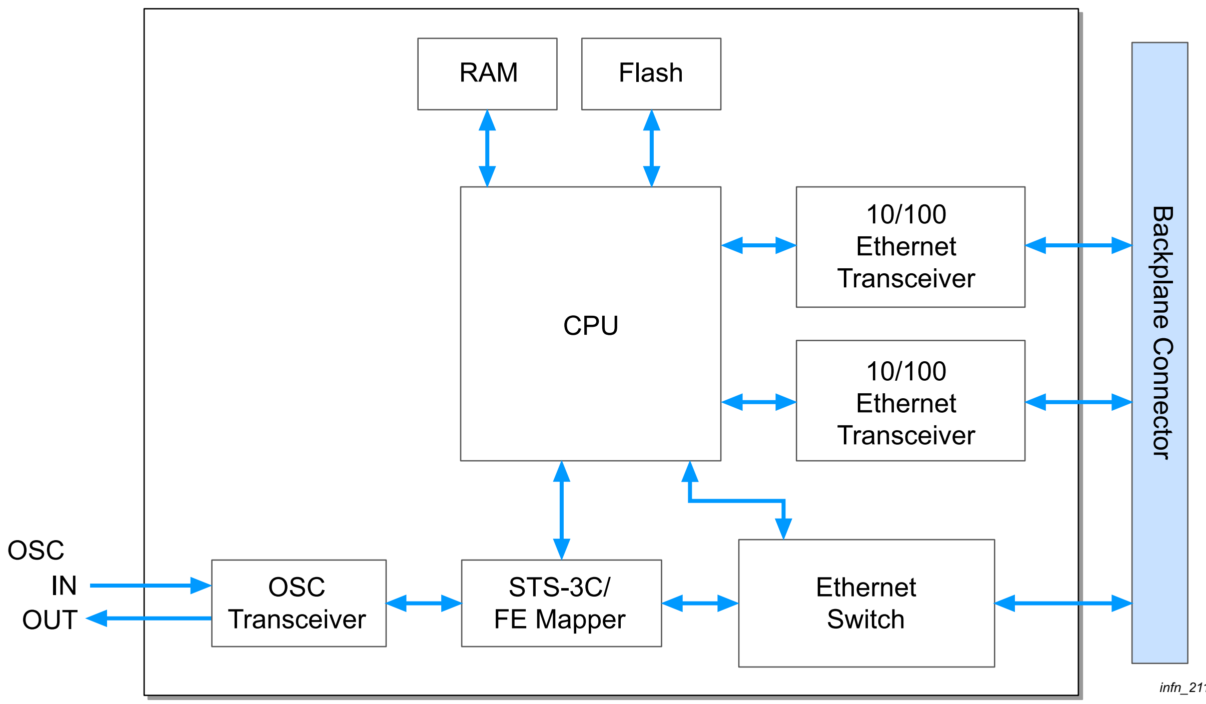


Figure 4-24 ORM-CXH1-MS and ORM-CXH1-MM-LL Data Plane Block Diagram

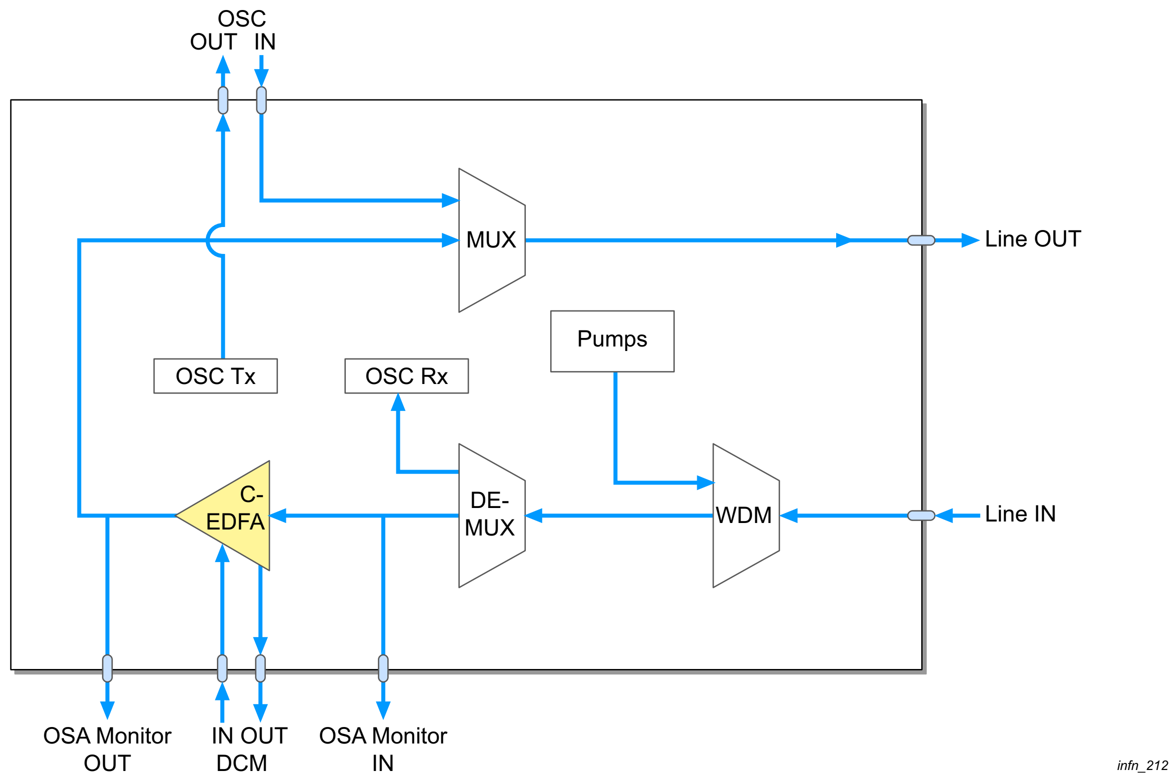


Figure 4-25 ORM-CXH1 Data Plane Block Diagram

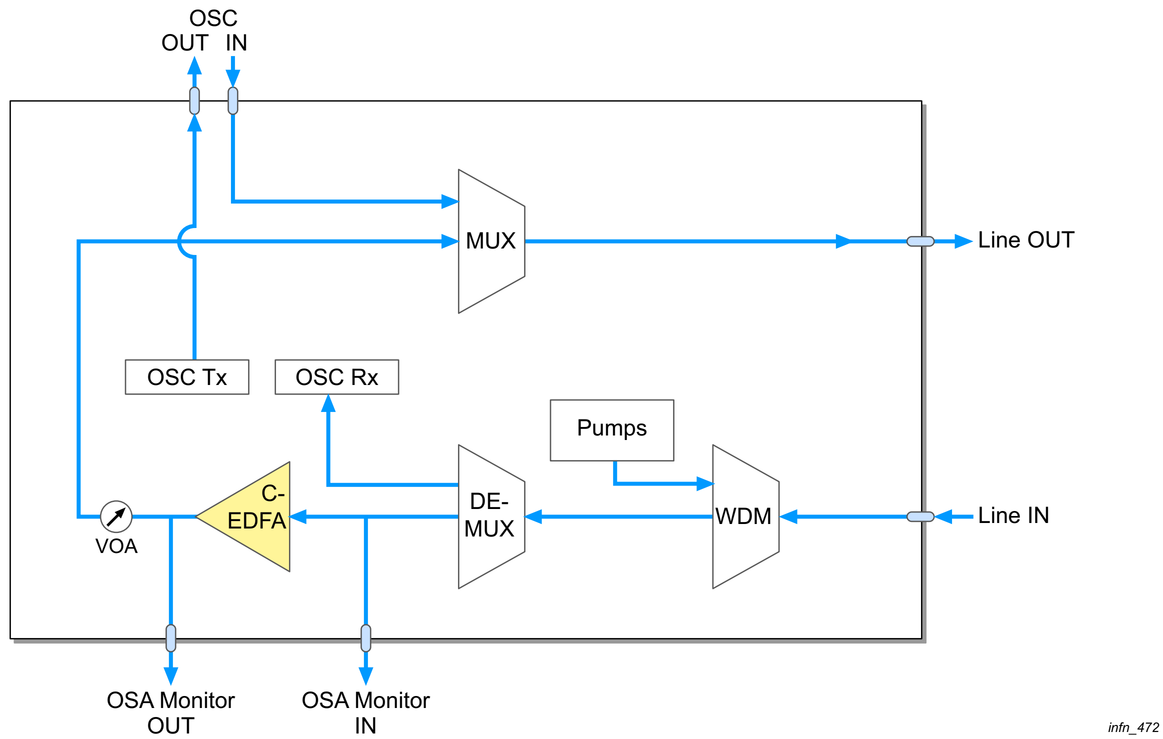
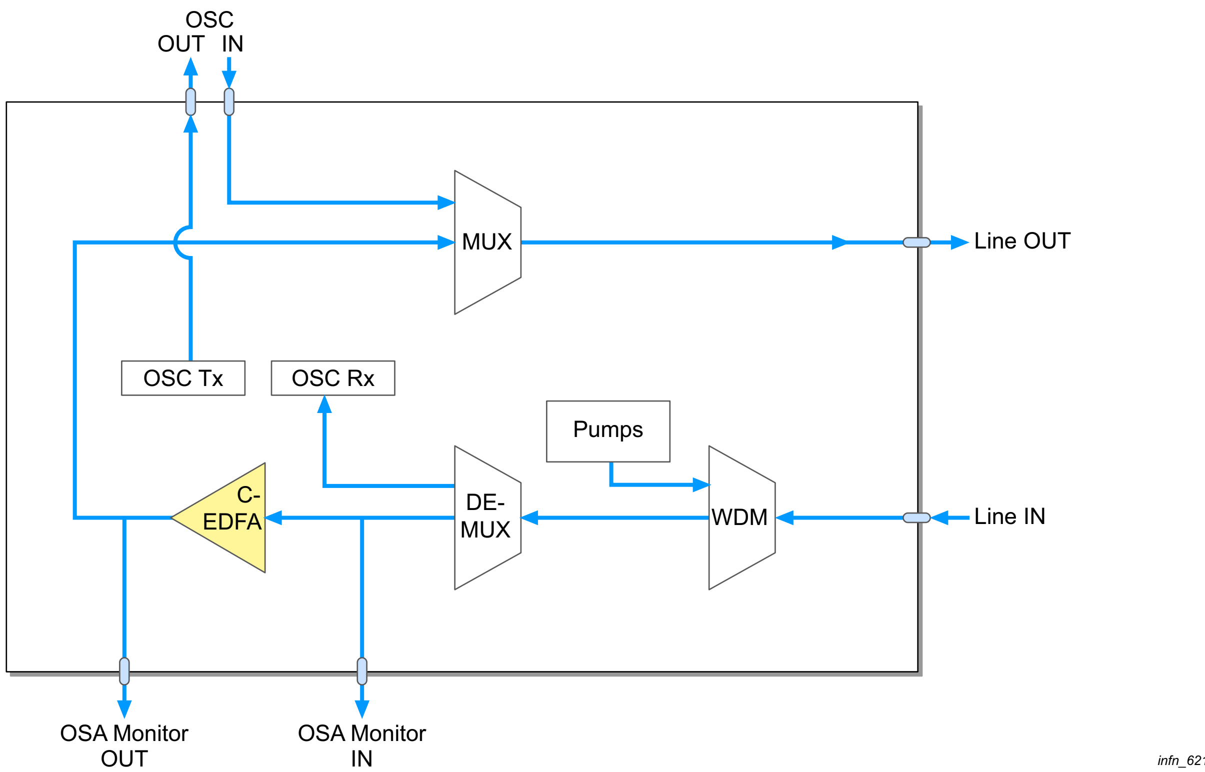


Figure 4-26 ORM-CXH1-LL Data Plane Block Diagram



External Indicators and Connectors

The ORM provides the circuit pack status/port LED indicators, and line/port connectors as follows:

- ORM-CXH1-MS as shown in Figure 4-27
- ORM-CXH1-MS-LL as shown in Figure 4-28 on page 4-70
- ORM-CXH1 as shown in Figure 4-29 on page 4-71
- ORM-CXH1-LL as shown in Figure 4-30 on page 4-72

Figure 4-27 ORM-CXH1-MS Faceplate

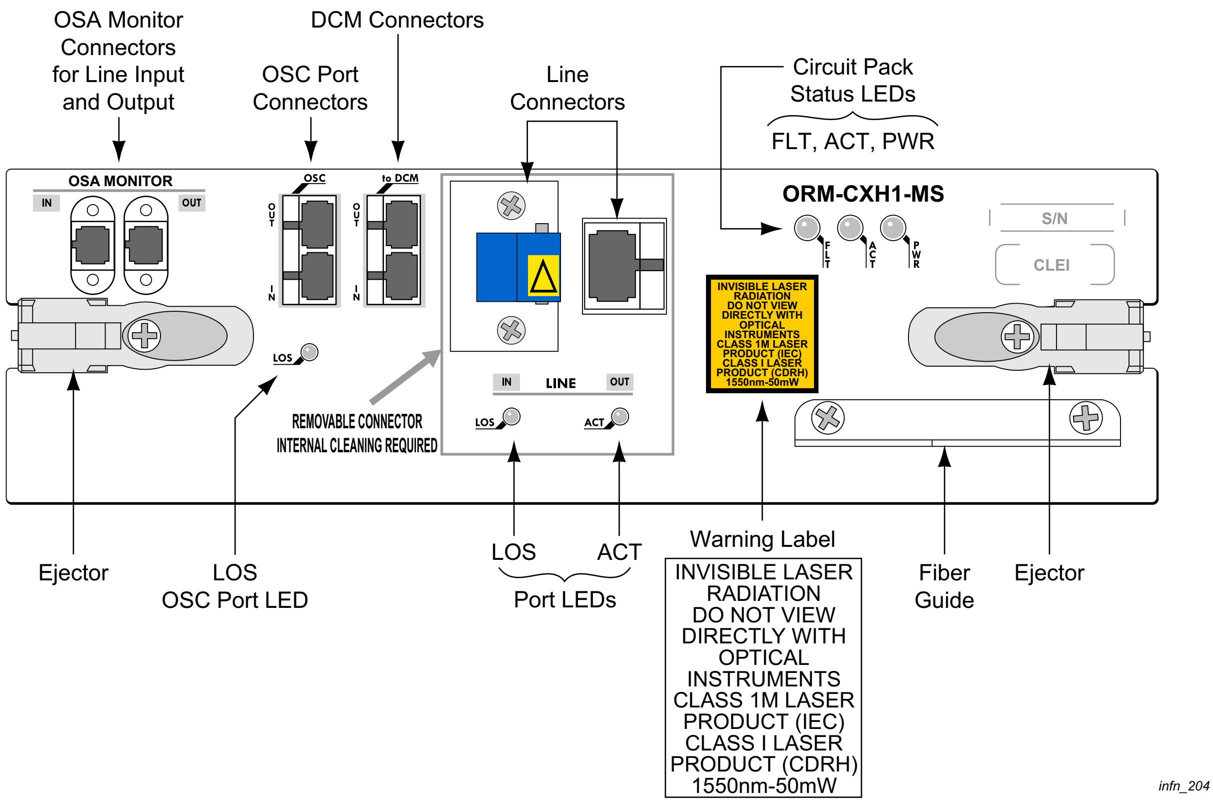


Figure 4-28 ORM-CXH1-MS-LL Faceplate

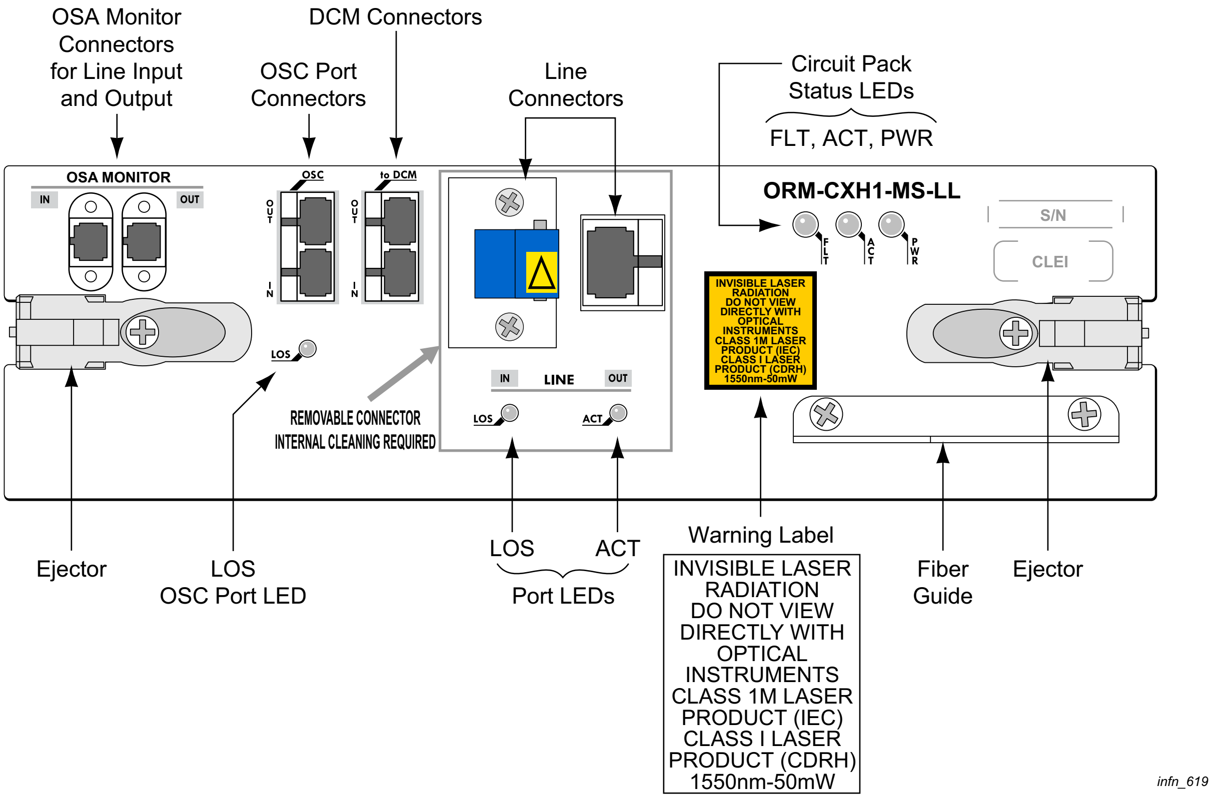


Figure 4-29 ORM-CXH1 Faceplate

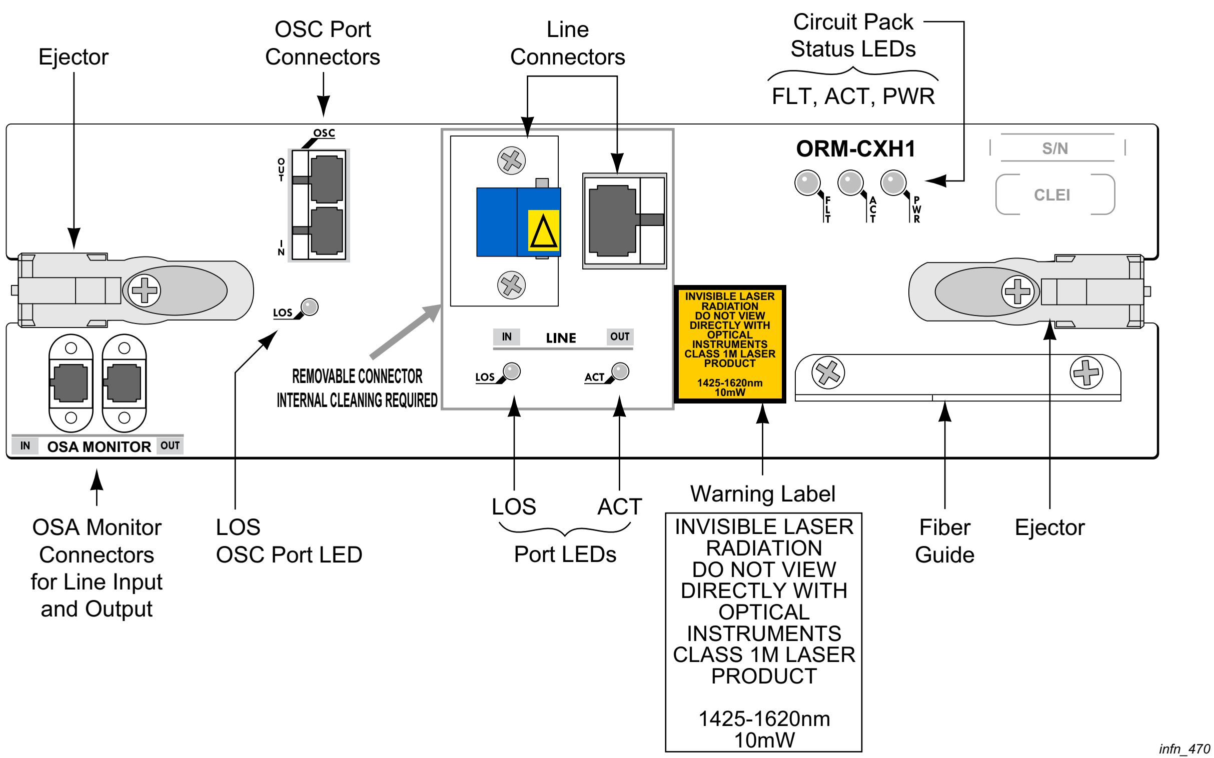
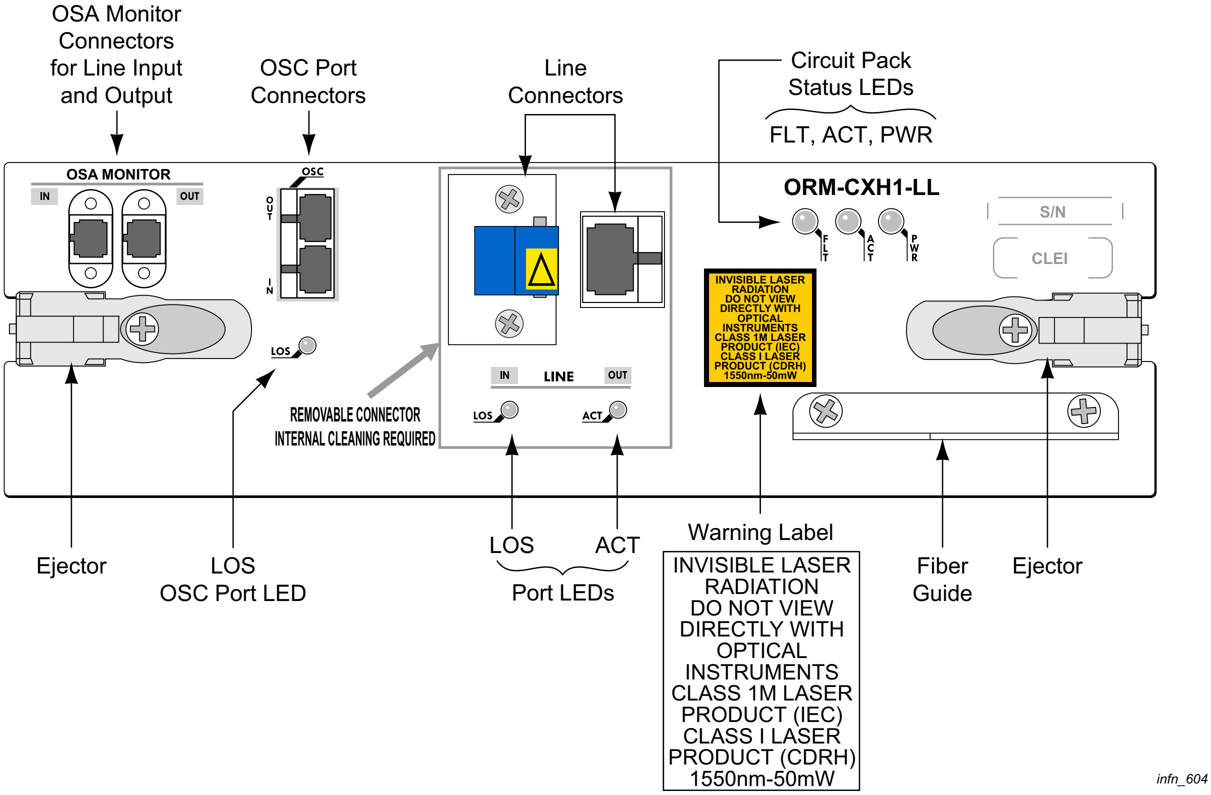


Figure 4-30 ORM-CXH1-LL Faceplate



Circuit Pack Level LEDs

The ORM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-57.

Table 4-57 ORM Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an equipment alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Green (Active, In-service), flashing Yellow (In Maintenance), or dimmed (Locked state)
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the ORM

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are three LEDs: ACTIVE and LOS for the ORM to indicate the line and Optical Supervisory Channel (OSC) port status. The significance of a lit LED is described in Table 4-58.

Table 4-58 Port Visual Alarm Indicators on the ORM

LED	State	Description
LINE ACT (Active)	Green / Yellow	Indicates the line port administrative status: • Solid Green (Active) • Flashing Green indicates that ALS is disabled • Flashing Yellow indicates that the Raman pumps are shutdown and the module is in Locked state • Dimmed indicates C-Band/OTS Loss of Signal (LOS) or EDFA is locked
LINE LOS	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit and dimmed when C-Band/OTS signal is received
OSC LOS	Red	Indicates the status of the incoming signal. During an OSC Loss of Signal (LOS) condition, this indicator will be lit and dimmed when C-Band/OTS signal is received

Connectors

The ORM provides connectors for the external fiber plant and management and control traffic.

Table 4-59 lists the connector information for ORM-CXH1-MS and ORM-CXH1-MS-LL.

Table 4-59 ORM-CXH1-MS and ORM-CXH1-MS-LL Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Ports to monitor line output
OSC IN	SC, Front access	OSC port connects to the OSC OUT of the associated ORM
OSC OUT	SC, Front access	OSC port connects to the OSC IN of the associated ORM
DCM IN	SC, Front access	Connects from a DCM or DSE
DCM OUT	SC, Front access	Connects to a DCM or DSE
LINE IN	SC, Front access	Connects the input of the ORM to the line side fiber (receive side)
LINE OUT	SC, Front access	Connects the output of the ORM to the line side fiber (transmit side)

Table 4-60 lists the connector information for ORM-CXH1 and ORM-CXH1-LL.

Table 4-60 ORM-CXH1 and ORM-CXH1-LL Connectors

Connector	Type	Purpose
OSA Monitor IN	SC, Front access	Port to monitor line input
OSA Monitor OUT	SC, Front access	Ports to monitor line output
OSC IN	SC, Front access	OSC port connects to the OSC OUT of the associated ORM
OSC OUT	SC, Front access	OSC port connects to the OSC IN of the associated ORM
LINE IN	SC, Front access	Connects the input of the ORM to the line side fiber (receive side)
LINE OUT	SC, Front access	Connects the output of the ORM to the line side fiber (transmit side)

Technical Specifications

Table 4-61 provides the mechanical and electrical specifications for the ORM.

Table 4-61 ORM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	3.20 inches / 81.28mm
	Depth	8.53 inches / 216.66mm
	Weight	10.0lb / 4.5kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Specifications

Table 4-62 provides the optical specifications for the ORM.

Table 4-62 ORM Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	25GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
Raman pumps	Wavelength	1425nm and 1465nm
	Maximum total pump power	1.08W
OSC	Wavelength	1510nm
	Format	OC-3c

Submarine Control Module (SCM)

Table 4-63 lists the name and a brief description of the SCM.

Table 4-63 SCM Product Details

Product Ordering Name (PON)	Description
SCM-1	• Submarine Control Module, provides communication channel with third-party wet plant systems via Infinera WPLM

Functional Description

The Submarine Control Module, referred to as SCM, is a component of the Infinera Wet Plant Control and Surveillance System (WPCS) and used exclusively with the Infinera Wet Plant Link Manager (WPLM) stand-alone software application to manage communication between Infinera DTNs and third-party wet plant systems (Figure 4-31 on page 4-77). For detailed information regarding Infinera WPCS and/or WPLM, refer to the *Infinera Wet Plant Link Manager Reference Guide*.

SCMs are installed in DTNs (OTC Expansion Chassis) located at cable landing stations at each end of a third-party wet plant link (Figure 4-32 on page 4-77.) and provide the interface for monitoring and control of idlers and submerged components such as repeaters and equalizers.

SCMs also provide the WPCS idler and management command/response functionality necessary for the third-party submerged components via a low data rate amplitude modulation of the WDM signal using several subcarrier frequencies specific to the release version of the submerged components. SCMs are connected to both the transmit link to the wet plant and the receive link from the wet plant. On transmit, idler tones are inserted before the signal is amplified and WPLM commands are modulated onto the signal after amplification. On receive, responses from the wet plant are extracted from the signal before the signal is amplified.

The SCM can be equipped in slot 2 and/or 3 of the OTC (Expansion Chassis only) and supports both multi-chassis DTN and Optical Line Amplifier configurations. The SCM interoperates with the following BMM/ OAM types only:

- BMM2-8-CXH2-MS
- BMM2-8-CH3-MS
- BMM2-8-CEH3
- OAM-CXH1-MS

Note: Idler lasers will be shutdown if the SCM is locked. Ensure that the SCM is in an unlocked state for idler lasers to transmit.

Figure 4-31 Infinera Wet Plant Control and Surveillance System

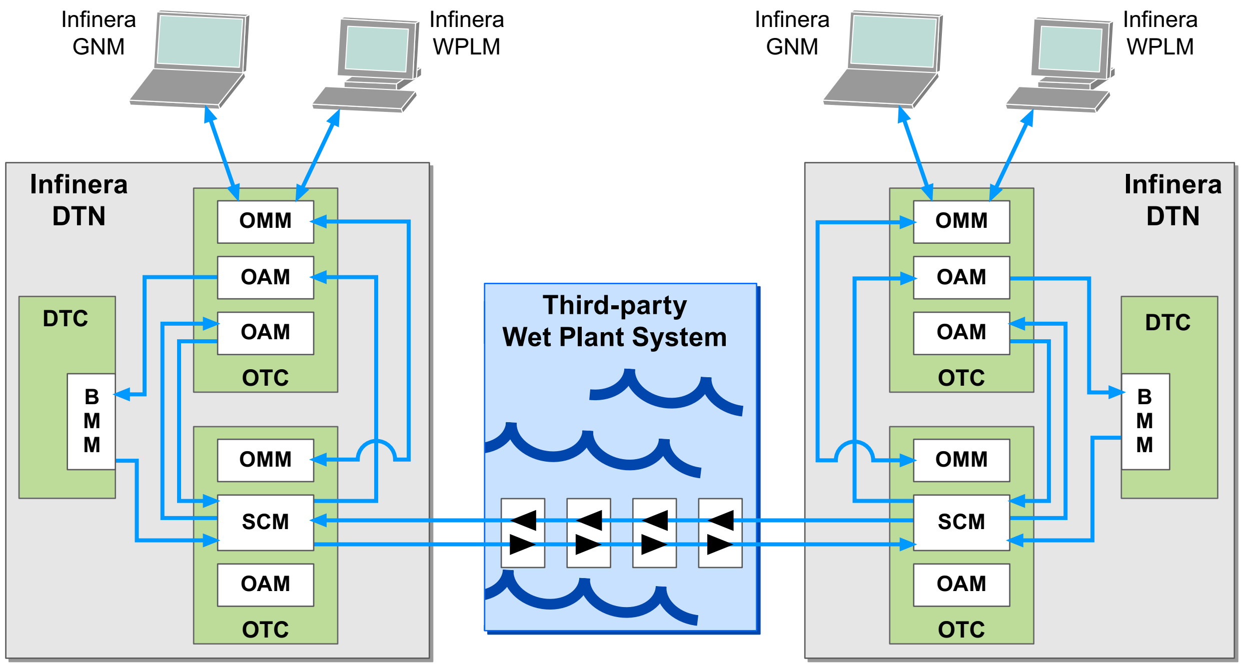
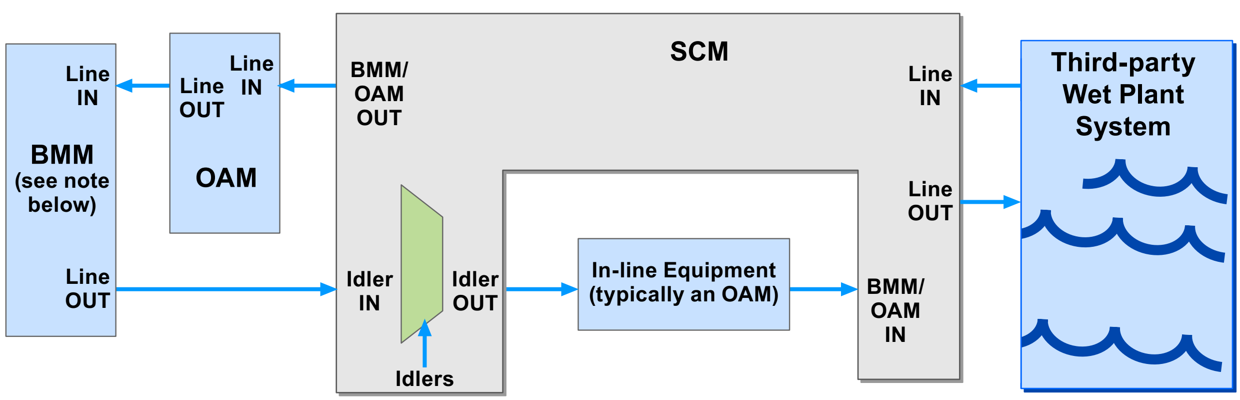


Figure 4-32 SCM Interconnection at the Cable Landing Station



Note: Typically this equipment will be a BMM. Certain designs may require other equipment to be deployed between the BMM and SCM.

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Block Diagrams

This section provides the SCM control and data plane block diagrams as shown in Figure 4-33 and Figure 4-34.

Figure 4-33 SCM Control Plane Block Diagram

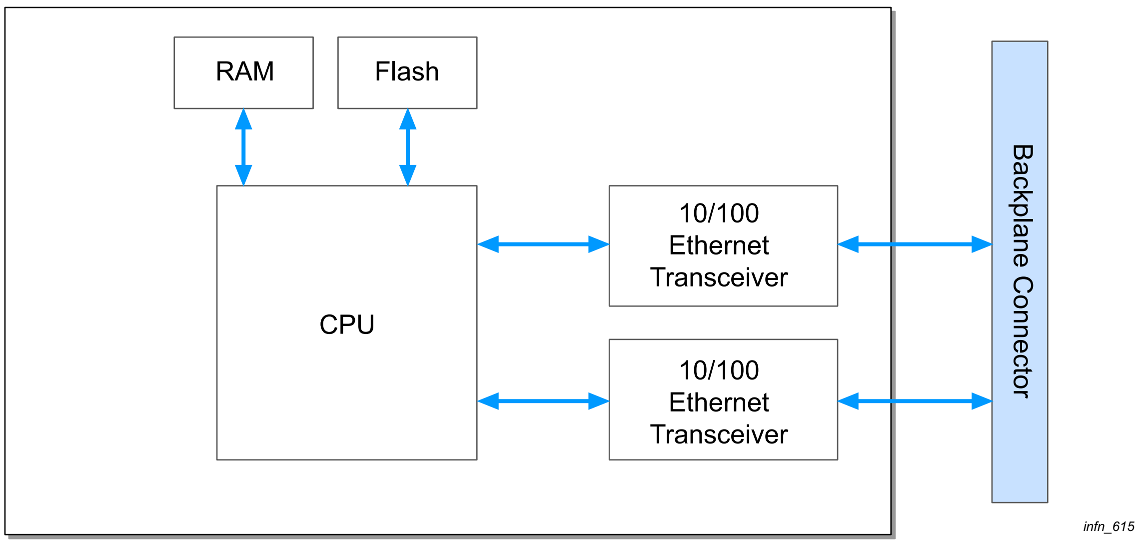
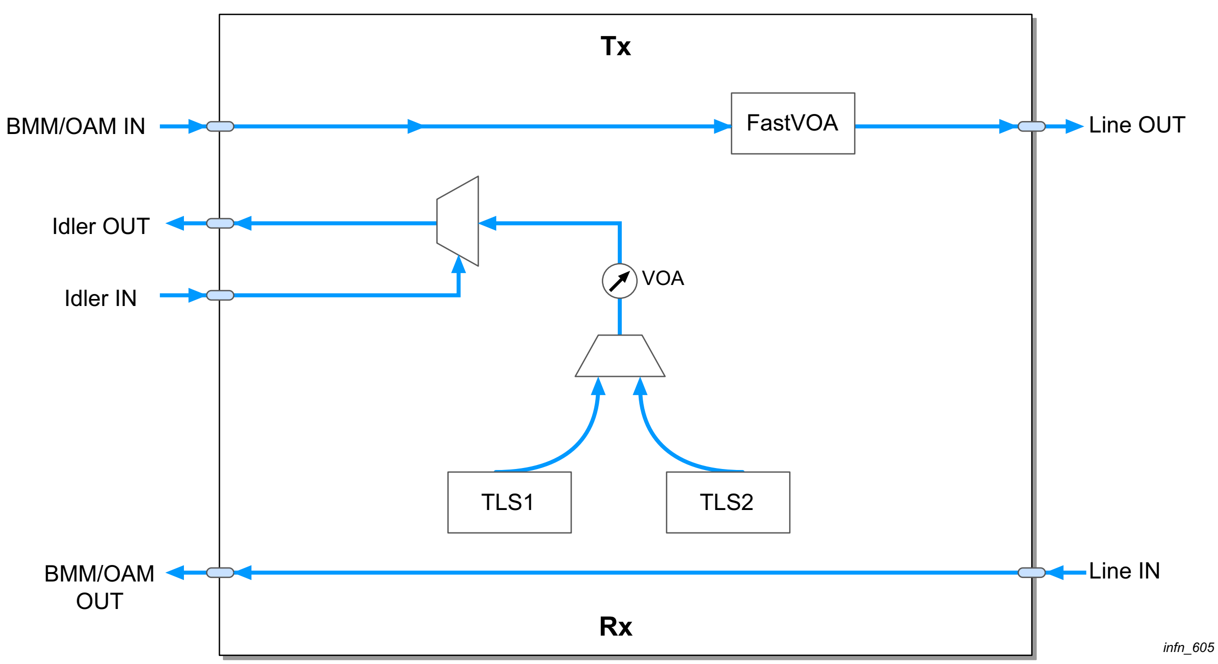


Figure 4-34 SCM Data Plane Block Diagram



Insertion Losses

Table 4-64 lists the maximum expected insertion losses between specific ports on the SCM.

Table 4-64 SCM Insertion Losses

Port Connections	Insertion Loss (dB)
IDLER IN to IDLER OUT	4.7
BMM/OAM IN to LINE OUT	2.0
LINE IN to BMM/OAM OUT	1.0

Idler Channel Assignments

Table 4-65 lists the idler channel assignments for the SCM.

Note: The idler maximum transmit power is 14.0dBm.

Table 4-65 Idler Channel Assignments

Channel	Frequency	Wavelength	OCG-Channel
1	191.50	1565.495864	N/A
2	191.55	1565.087225	N/A
3	191.60	1564.6788	N/A
4	191.65	1564.270587	N/A
5	191.70	1563.862587	N/A
6	191.75	1563.454801	OCG1-1
7	191.80	1563.047226	OCG2-1
8	191.85	1562.639864	OCG3-1
9	191.90	1562.232715	OCG4-1
10	191.95	1561.825778	OCG1-2
11	192.00	1561.419052	OCG2-2
12	192.05	1561.012538	OCG3-2
13	192.10	1560.606236	OCG4-2
14	192.15	1560.200146	OCG1-3
15	192.20	1559.794266	OCG2-3
16	192.25	1559.388598	OCG3-3
17	192.30	1558.983141	OCG4-3
18	192.35	1558.577894	OCG1-4

Table 4-65 Idler Channel Assignments

Channel	Frequency	Wavelength	OCG-Channel
19	192.40	1558.172859	OCG2-4
20	192.45	1557.768033	OCG3-4
21	192.50	1557.363418	OCG4-4
22	192.55	1556.959013	OCG1-5
23	192.60	1556.554818	OCG2-5
24	192.65	1556.150833	OCG3-5
25	192.70	1555.747058	OCG4-5
26	192.75	1555.343492	OCG1-6
27	192.80	1554.940135	OCG2-6
28	192.85	1554.536987	OCG3-6
29	192.90	1554.134049	OCG4-6
30	192.95	1553.731319	OCG1-7
31	193.00	1553.328798	OCG2-7
32	193.05	1552.926485	OCG3-7
33	193.10	1552.524381	OCG4-7
34	193.15	1552.122485	OCG1-8
35	193.20	1551.720797	OCG2-8
36	193.25	1551.319317	OCG3-8
37	193.30	1550.918044	OCG4-8
38	193.35	1550.51698	OCG1-9
39	193.40	1550.116122	OCG2-9
40	193.45	1549.715472	OCG3-9
41	193.50	1549.315028	OCG4-9
42	193.55	1548.914792	OCG1-10
43	193.60	1548.514762	OCG2-10
44	193.65	1548.114939	OCG3-10
45	193.70	1547.715323	OCG4-10
46	193.75	1547.315912	N/A
47	193.80	1546.916708	N/A
48	193.85	1546.51771	N/A
49	193.90	1546.118917	N/A
50	193.95	1545.72033	OCG5-1
51	194.00	1545.321948	OCG6-1
52	194.05	1544.923772	OCG7-1
53	194.10	1544.525801	OCG8-1

Table 4-65 Idler Channel Assignments

Channel	Frequency	Wavelength	OCG-Channel
54	194.15	1544.128035	OCG5-2
55	194.20	1543.730474	OCG6-2
56	194.25	1543.333117	OCG7-2
57	194.30	1542.935965	OCG8-2
58	194.35	1542.539017	OCG5-3
59	194.40	1542.142274	OCG6-3
60	194.45	1541.745734	OCG7-3
61	194.50	1541.349398	OCG8-3
62	194.55	1540.953267	OCG5-4
63	194.60	1540.557338	OCG6-4
64	194.65	1540.161613	OCG7-4
65	194.70	1539.766091	OCG8-4
66	194.75	1539.370773	OCG5-5
67	194.80	1538.975657	OCG6-5
68	194.85	1538.580744	OCG7-5
69	194.90	1538.186034	OCG8-5
70	194.95	1537.791526	OCG5-6
71	195.00	1537.397221	OCG6-6
72	195.05	1537.003117	OCG7-6
73	195.10	1536.609216	OCG8-6
74	195.15	1536.215516	OCG5-7
75	195.20	1535.822018	OCG6-7
76	195.25	1535.428722	OCG7-7
77	195.30	1535.035627	OCG8-7
78	195.35	1534.642734	OCG5-8
79	195.40	1534.250041	OCG6-8
80	195.45	1533.857549	OCG7-8
81	195.50	1533.465258	OCG8-8
82	195.55	1533.073168	OCG5-9
83	195.60	1532.681278	OCG6-9
84	195.65	1532.289589	OCG7-9
85	195.70	1531.898099	OCG8-9
86	195.75	1531.50681	OCG5-10
87	195.80	1531.11572	OCG6-10
88	195.85	1530.72483	OCG7-10

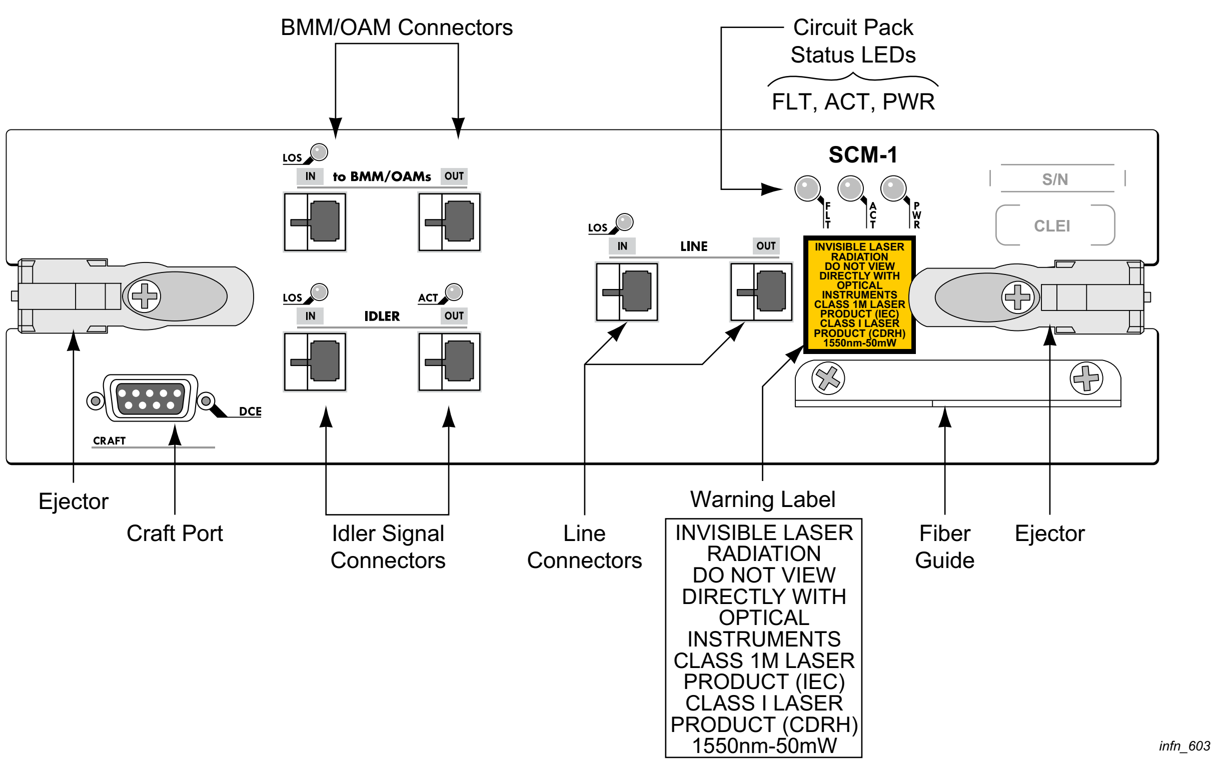
Table 4-65 Idler Channel Assignments

Channel	Frequency	Wavelength	OCG-Channel
89	195.90	1530.33414	OCG8-10
90	195.95	1529.943649	N/A
91	196.00	1529.553357	N/A
92	196.05	1529.163264	N/A
93	196.10	1528.773371	N/A
94	196.15	1528.383676	N/A
95	196.20	1527.994179	N/A
96	196.25	1527.604882	N/A

External Indicators and Connectors

The SCM provides the circuit pack status/port LED indicators, and line/port connectors as shown in Figure 4-35

Figure 4-35 SCM Faceplate



Circuit Pack Level LEDs

The SCM provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-66.

Table 4-66 SCM Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an equipment alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Green (Active, In-service), flashing Yellow (In Maintenance), or dimmed (Locked state)
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the SCM

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are two LEDs: ACTIVE and LOS for the SCM to indicate the idler, line, and associated BMM/OAM port status. The significance of a lit LED is described in Table 4-67.

Table 4-67 Port Visual Alarm Indicators on the SCM

LED	State	Description
IDLER ACT (Active)	Green	Indicates the port status of the incoming signal. During idler signal activity, this indicator will be lit and dimmed otherwise
IDLER LOS	Red	Indicates the status of the incoming signal. During an idler signal Loss of Signal (LOS) condition, this indicator will be lit and dimmed when idler signal is received
BMM/OAM LOS	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit and dimmed when C-Band/OTS signal is received
LINE LOS	Red	Indicates the status of the incoming signal. During a C-Band/OTS Loss of Signal (LOS) condition, this indicator will be lit and dimmed when C-Band/OTS signal is received

Connectors

The SCM provides connectors for the external fiber plant and management and control traffic.

Table 4-68 lists the connector information for the SCM.

Table 4-68 SCM Connectors

Connector	Type	Purpose
IDLER IN	SC, Front access	Connects from the idler signal source
IDLER OUT	SC, Front access	Connects to the idler signal source
BMM/OAM IN	SC, Front access	Connects from the associated BMM/OAM
BMM/OAM OUT	SC, Front access	Connects to the associated BMM/OAM
LINE IN	SC, Front access	Connects from the third-party wet plant system
LINE OUT	SC, Front access	Connects to the third-party wet plant system
CRAFT DCE	9600 RS-232 DCE DB-9 Female	Used by maintenance personnel for field-debugging

Technical Specifications

Table 4-69 provides the mechanical and electrical specifications for the SCM.

Table 4-69 SCM Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	3.20 inches / 81.28mm
	Depth	8.53 inches / 216.66mm
	Weight	8.0lb / 3.6kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Specifications

Table 4-70 provides the optical specifications for the SCM.

Table 4-70 SCM Optical Specifications

Type	Parameter	Specification
Line side optics	Number of channels supported	8 (minimum) through 160 (maximum)
	Wavelength range	1530-1563.75nm ITU Grid
Idler optics	Wavelength spacing	50GHz
	Wavelength range	1530-1563.75nm ITU Grid

Dynamic Spectrum Equalizer (DSE)

Note: Provisioning a DSE in an OTC configured as the Main Chassis is not supported. DSEs can be provisioned only in an OTC configured as the Expansion Chassis.

Note: Mixing of DSEs with REM-2s in the same OTC is not supported.

Note: Provisioning a DSE at mid-stage of a BMM/BMM2H/BMM2P is not supported. DSEs can only be provisioned at mid-stage of a BMM2/OAM/ORM.

Table 4-71 lists the name and a brief description of the DSE.

Table 4-71 DSE Product Details

Product Ordering Name (PON)	Description
DSE-1	Dynamic Spectrum Equalizer—used in ULH applications to provide flatter gain, supports linear and user-defined tracking, and operates in one of two modes: Native-Automated (default) used for terrestrial links and SLTE Mode 1 used exclusively for links traversing submarine networks

Functional Description

The Dynamic Spectrum Equalizer, referred to as DSE, is deployed at mid-stage of a BMM2/OAM/ORM for ultra long haul (ULH) applications to provide gain flattening for enhanced reach. The DSE is an active device and uses a sampling of the optical signal from the optical spectrum analyzer (OSA) monitor output port of a BMM/BMM2/OAM/ORM to adjust its output to flatten the gain power variation across the C-Band. DSEs are also supported for spans that use BMMs (as opposed to previous software releases in which DSEs were supported only on spans between BMM2s).

The DSE consists of two main components: a dynamic gain equalizer (DGE) and an optical power monitor (OPM) as shown in Figure 4-37 on page 4-88. The DGE is a two-port device consisting of an array of wavelength-dependent attenuation devices. The DGE receives an optical signal and attenuates certain wavelengths within the signal's spectrum in order to provide a given spectral shape. The OPM device scans the C-band and measures optical power at various wavelengths.

The DSE can be equipped in slot 2 and/or 3 of the OTC (Expansion Chassis only) and supports both multi-chassis DTN and Optical Line Amplifier configurations.

DSE Operating Modes

The DSE provides two operating modes: Native-Automated (default) which is used for terrestrial links and SLTE Mode 1 which is used exclusively for links traversing submarine networks.

The following configurations are supported for the DSE:

- BMM2 (set to Native-Automated) + DSE (set to Native-Automated)
- OAM (set to Native-Automated) + DSE (set to Native-Automated)
- ORM (set to Native-Automated) + DSE (set to Native-Automated)
- OAM (set to SLTE Mode 1) + DSE (set to SLTE Mode 1)

The DSE supports a Target Mode parameter (selectable options are: Linear [default] or User-defined) to configure the DSE for linear tracking (tracking towards a flat spectrum), or for user-defined tracking. The DSE Target Mode is selectable from Infinera GNM after the DSE has been administratively set to Locked or Maintenance.

When the DSE is configured for user-defined tracking (to support submarine networks), once the user provides a set of relative power values (from Infinera GNM), the DSE will track towards achieving this relative power. These powers will be relative to the channel which has relative power set to zero (0). In this mode, the Spectrum Tilt setting is ignored. User-defined tracking means that the DSE will track towards a user-provided shape, which is 160 points of relative power (dB), one point of which must be 0. The DSE profile settings are persisted in the database while the DSE is in user-defined tracking mode.

Per-OCG and Per-Channel Target Power Offsets

Support for per-OCG and per-channel target power offsets is provided which is based on the profile type as described below:

- Linear profile—the DSE maintains a flat output spectrum while incorporating any OCG and/or per-channel target power offsets known to the BMM/BMM2. The BMM/BMM2 communicates a total offset map to the DSE via Infinera’s Automated Gain Control (AGC)
- Arbitrary profile—the DSE ignores any OCG and/or channel offsets known to the BMM/BMM2 and operates using the target relative power profile. If OCG and/or channel offsets are necessary, they should be applied directly to the OCG/OCH ports of the BMM/BMM2/CMM and to the target relative power profile for the DSE

Block Diagrams

This section provides the DSE control and data plane block diagrams as shown in Figure 4-36 and Figure 4-37.

Figure 4-36 DSE Control Plane Block Diagram

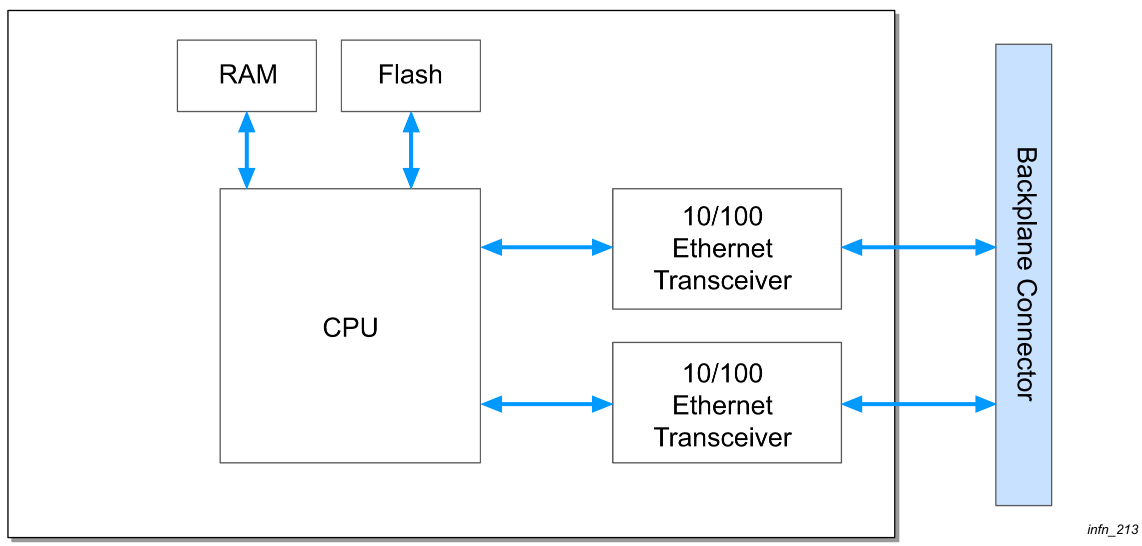
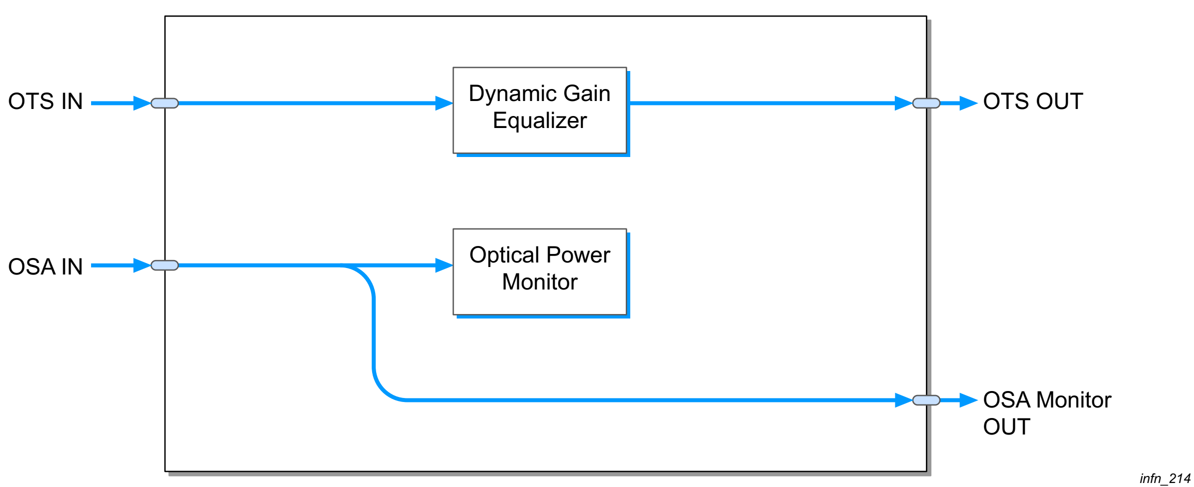


Figure 4-37 DSE Data Plane Block Diagram



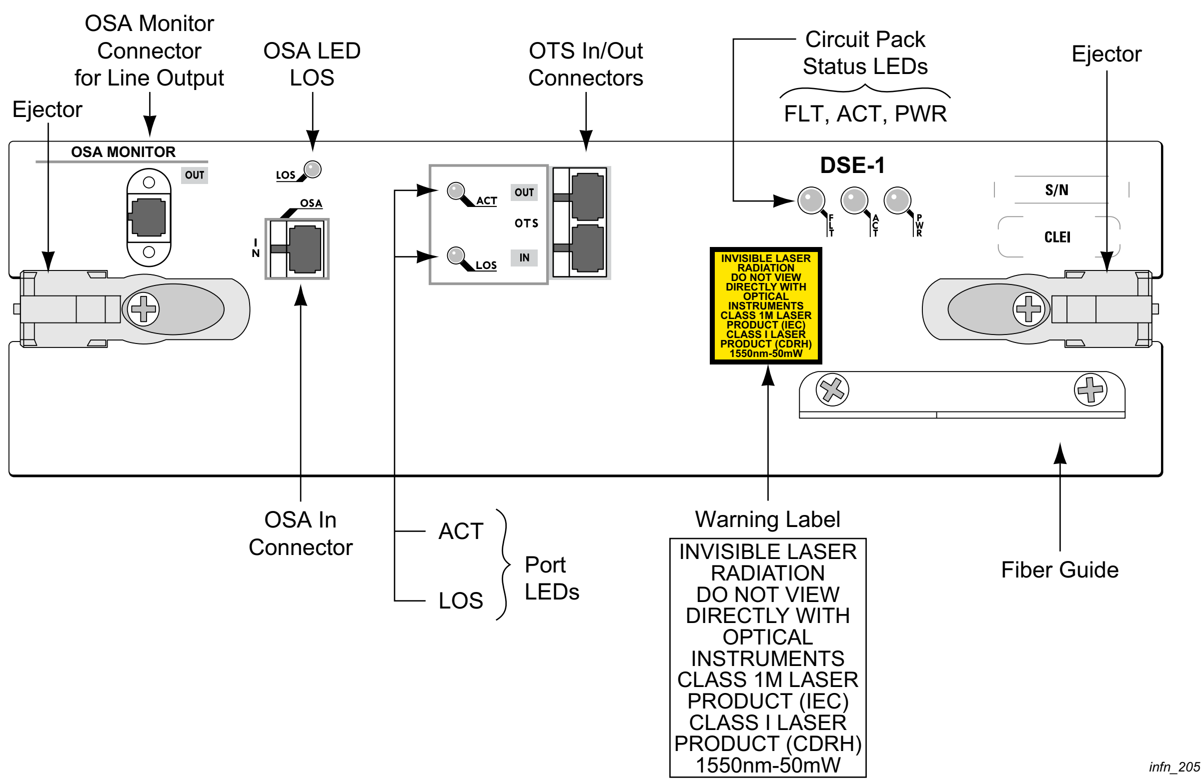
Insertion Loss

The maximum insertion loss for a DSE is 3.8dB. However, the total loss allowed for a DSE (including actual insertion loss) can vary between 7.5 and 12.5dB depending on the gain setting and type of BMM/BMM2/OAM/ORM associated with the DSE.

External Indicators and Connectors

The DSE provides the circuit pack status/port LED indicators, and line/port connectors as shown in Figure 4-38.

Figure 4-38 DSE Faceplate



Circuit Pack Level LEDs

The DSE provides three LEDs to indicate the circuit pack status. The significance of an illuminated LED is described in Table 4-72.

Table 4-72 DSE Status LED Indicators

LED	Color	Description
FLT (Fault)	Red	Indicates the presence (lit) or absence (dimmed) of an equipment alarm on the circuit pack: Critical, Major, or Minor. Flashing Red indicates (Bring-up mode)
ACT (Active)	Green / Yellow	Indicates the circuit pack status: Green (Active, In-service), flashing Yellow (In Maintenance), or dimmed (Locked state)
PWR (Power)	Green	Indicates the presence (lit) or absence (dimmed) of power supply to the DSE

Note: Refer to the *Infinera GNM Fault Management and Diagnostics Guide* for more detailed information regarding circuit pack and port LED functions.

Port Indicators

There are three LEDs: ACTIVE and LOS for the DSE to indicate the Optical Transport Section (OTS) and OSA port status. The significance of a lit LED is described in Table 4-73.

Table 4-73 Port Visual Alarm Indicators on the DSE

LED	State	Description
OTS ACT (Active)	Green / Yellow	Indicates the OTS administrative status: • Solid Green (Active) • Flashing Yellow indicates that the module is in Locked state • OFF indicates Loss of Signal (LOS)
OTS LOS	Red	Indicates the status of the incoming OTS signal. During a Loss of Signal (LOS) condition, this indicator will be lit. OFF indicates that a signal is being received.
OSA LOS	Red	Indicates the status of the incoming OSA signal. During a Loss of Signal (LOS) condition, this indicator will be lit. OFF indicates that a signal is being received.

Connectors

The DSE provides connectors for the external fiber plant and management and control traffic.

Table 4-74 lists the connector information for DSE.

Table 4-74 DSE Connectors

Connector	Type	Purpose
OTS IN	SC, Front access	Connects from the DCM OUT port of a BMM2/OAM/ORM
OTS OUT	SC, Front access	Connects to the DCM IN port of a BMM2/OAM/ORM
OSA IN	SC, Front access	Port used to provide the BMM/BMM2/OAM/ORM output spectrum to the DSE's onboard OPM device
OSA Monitor OUT	SC, Front access	Port to monitor line output of a BMM/BMM2/OAM/ORM

Technical Specifications

Table 4-75 provides the mechanical and electrical specifications for the DSE.

Table 4-75 DSE Technical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	10.50 inches / 266.70mm
	Width	3.20 inches / 81.28mm
	Depth	8.53 inches / 216.66mm
	Weight	9.0lb / 4.1kg
Electrical specifications	Power consumption	See Table 4-1 on page 4-2

Optical Specifications

Table 4-76 provides the optical specifications for the DSE.

Table 4-76 DSE Optical Specifications

Type	Parameter	Specification
Line side optics	Wavelength spacing	25GHz
	Wavelength range	1530.334-1563.455nm ITU Grid
	OTS input power range	-14.5dBm to +14.5dBm
	OSA input power range	-23.0dBm to +7.5dBm

Blank Circuit Packs

Whenever a circuit pack is removed, the blank space must be occupied by the corresponding blank circuit pack. Blank circuit packs serve three important functions:

- Prevents exposure to hazardous voltage and currents inside the chassis
- Contains any electromagnetic interference (EMI) that might affect other equipment
- Directs the flow of cooling air through the chassis

Table 4-77 lists the corresponding blank circuit packs.

Table 4-77 OTC Blank Circuit Packs

Product Ordering Name (PON)	Description
OMM-BLANK-A	Optical Management Module (OMM) blank
OAM-BLANK-A	Optical Amplification Module (OAM) blank

CHAPTER 5

Infinera Dispersion Management Chassis

The Infinera Dispersion Management Chassis (DMC), referred to as the DMC, is a rack mountable passive chassis and does not require management or power. Depending on the span characteristics, the DMC is optionally included with DTNs and Optical Line Amplifiers to house Dispersion Compensation Modules (DCMs), Band Pass Filters (BPFs), Passive Spectrum Equalizers (PSEs), Red/Blue Band Mux/Demuxes (RBMs), and/or Line Multiplexing Modules (LMMs).

This chapter provides a hardware description for the DMC including a functional description of the hardware, block diagram of the internal signal flow (where applicable), and technical specifications. This chapter includes the following sections:

For DMC, DCM, BPF, PSE, RBM, and/or LMM installation procedures, refer to the *Infinera DTN and DTN-X Site Preparation and Hardware Installation Guide.*

DMC Overview

The DMC is comprised of a DMC and either DCMs, BPFs, PSEs, RBMs, and/or LMMs as listed in Table 5-1.

Table 5-1 DMC Hardware Equipment

Equipment Type	Name
DMC	Dispersion Management Chassis
Circuit Packs	Dispersion Compensation Module (DCM)
	Band Pass Filter (BPF)
	Passive Spectrum Equalizer (PSE)
	Red/Blue Band Mux/Demux (RBM)
	Line Multiplexing Module (LMM)

- Views of the DMC with the supported DCM types are shown in Figure 5-1 on page 5-3 (half-width) and Figure 5-2 on page 5-4 (full-width)
- A view of the DMC with the supported BPF types is shown in Figure 5-3 on page 5-5
- A view of the DMC with the supported PSE types is shown in Figure 5-4 on page 5-6
- A view of the DMC with the supported RBM types is shown in Figure 5-5 on page 5-7
- A view of the DMC with the supported LMM types is shown in Figure 5-6 on page 5-8

Figure 5-1 DMC with Half-width DCMs

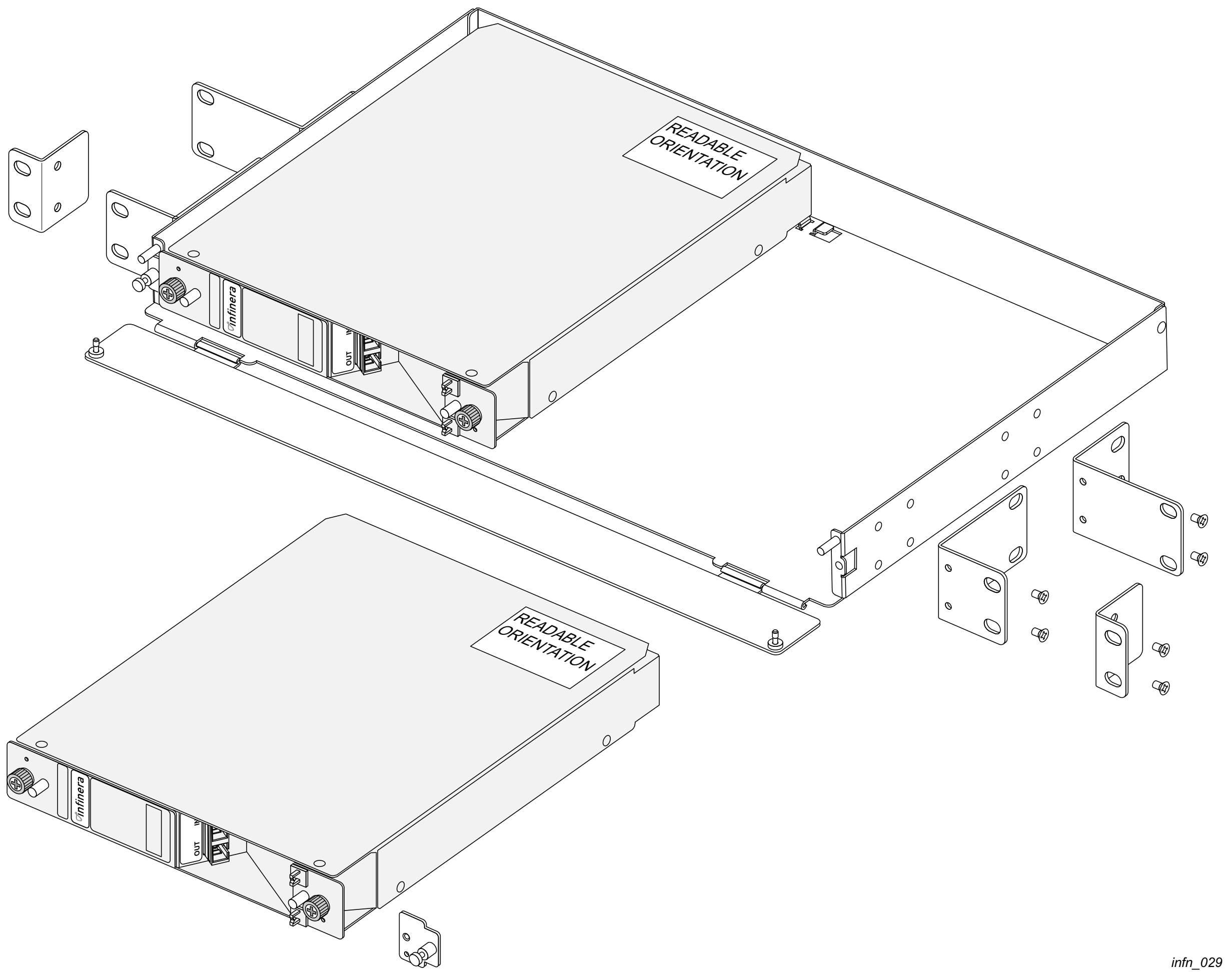


Figure 5-2 DMC with a Full-width DCM

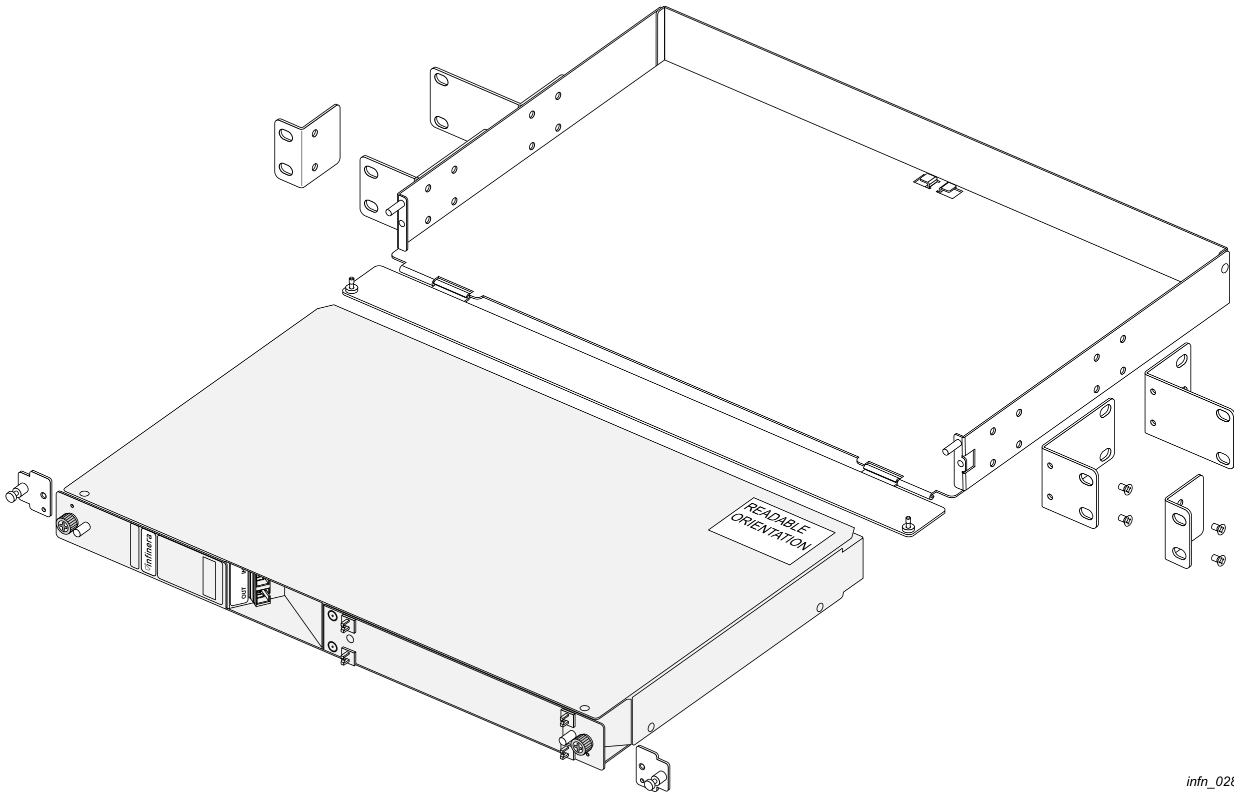


Figure 5-3 DMC with BPFs

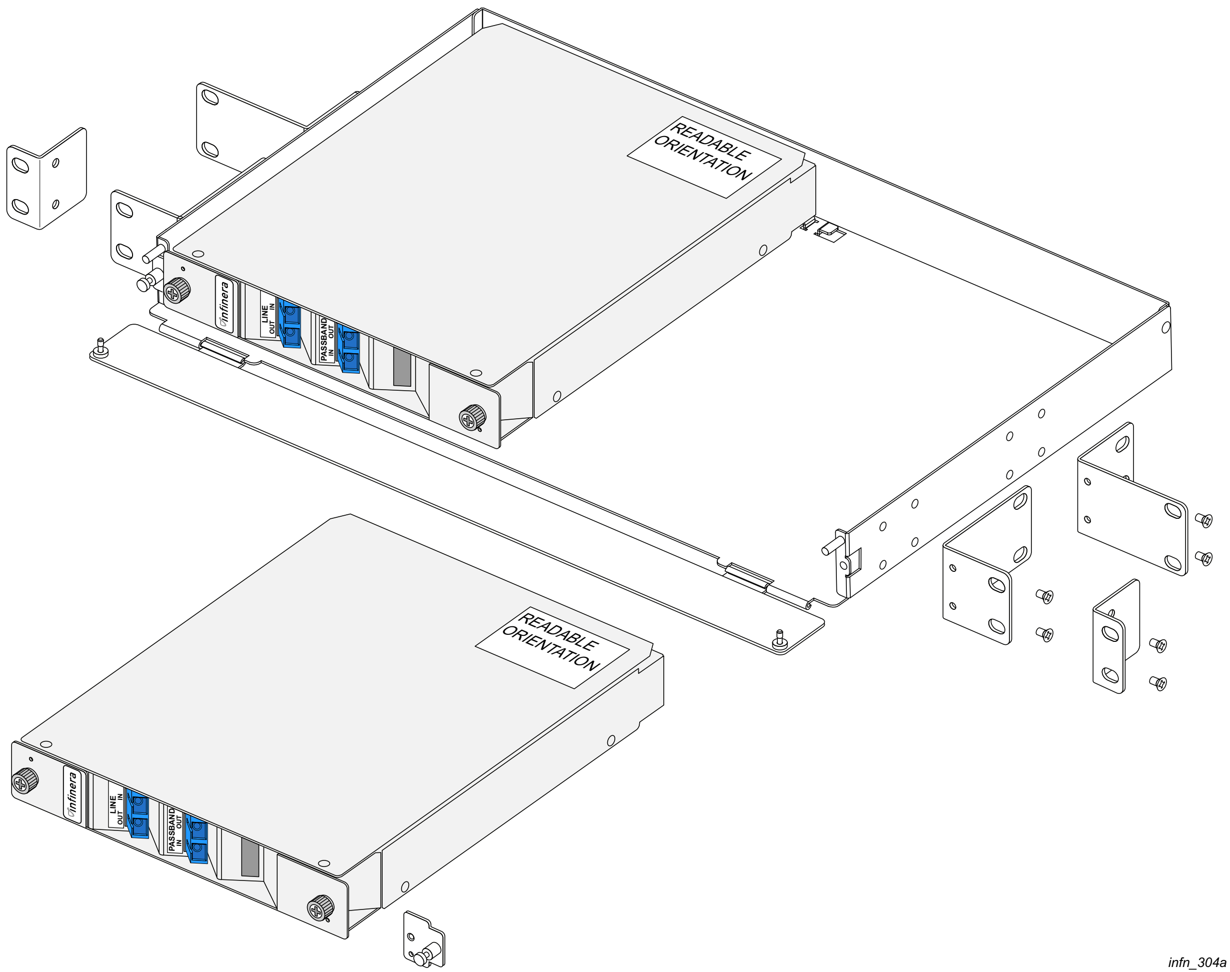


Figure 5-4 DMC with PSEs

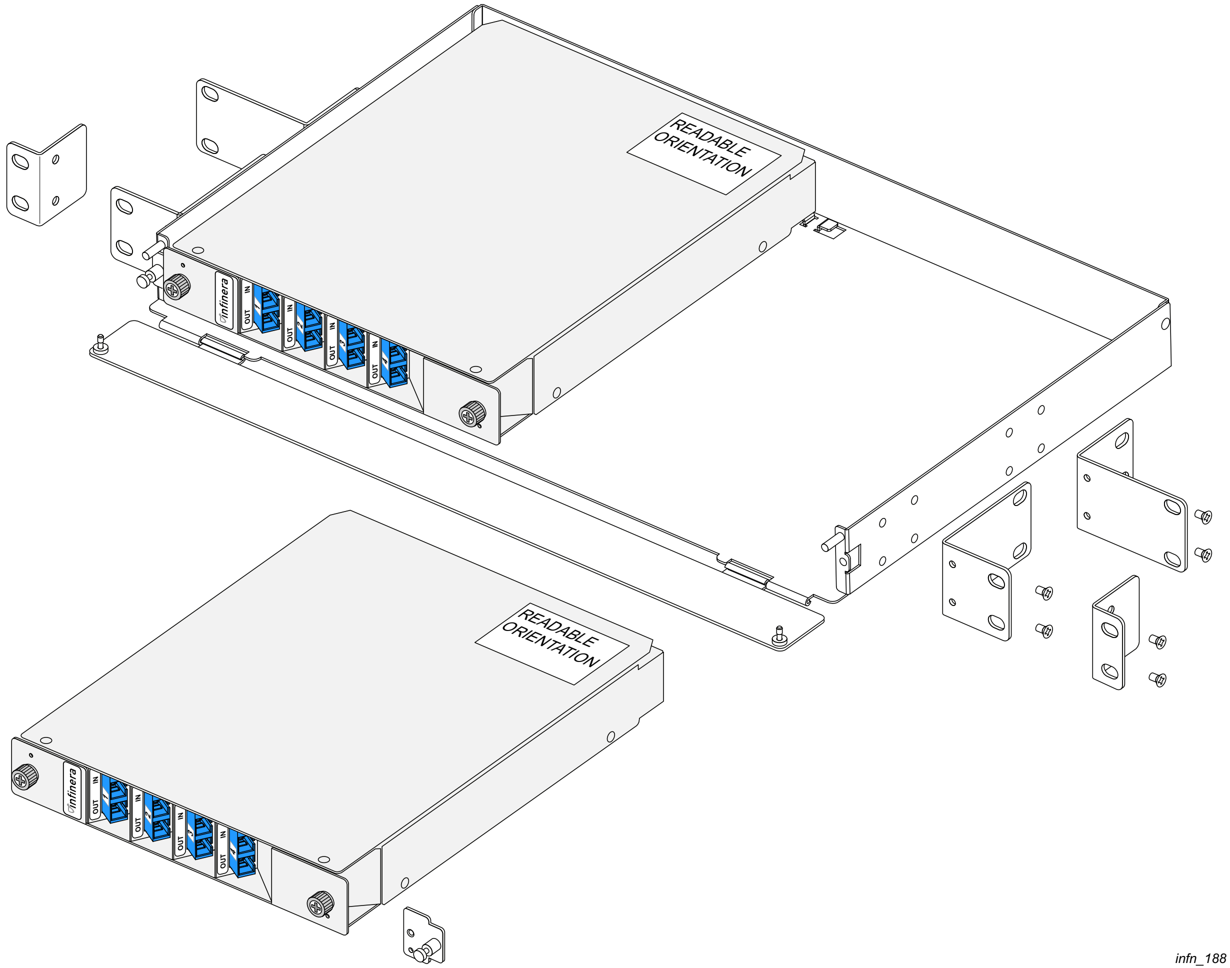


Figure 5-5 DMC with RBMs

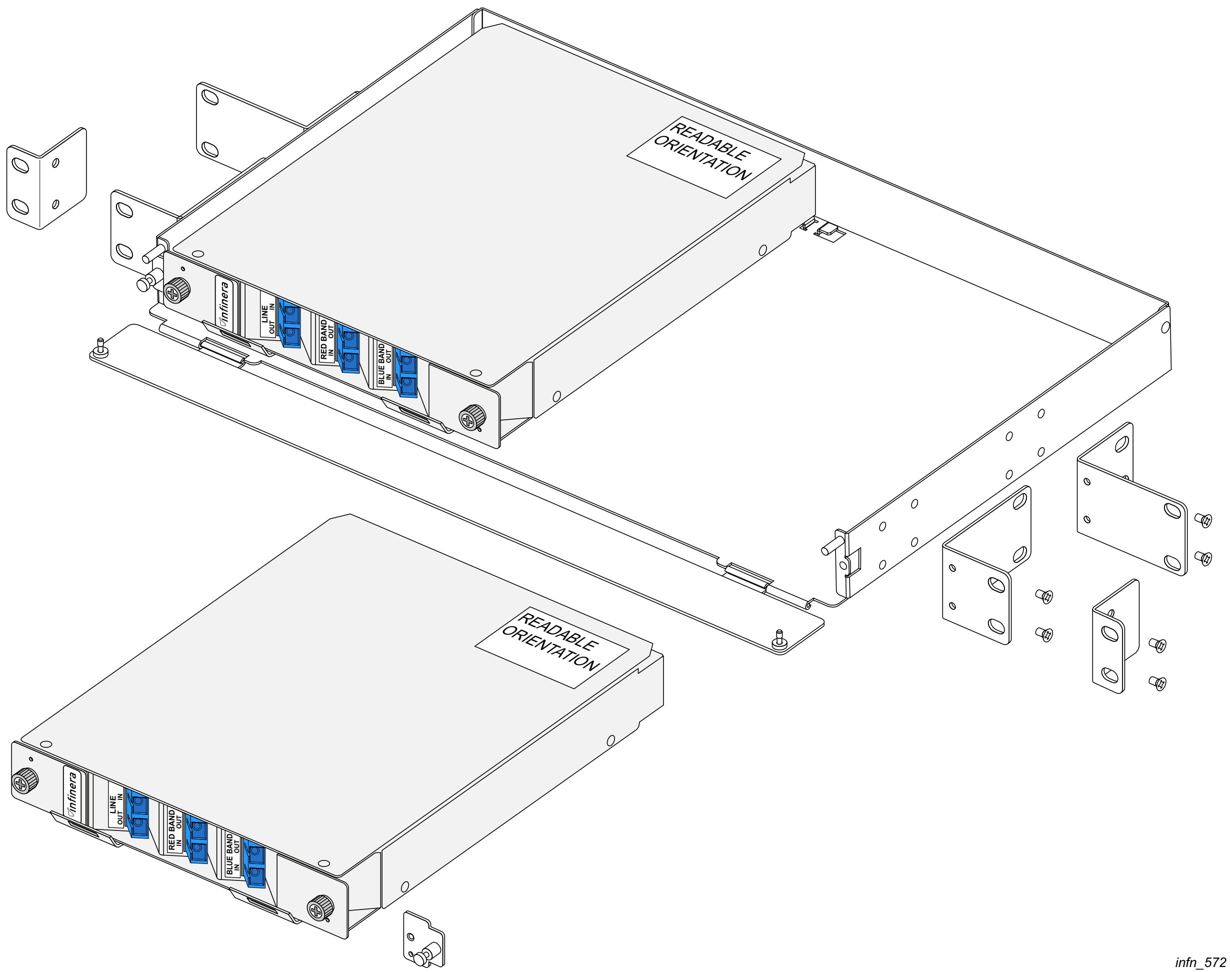
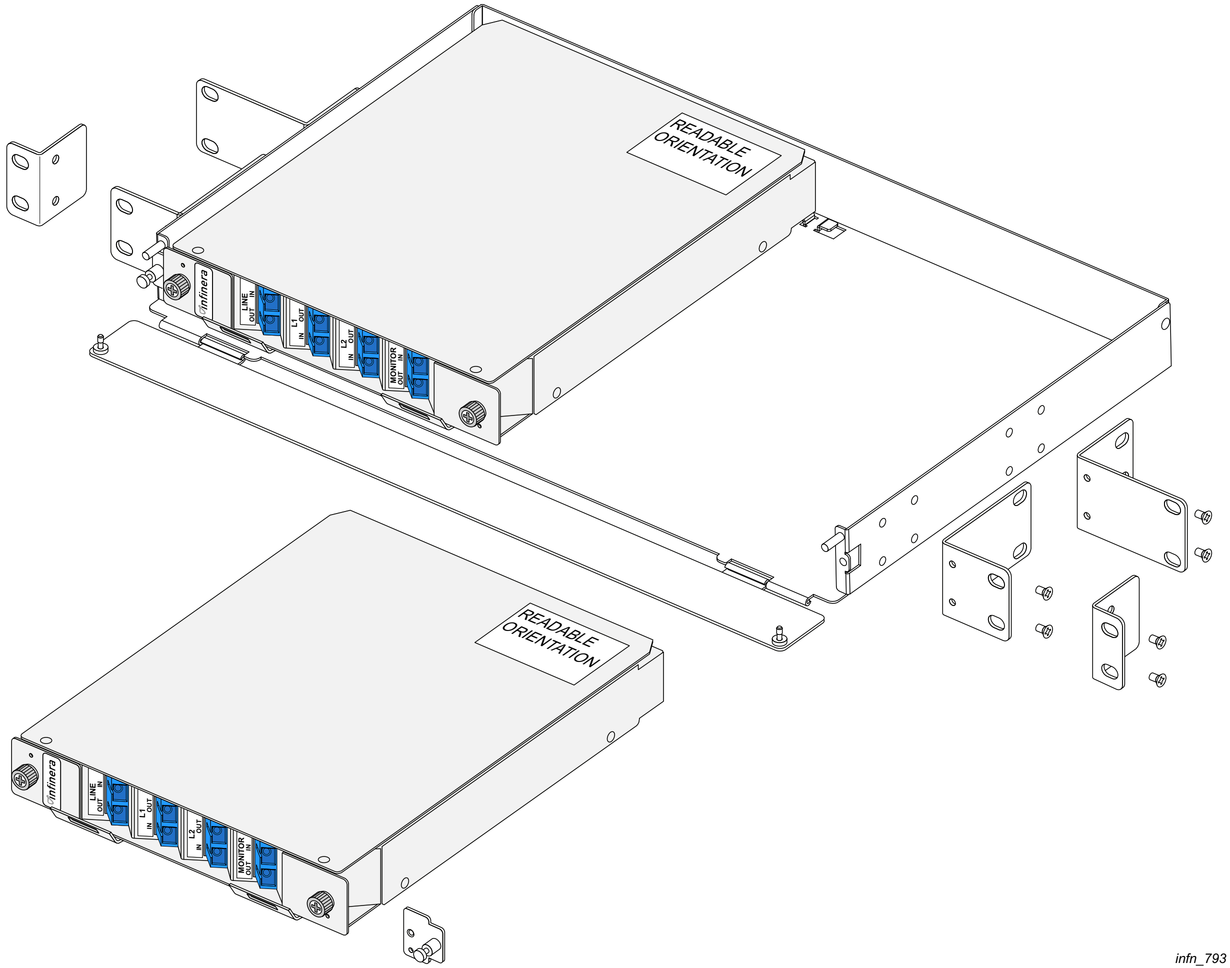


Figure 5-6 DMC with LMMs



DMC Product Details

Table 5-2 lists the name and a brief description of each of the supported DMCs.

Table 5-2 DMC Product Details

Product Ordering Name (PON)	Description
DMC1-B	Dispersion Management Chassis

Functional Description

The Dispersion Management Chassis, referred to as DMC, supports the following functions:

- The chassis is passive and does not require electrical connections to the chassis or within the chassis
- Accommodates the following:
  - Up to two half-width DCMs or one full-width DCM
  - Up to two half-width BPFs
  - Up to two half-width PSEs
  - Up to two half-width RBMs
  - Up to two half-width LMMs
- Can be installed on an ETSI (600mm) rack as flush mount or 23-inch rack as 1-inch, 2-inch, 5-inch, or 6-inch forward mount
- Can be installed on a 19-inch rack as 2-inch or 6-inch forward mount

Table 5-3 lists the mounting kit available for the DMC.

Table 5-3 DMC Mounting Kit

Part Number (P/N)	Description	Rack Mounting Ears
120-0096-001 (This one kit includes all of the mounting options)	Mounting option for a DCM shelf (DMC1-B) in an ETSI (600mm) or 23-inch rack	2 each, P/N 590-0156-001
	Mounting option for a DCM shelf (DMC1-B) in a 19-inch rack	2 each, P/N 590-0215-001

Mechanical Specifications

Table 5-4 lists the mechanical specifications for the DMC.

Table 5-4 DMC Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.72 inches / 43.68mm (1 RU)
	Width	17.40 inches / 441.96mm
	Depth	11.00 inches / 279.4mm
	Weight	5.5lb / 2.4kg

Dispersion Compensation Module (DCM)

There are several different DCM types that are provided to help equalize chromatic dispersion of different frequency components having different propagation speeds. DCMs are capable of reversing the dispersion effect of the transmission fiber and restoring the optical signal.

Release 8.0 provides support for several new DCM types designed for specific customer applications:

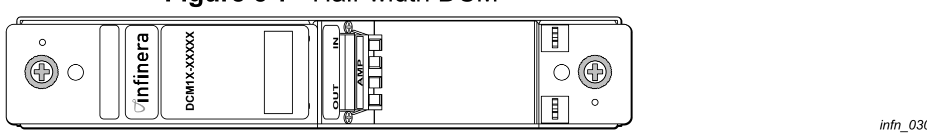
- Fiber Bragg grating (FBG)-based DCMs—used to filter out a particular wavelength. FBG-based DCMs contain periodically spaced zones in the fiber core which are altered to have different refractive indexes, slightly higher than the core; this allows for the reflection of a very narrow range of wavelengths while transmitting others
- Slope-matched DCMs— used for applications such as submarine line terminating equipment (SLTE) configurations to enable full-band compensation of residual chromatic dispersion of all Dense Wavelength Division Multiplexing (DWDM) channels after transmission over submarine fiber plant. Slope-matched DCMs provide a variable value of dispersion compensation for each DWDM channel across the entire fiber operating range. The specific dispersion compensation slope and DCM values are matched to cable characteristics, and several ranges of full-band operation are supported for different cable types

Table 5-5 on page 5-12 lists the name and a brief description of each of the supported DCMs.

Note: There are several DCMs that are generally no longer available but are still supported as noted in Table 5-5 on page 5-12.

The half-width DCM type is shown in Figure 5-7.

Figure 5-7 Half-width DCM



The full-width DCM type is shown in Figure 5-8.

Figure 5-8 Full-width DCM

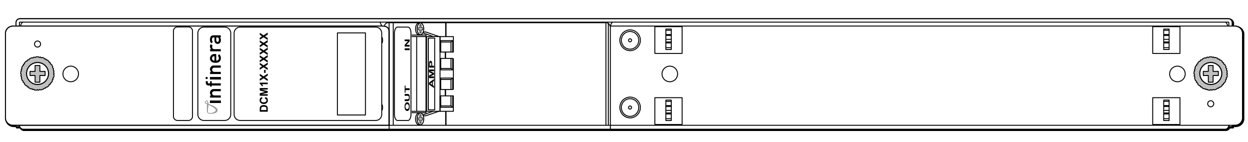


Table 5-5 DCM Product Details

Product Ordering Name (PON)	Description
Half-width DCMs	
DCM1H-100N-A	Half-width, 100ps/nm, negative dispersion, maximum insertion loss: 1.9dB
DCM1H-200N-A[a]	Half-width, 200ps/nm, negative dispersion, maximum insertion loss: 2.3dB
DCM1H-300N-A	Half-width, 300ps/nm, negative dispersion, maximum insertion loss: 2.7dB
DCM1H-400N-A[a]	Half-width, 400ps/nm, negative dispersion, maximum insertion loss: 3.1dB
DCM1H-500N-A	Half-width, 500ps/nm, negative dispersion, maximum insertion loss: 3.6dB
DCM1H-600N-A[a]	Half-width, 600ps/nm, negative dispersion, maximum insertion loss: 4.0dB
DCM1H-700N-A	Half-width, 700ps/nm, negative dispersion, maximum insertion loss: 4.4dB
DCM1H-800N-A[a]	Half-width, 800ps/nm, negative dispersion, maximum insertion loss: 4.8dB
DCM1H-900N-A	Half-width, 900ps/nm, negative dispersion, maximum insertion loss: 5.2dB
DCM1H-1000N-A[a]	Half-width, 1000ps/nm, negative dispersion, maximum insertion loss: 5.7dB
DCM1H-1100N-A	Half-width, 1100ps/nm, negative dispersion, maximum insertion loss: 6.1dB
DCM1H-1200N-A[a]	Half-width, 1200ps/nm, negative dispersion, maximum insertion loss: 6.6dB
DCM1H-1300N-A	Half-width, 1300ps/nm, negative dispersion, maximum insertion loss: 7.0dB
DCM2H-2000N-2	Half-width, 2000ps/nm, negative dispersion, maximum insertion loss: 3.4dB. SMF slope-matched
DCM2H-3000N	Half-width, 3000ps/nm, negative dispersion, maximum insertion loss: 4.5dB. Designed to operate with OCGs 1, 3, 5, and/or 7 for Raman festoon applications (extra long, single span). 40 channels maximum
DCM2H-4000N	Half-width, 4000ps/nm, negative dispersion, maximum insertion loss: 4.5dB. Designed to operate with OCGs 1, 3, 5, and/or 7 for Raman festoon applications (extra long, single span). 40 channels maximum
DCM1H-100P-A	Half-width, +100ps/nm, positive dispersion, maximum insertion loss: 1.7dB
DCM1H-200P-A[a]	Half-width, +200ps/nm, positive dispersion, maximum insertion loss: 3.0dB
DCM4H-200L	Half-width, -200ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-300L	Half-width, -300ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-500L	Half-width, -500ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-800L	Half-width, -800ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-1300L	Half-width, -1300ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based

Table 5-5 DCM Product Details

Product Ordering Name (PON)	Description
DCM4H-1700L	Half-width, -1700ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-2000L	Half-width, -2000ps/nm, negative dispersion, maximum insertion loss: 4.0dB. LEAF matched, FBG-based
DCM4H-300N	Half-width, -300ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
DCM4H-700N	Half-width, -700ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
DCM4H-1000N	Half-width, -1000ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
DCM4H-1300N	Half-width, -1300ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
DCM4H-1700N	Half-width, -1700ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
DCM4H-2000N	Half-width, -2000ps/nm, negative dispersion, maximum insertion loss: 4.0dB. SMF matched, FBG-based
Full-width DCMs	
DCM1F-400L-A	Full-width, 400ps/nm, negative dispersion, maximum insertion loss: 7.3dB
DCM1F-1400N-A[a]	Full-width, 1400ps/nm, negative dispersion, maximum insertion loss: 7.4dB
DCM1F-1500N-A	Full-width, 1500ps/nm, negative dispersion, maximum insertion loss: 7.9dB
DCM1F-1600N-A[a]	Full-width, 1600ps/nm, negative dispersion, maximum insertion loss: 8.3dB
DCM1F-1700N-A	Full-width, 1700ps/nm, negative dispersion, maximum insertion loss: 8.8dB
DCM1F-1800N-A[a]	Full-width, 1800ps/nm, negative dispersion, maximum insertion loss: 9.2dB
DCM1F-1900N-A	Full-width, 1900ps/nm, negative dispersion, maximum insertion loss: 9.7dB
DCM1F-1700N-LL	Full-width, 1700ps/nm, negative dispersion, maximum insertion loss: 8.0dB. Used to support specific Raman configurations for ultra long haul (ULH) applications
DCM1F-1900N-LL	Full-width, 1900ps/nm, negative dispersion, maximum insertion loss: 8.0dB. Used to support specific Raman configurations for ultra long haul (ULH) applications
DCM1F-200P-A	Full-width, +200ps/nm, positive dispersion, maximum insertion loss: 3.0dB
DCM1F-300P-A	Full-width, +300ps/nm, positive dispersion, maximum insertion loss: 4.4dB
DCM3F-150S2	Full-width, +1300ps/nm at 1553nm, -800ps/nm at 1563nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-300S	Full-width, +300ps/nm at 1540nm, -300ps/nm at 1560nm, zero at 1550nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-600S2	Full-width, +800ps/nm at 1547nm, -600ps/nm at 1560nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-800S	Full-width, +800ps/nm at 1540nm, -800ps/nm at 1560nm, zero at 1550nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications

Table 5-5 DCM Product Details

Product Ordering Name (PON)	Description
DCM3F-800S2	Full-width, +1000ps/nm at 1547nm, -800ps/nm at 1560nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-1000S2	Full-width, +1200ps/nm at 1547nm, -1000ps/nm at 1560nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-1100S	Full-width, +1100ps/nm at 1540nm, -1100ps/nm at 1560nm, zero at 1550nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-1600S	Full-width, +1600ps/nm at 1540nm, -1600ps/nm at 1560nm, zero at 1550nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-1900S	Full-width, +1900ps/nm at 1540nm, -1900ps/nm at 1560nm, zero at 1550nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM3F-2400S2	Full-width, +2300ps/nm at 1544nm, -2700ps/nm at 1561nm, maximum insertion loss: 7.0dB. Slope-matched DCM used for SLTE applications
DCM4F-360LS	Full-width, +360ps/nm at 1530/1564nm, maximum insertion loss: 7.0dB. Slope matched, FBG-based DCM used for SLTE applicaitons
DCM4F-870LS	Full-width, +870ps/nm at 1530/1564nm, maximum insertion loss: 7.0dB. Slope matched, FBG-based DCM used for SLTE applications
DCM4F-3000N	Full-width, -3000ps/nm, negative dispersion, maximum insertion loss: 8.0dB. SMF matched, FBG-based DCM used for SLTE applications
DCM4F-4000N	Full-width, -4000ps/nm, negative dispersion, maximum insertion loss: 8.0dB. SMF matched, FBG-based DCM used for SLTE applications

a. This DCM is generally no longer available but is still supported.

Note: The DCMs listed in Table 5-5 on page 5-12 are all supported in Release 8.0 and can be physically installed in Release 8.0 nodes. However, provisioning and inventory management for only some DCMs is supported from the management interfaces. Future releases will provide inventory management for remaining DCMs.

Functional Description

The Dispersion Compensation Module, referred to as DCM, is a pluggable module that is installed in a DMC. DCMs are available in two different module types: half-width and full-width.

The DCM supports the following functions:

- Houses dispersion compensating fiber that is optically connected to a BMM/OAM/ORM mid-stage access port (DCM) through a pair of front panel, duplex optical cables. DCMs can also be connected inline (OTS), depending on customer configuration and fiber type deployed
- The length of the optical cables depends upon the site requirements

- Equalizes chromatic dispersion of different frequency components having different propagation speeds
- Reverses the dispersion effect of transmission fiber and restores the optical signal
- Performs optical dispersion compensation through the mid-stage access port (DCM) of the BMM/OAM/ORM
- Each DCM has two ports labeled IN and OUT

Mechanical Specifications

Table 5-6 lists the mechanical specifications for the DCM.

Table 5-6 DCM Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.49 inches / 37.84mm
	Width	Half-width: 8.44 inches / 214.37mm Full-width: 16.92 inches / 429.76mm
	Depth	Half-width: 10.25 inches / 260.35mm Full-width: 10.27 inches / 260.85mm
	Weight	Varies - <6.0lb / 2.7kg

Connectors

Note: The DCM is a passive device and does not require electrical connections to the DMC or within the DMC.

All DCMs have two (2) SC type connectors labeled IN and OUT for optical interface as listed in Table 5-7.

Table 5-7 DCM Connectors

Connector	Type	Purpose
2	SC	Optical interface

Band Pass Filter (BPF)

Note: Unless specifically noted otherwise, all references to the BPF will refer to either the BPF-1, BPF-1X, BPF-2X, BPF-3, and/or BPF-4X interchangeably.

The Band Pass Filter, referred to as BPF, is a half-width pluggable module that is installed in a DMC. The BPF is designed to interoperate between an Infinera DTN and a third-party submarine amplifier system. The BPF provides band and channel filtering from the DTN to match the band of the submarine amplifier system.

The BPF is optically connected to a full-height BMM2 via the Line IN/Line OUT ports through a pair of duplex optical cables. In some configurations, the BPF can be optically connected to an OAM (OAM-CXH1-MS). The BPF (Table 5-8) is a passive device and does not require electrical connections to the DMC or within the DMC.

Table 5-8 BPF Product Details

Product Ordering Name (PON)	Description
BPF-1	Band Pass Filter, Type 1, transmits channels between 1540.95nm and 1560nm
BPF-1X	Band Pass Filter, Type 1X, transmits channels between 1540.65nm and 1560.71nm
BPF-2X	Band Pass Filter, Type 2X, transmits channels between 1535.72nm and 1563.77nm
BPF-3	Band Pass Filter, Type 3, transmits channels between 1547.61nm and 1560.71nm
BPF-4X	Band Pass Filter, Type 4X, transmits channels between 1544.02nm and 1560.92nm

The half-width BPF types are shown in Figure 5-9 and Figure 5-10.

Figure 5-9 Half-width BPF-1

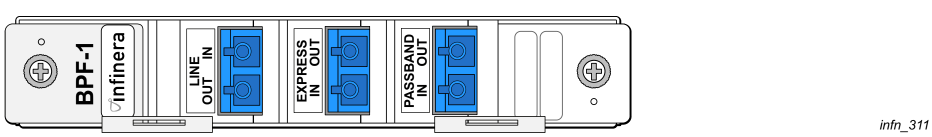
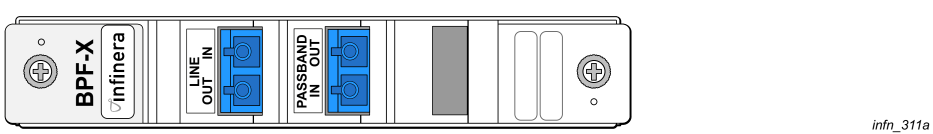


Figure 5-10 Half-width BPF-1X, BPF-2X, BPF-3, and/or BPF-4X



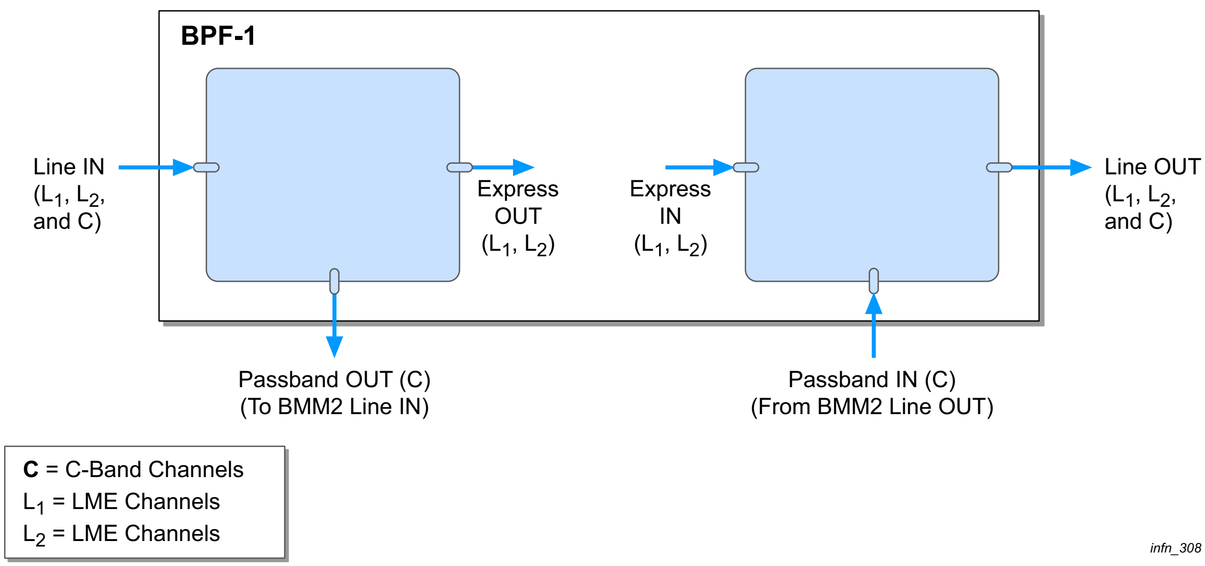
Block Diagrams

This section provides the BPF block diagrams as follows:

- BPF-1 as shown in Figure 5-11
- BPF-1X, BPF-2X, BPF-3, and/or BPF-4X as shown in Figure 5-12 on page 5-18

The BPF-1 is capable of suppressing third-party Line Monitoring Equipment (LME) channels, providing add/drop capability of Infinera C-Band channels, and expressing third-party LME channels through regeneration sites. The BPF provides pass-through of optical channels between 1540.95nm and 1560nm.

Figure 5-11 BPF-1 Block Diagram



In the transmit direction (between the Passband IN and Line OUT ports), the BPF-1 performs channel filtering of the incoming C-Band signals from 1540.95nm and 1560nm, and then combines the LME channels 1560.61nm (LME 1) and 1540.16nm (LME 2) from the Express IN port, see Figure 5-11.

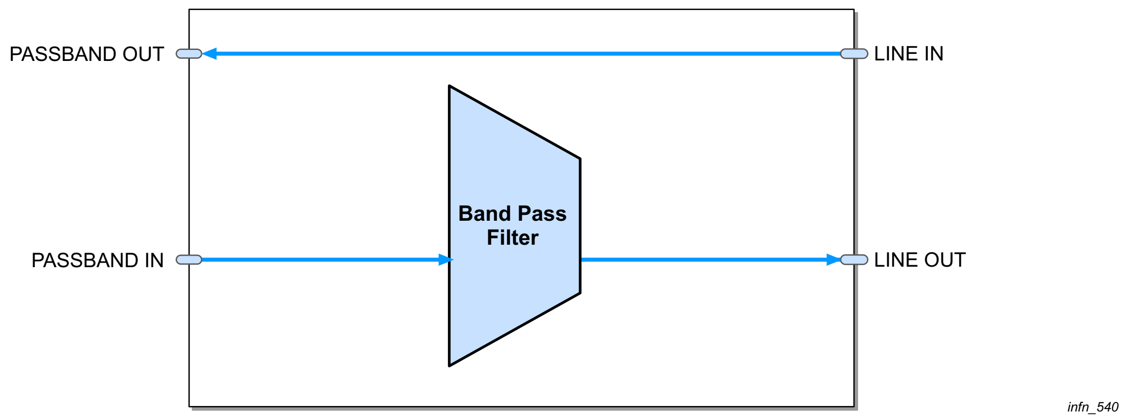
In the receive direction (between the Line IN and Passband OUT ports), the following wavelengths are filtered and sent to the Express OUT port:

- 1560.61nm (LME 1)
- 1540.16nm (LME 2)

The remaining wavelengths continue to the Passband OUT port, see Figure 5-11.

The BPF-1X, BPF-2X, BPF-3, and/or BPF-4X are designed to interoperate between an Infinera DTN network, operating in submarine line terminal equipment (SLTE) mode, and a third-party submarine amplifier system. The BPF-1X, BPF-2X, BPF-3, and/or BPF-4X provide band and channel filtering from the DTN to match the band of the submarine amplifier system.

Figure 5-12 BPF-1X, BPF-2X, BPF-3, and/or BPF-4X Block Diagram



Insertion Losses

Table 5-9 lists the expected insertion losses between two specific ports on the BPF-1.

Table 5-9 BPF-1 Insertion Losses

Port Connections	Insertion Loss (dB)
Line IN to Passband OUT	<1.7
Line IN to Express OUT	<3.4
Express IN to Line OUT	<3.4
Passband IN to Line OUT	<2.4

Table 5-10 lists the expected insertion losses between two specific ports on the BPF-1X, BPF-2X, BPF-3, and/or BPF-4X.

Table 5-10 BPF-1X, BPF-2X, BPF-3, and/or BPF-4X Insertion Losses

Port Connections	Insertion Loss (dB)
Line IN to Passband OUT	0.7
Passband IN to Line OUT	1.3

Mechanical Specifications

Table 5-11 lists the mechanical specifications for the BPF-1.

Table 5-11 BPF-1 Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.49 inches / 37.84mm
	Width	8.44 inches / 214.37mm
	Depth	10.25 inches / 260.35mm
	Weight	3.0lb / 1.3kg

Table 5-12 lists the mechanical specifications for the BPF-1X, BPF-2X, BPF-3, and/or BPF-4X.

Table 5-12 BPF-1X, BPF-2X, BPF-3, and/or BPF-4X Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.48 inches / 37.59mm
	Width	8.39 inches / 212.85mm
	Depth	10.25 inches / 260.35mm
	Weight	3.0lb / 1.3kg

Connectors

Note: The BPF is a passive device and does not require electrical connections to the DMC or within the DMC.

The BPF-1 contains three (3) filter ports labeled Line, Express, and Passband. Each port has an SC fiber connector labeled IN and OUT for optical interface as listed in Table 5-13.

Table 5-13 BPF-1 Connectors

Filter Port	Connector Type	Description
Line IN	SC, Front access	Connects from a third-party submarine amplifier system and provides pass filtering of LME channels to the Express OUT port and dropping of Infinera C-Band channels to the Passband OUT port
Line OUT	SC, Front access	Connects to a third-party submarine amplifier system and provides expressing of LME channels from the Express IN port and adding of Infinera C-Band channels from the Passband IN port
Express IN	SC, Front access	Connects from the Express OUT port of another BPF-1 for routing of expressed LME channels through a regeneration site

Table 5-13 BPF-1 Connectors

Filter Port	Connector Type	Description
Express OUT	SC, Front access	Connects from the Express IN port of another BPF-1 for routing of expressed LME channels through a regeneration site
Passband IN	SC, Front access	Connects to BMM2 Line OUT (Tx) port for routing of dropped Infinera C-Band channels to a third-party submarine amplifier system
Passband OUT	SC, Front access	Connects to BMM2 Line IN (Rx) port for routing of added Infinera C-Band channels from third-party submarine amplifier system

The BPF-1X, BPF-2X, BPF-3, and/or BPF-4X each contain two (2) filter ports labeled Line and Passband. Each port has an SC fiber connector labeled IN and OUT for optical interface as listed in Table 5-14.

Table 5-14 BPF-1X, BPF-2X, BPF-3, and/or BPF-4X Connectors

Filter Port	Connector Type	Description
Line IN	SC, Front access	Connects from a third-party submarine amplifier system (via an OAM in certain configurations) and provides dropping of Infinera C-Band channels to the Passband OUT port
Line OUT	SC, Front access	Connects to a third-party submarine amplifier system (via an OAM in certain configurations) and provides adding of Infinera C-Band channels from the Passband IN port
Passband IN	SC, Front access	Connects to BMM2 (or inline DCM) Line OUT (Tx) port for routing of dropped Infinera C-Band channels to a third-party submarine amplifier system
Passband OUT	SC, Front access	Connects to BMM2 (or inline DCM) Line IN (Rx) port for routing of added Infinera C-Band channels from third-party submarine amplifier system

Note: Depending on customer configuration, an OAM (OAM-CXH1-MS) may or may not be included.

Passive Spectrum Equalizer (PSE)

The Passive Spectrum Equalizer, referred to PSE, is a half-width pluggable module that is installed in a DMC. The PSE contains a set of filters and is deployed at mid-stage of an OAM to improve the optical reach capabilities of certain ultra long haul (ULH) applications, see Figure 5-14 on page 5-22. The PSE provides a solution for reducing channel ripple along certain spans where more rigorous fiber characterization is required.

The PSE (Table 5-15) is a passive device and does not require electrical connections to the DMC or within the DMC.

Table 5-15 PSE Product Details

Product Ordering Name (PON)	Description
PSE-1	Passive Spectrum Equalizer, C-Band, Type 1

The half-width PSE type is shown in Figure 5-13.

Figure 5-13 Half-width PSE

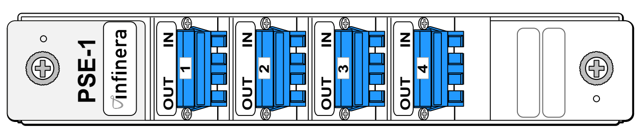
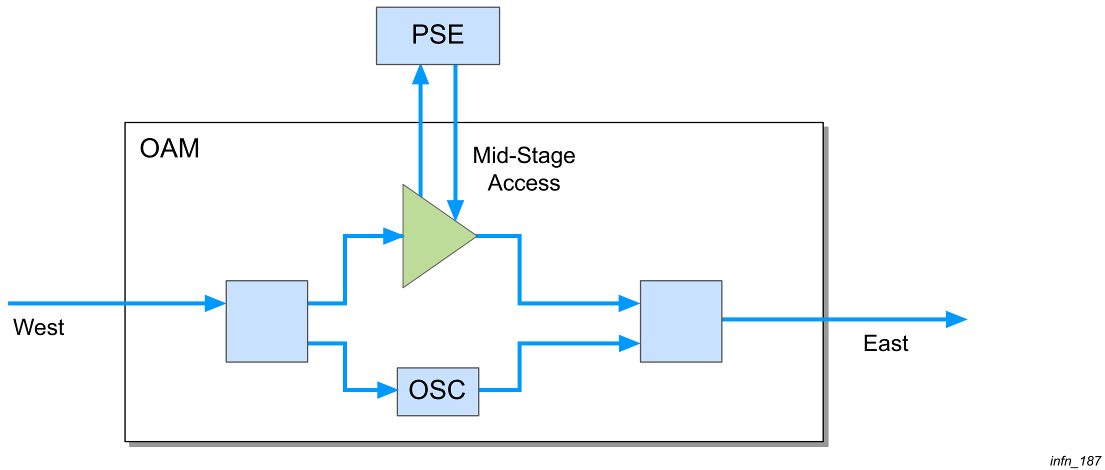


Figure 5-14 PSE Implementation with OAM



Mechanical Specifications

Table 5-16 lists the mechanical specifications for the PSE.

Table 5-16 PSE Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.49 inches / 37.84mm
	Width	8.44 inches / 214.37mm
	Depth	10.25 inches / 260.35mm
	Weight	3.0lb / 1.3kg

Connectors

Note: The PSE is a passive device and does not require electrical connections to the DMC or within the DMC.

The PSE contains four (4) filter ports labeled 1 through 4. Each port has an SC fiber connector labeled IN and OUT for optical interface with an OAM, as listed in Table 5-17.

Table 5-17 PSE Connectors

Filter Port	Connector Type	Filter Characteristics
1	SC, Front access	Reduces channel ripple for up to four (4) cascaded OAM-CXH1-MS modules
2	SC, Front access	Reduces channel ripple for up to six (6) cascaded OAM-CXH1-MS modules
3	SC, Front access	Reduces channel ripple for up to three (3) cascaded OAM-CXH2-MS modules
4	SC, Front access	Reduces channel ripple for one (1) span using RAM-1 modules on TW-RS, TW-C, and TW-Plus fiber types

Red/Blue Band Mux/Demux (RBM)

The Red/Blue Band Mux/Demux, referred to as RBM, is a half-width pluggable module that is installed in a DMC. The RBM contains multiplexing and demultiplexing components (see Figure 5-16 on page 5-25) and performs the following:

- Separates the Red and Blue bands from the incoming C-Band signal
- Combines the Red and Blue bands with the outgoing C-Band signal
- Provides a 1510nm bypass for a portion of the S-Band supporting the Infinera Optical Supervisory Channel (OSC)

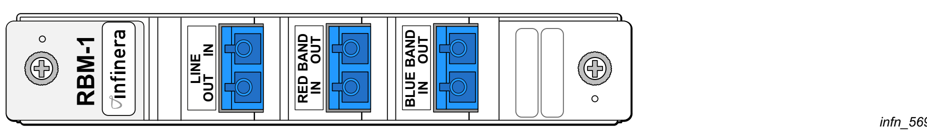
The RBM (Table 5-18) is a passive device and does not require electrical connections to the DMC or within the DMC.

Table 5-18 RBM Product Details

Product Ordering Name (PON)	Description
RBM-1	Red/Blue Band Mux/Demux Module, transmits channels between: • 1547.62nm to 1567nm (Red) • 1527nm to 1545.82nm (Blue)

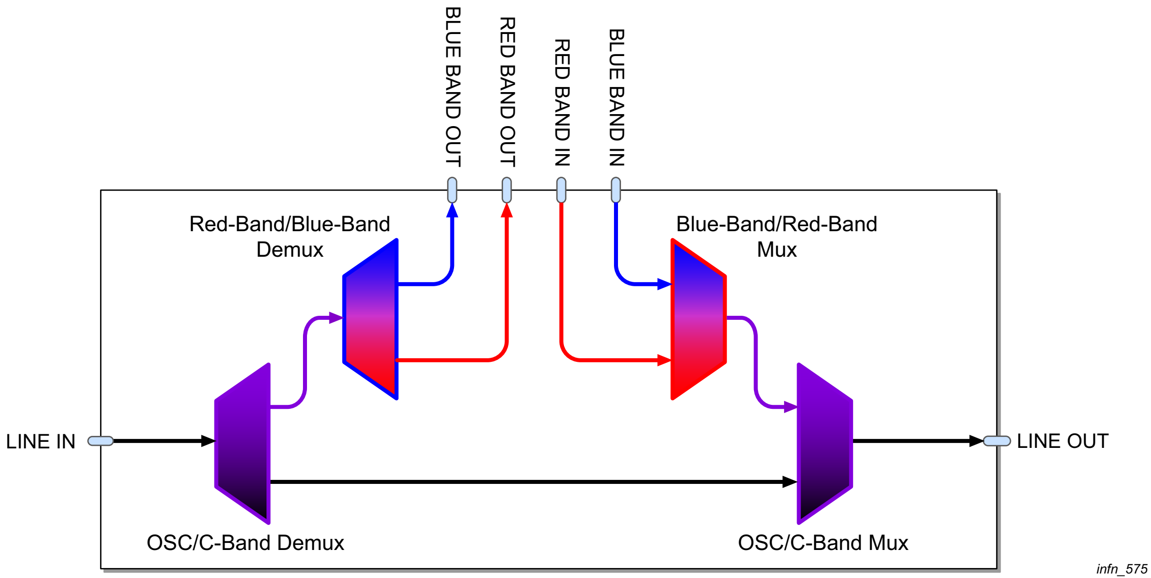
The half-width RBM type is shown in Figure 5-15.

Figure 5-15 Half-width RBM



Block Diagram

Figure 5-16 RBM Block Diagram



Insertion Losses

Table 5-19 lists the maximum expected insertion losses between specific ports on the RBM.

Table 5-19 RBM Insertion Losses

Port Connections	Insertion Loss (dB)
LINE IN to LINE OUT	1.8
LINE IN to RED BAND OUT	1.6
LINE IN to BLUE BAND OUT	1.6
RED BAND IN to LINE OUT	1.6
BLUE BAND IN to LINE OUT	1.6

Mechanical Specifications

Table 5-20 lists the mechanical specifications for the RBM.

Table 5-20 RBM Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.48 inches / 37.59mm
	Width	8.39 inches / 212.85mm
	Depth	10.25 inches / 260.35mm
	Weight	3.0lbs / 1.3kgs

Connectors

Note: The RBM is a passive device and does not require electrical connections to the DMC or within the DMC.

The RBM contains three (3) filter ports labeled LINE, RED BAND, and BLUE BAND. Each port has an SC fiber connector labeled IN and OUT for optical interface as listed in Table 5-21.

Table 5-21 RBM Connectors

Filter Port	Connector Type	Description
LINE IN	SC, Front access	Connects from a regenerator site; represents the incoming C-Band signal source
LINE OUT	SC, Front access	Connects to a regenerator site; represents the outgoing C-Band signal
RED BAND IN	SC, Front access	Connects from a regenerator site; represents the incoming Red band wavelengths
RED BAND OUT	SC, Front access	Connects to a regenerator site; represents the outgoing Red band wavelengths
BLUE BAND IN	SC, Front access	Connects from a regenerator site; represents the incoming Blue band wavelengths
BLUE BAND OUT	SC, Front access	Connects to a regenerator site; represents the outgoing Blue band wavelengths

Line Multiplexing Module (LMM)

Note: The management interfaces allow provisioning of an LMM at mid-stage of a BMM/OAM, but this is not a supported configuration.

The Line Multiplexing Module, referred to as LMM, is a half-width pluggable module that is installed in a DMC. The LMM is used in support of third-party submarine amplifier systems and functions as a coupler to enable two different sets of SLTE equipment to be deployed along a single submarine cable fiber pair (see Figure 5-18 on page 5-28). The LMM also provides a monitor port for measurement of the launch power spectrum into the third-party submarine amplifier system.

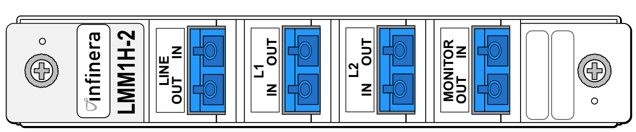
The LMM (Table 5-22) is a passive device and does not require electrical connections to the DMC or within the DMC.

Table 5-22 LMM Product Details

Product Ordering Name (PON)	Description
LMM1H-2	Line Multiplexing Module, transmits channels between 1529.50nm and 1564.50nm, coupling device used in support of third-party submarine amplifier systems to enable two different sets of SLTE equipment to be deployed along a single sub-marine cable fiber pair

The half-width LMM type is shown in Figure 5-17.

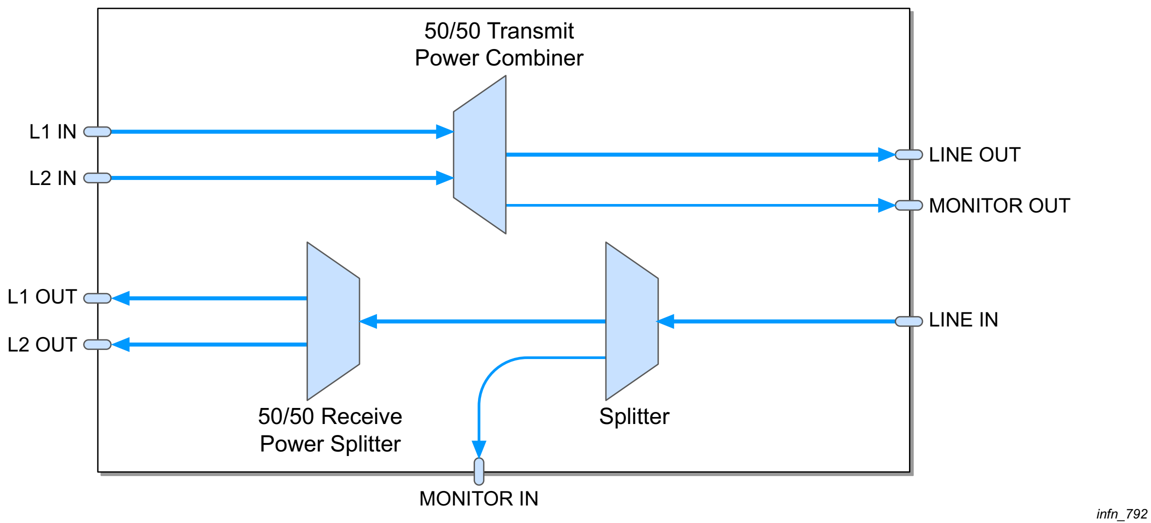
Figure 5-17 Half-width LMM



infn_794

Block Diagram

Figure 5-18 LMM Block Diagram



Insertion Losses

Table 5-23 lists the maximum expected insertion losses between specific ports on the LMM.

Table 5-23 LMM Insertion Losses

Port Connections	Insertion Loss (dB)
L1 IN to LINE OUT	2.80 to 3.50
L2 IN to LINE OUT	
L1 IN to MONITOR OUT	
L2 IN to MONITOR OUT	
LINE IN to L1 OUT	2.80 to 3.75
LINE IN to L2 OUT	
LINE IN to MONITOR IN	16.40 to 18.40

Mechanical Specifications

Table 5-24 lists the mechanical specifications for the LMM.

Table 5-24 LMM Mechanical Specifications

Type	Parameter	Specification
Mechanical specifications	Height	1.48 inches / 37.59mm
	Width	8.39 inches / 212.85mm
	Depth	10.25 inches / 260.35mm
	Weight	3.0lbs / 1.3kgs

Connectors

Note: The LMM is a passive device and does not require electrical connections to the DMC or within the DMC.

The LMM contains four (4) ports labeled L1, L2, LINE, and MONITOR. Each port has an SC fiber connector labeled IN and OUT for optical interface as listed in Table 5-25.

Table 5-25 LMM Connectors

Filter Port	Connector Type	Description
L1 IN	SC, Front access	Connects from SLTE equipment (e.g., SLTE system #1)
L1 OUT	SC, Front access	Connects to SLTE equipment (e.g., SLTE system #1)
L2 IN	SC, Front access	Connects from SLTE equipment (e.g., SLTE system #2)
L2 OUT	SC, Front access	Connects to SLTE equipment (e.g., SLTE system #2)
LINE IN	SC, Front access	Connects from a third-party submarine amplifier system
LINE OUT	SC, Front access	Connects to a third-party submarine amplifier system
MONITOR IN	SC, Front access	Port to monitor launch power spectrum input
MONITOR OUT	SC, Front access	Port to monitor launch power spectrum output

Blank Circuit Pack

Whenever a circuit pack is removed, the blank space can be occupied by a corresponding blank circuit pack. Table 5-26 lists the corresponding blank circuit pack.

Table 5-26 DMC Blank Circuit Pack

Product Ordering Name (PON)	Description
DCM1H-BLANK-A	Dispersion Compensation Module (DCM) blank, half-width

Appendix A

Infinera DTN-X, DTN, and Optical Line Amplifier PM Parameters

Infinera DTN-X, DTN, and Optical Line Amplifiers collect extensive PM data, including:

- Optical performance monitoring (PM) data within the optical domain (see “Optical PM Parameters and Thresholds” on page A-3)
- Client signal diagnostic DTF PM data at every DTN (see “DTF PM Parameters and Thresholds” on page A-17)
- FEC PM data enabling BER calculation (see “FEC PM Parameters and Thresholds” on page A-21)
- PM and FEC data for the Digital Channel (see “DCh Parameters and Thresholds” on page A-22)
- Native client signal PM data at the tributary ports (see “Client Signal PM Parameters and Thresholds” on page A-24)
- Optical Supervisory Channel (OSC) PM data (see “OSC PM Parameters” on page A-63)
- Additional OSCT and ALS pilot laser PM data for Raman modules (see “Additional PM Data for Raman” on page A-65)
- Power Entry Module (PEM) PM data (see “PM Collected for PEM Feed PTP on the XTC” on page A-67)

Note: For all real-time PMs, the DNA and GNM lists a “delta” value. Note that this delta value is the difference between the current last value and the previous last value. (The delta is not the difference between the values displayed in the Last Value column and the Initial Value column.)

Note: Unless specifically noted otherwise, all references to the XTC will refer to the XTC-10 and/or XTC-4 interchangeably.

Note: Unless specifically noted otherwise, all references to “line module” will refer to either the OLM (AOLM/SOLM), OLX (AOLX/SOLX), DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the AXLM-80, ADLM-80 and/or SLM-80 interchangeably. Note that the term “line module” does not refer to TEMs, as they do not have line-side capabilities and are used for tributary extension.

Note: Unless specifically noted otherwise, all references to the RAM will refer to either the RAM-1, RAM-2-OR, or REM-2 interchangeably.

Optical PM Parameters and Thresholds

The network element collects extensive optical analog PM data at each optical transport layer, including OTS layer, OMS Band (OMSb) layer (referred to as C-band), OMS Optical Carrier Group (OMSo) layer (referred to as OCG), and Optical Channel (OCh) layer. Infinera DTN-X, DTN, and Optical Line Amplifier modules utilize photodetectors (PDs) to measure and/or derive optical power measurements for PM data collection.

The optical PM parameters are essentially gauges, snapshot of the current condition. The optical PM parameters, such as Optical Power Received (OPR) and Optical Power Transmitted (OPT), are the measures of the average optical power of the received and transmitted optical signals, respectively, in dBm.

Within the DTN-X, the following optical PM data is collected on the modules:

- AOLX, SOLX, AOLM and SOLM collect OCG and OCh layer PM data.

Within the DTN, the following optical PM data is collected on the modules:

- BMMs collect OTS, C-band, and OCG layer PM data.
- Base and expansion BMM types (e.g., BMM2P-8-CH1-MS, BMM2H-4-B3, BMM2-8-CEH3, etc.) collect additional BAND CTP PM data.
- Line modules/LM-80s (DLMs, XLMs, ADLMs, AXLM-80s, etc.) collect OCh layer PM data.
- RAMs collect OTS layer PM data, C-band layer PM data, OSCT layer PM data, laser pump power data, laser bias current data, and Automatic Laser Shutdown (ALS) pilot PM data.
- GAMs collect additional OCG PM data.
- SCM collect OTS PM data.

Within the Optical Line Amplifier, the following optical PM data is collected on the modules:

- OAMs/ORMs collect OTS, C-band, OSC, and DCF PM data
- DSEs collect DSE and OSA PM data.
- RAMs collect OTS layer PM data, C-band layer PM data, OSCT layer PM data, laser pump power data, laser bias current data, and Automatic Laser Shutdown (ALS) pilot PM data.

Note: REM-2 has one OSCT object, one BAND CTP object, and one OTS PTP object. The RAM-1 and RAM-2-OR have two each of these objects:

The OSCT-1 object with an AID ending in “O1” (e.g., 2-A-2-O1) indicates PMs from the line side to the RAM. The OSCT-2 object with an AID ending in “O2” (e.g., 2-A-2-O2) indicates PMs from the BMM/OAM/ORM side to the RAM.

The C band object with an AID ending in “C” (e.g., 2-A-2-C) indicates PMs from the line side to the RAM. The second band object with an AID ending in “C2” (e.g., 2-A-2-C2) indicates PMs from the BMM/OAM/ORM side to the RAM.

The OTS object with an AID ending in “L1” (e.g., 2-A-2-L1) indicates the PM from the line side to the RAM. The second OTS object with an AID ending in “L2” (e.g., 2-A-2-L2) indicates PMs from the BMM/OAM/ORM side to the RAM.

Table A-1 on page A-5 captures the optical PM parameters supported at each layer. The historical data is maintained for some PM parameters. Historical data is provided in both 15 minute and 24 hour capture periods. Real Time, or Intermediate, PM data is a valuable troubleshooting tool as it provides the user a snapshot of the current performance for the particular PM parameter. The user can set the Real Time PM refresh rate to automatically refresh the count at various increments from 5 seconds to never (thus locking the current view).

For the following PM parameters only Real Time (current) PMs are available:

- Optical Power Transmitted
- OPT to OSA Ratio
- Optical Power Received
- OPR to OSA Ratio
- C-Band Tx EDFA LBC
- C-Band Rx EDFA LBC1
- C-Band Rx EDFA LBC2
- C-Band Rx EDFA Optical Power Transmitted
- C-Band Rx Expected OSA Ratio
- OCG Total Optical Power Transmitted
- OCG Total Optical Power Received
- OCh Measured Wavelength
- ALS Pilot
- Utilization

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
OTS Layer Parameters (collected on BMM/OAM/ORM)				
Total Optical Power Transmitted OPT Min OPT Max OPT Ave	Average optical output power transmitted onto the Line output. This is the sum of C-Band + L-Band (when L-Band supported) + OSC output power.	dBm	Yes	Yes
Total Optical Power Received OPR Min OPR Max OPR Ave	Average optical power received from the Line input. This is the sum of C-Band + L-Band (when L-Band supported) + OSC received power.	dBm	Yes	Yes
Laser Bias Current for Pump1 to Pump4 (mA) LBCMin LBCMax LBCAvg	Laser bias current of the optical transmitter, displayed for line-side (L1) OTS PTPs only.	mA	Yes	Yes
Laser Pump Power for Pump1 to Pump4 (mW) LPPMin LPPMax LPPAvg	Laser pump power, displayed for line-side (L1) OTS PTPs only.	mW	Yes	Yes
OPT to OSA Ratio	Expected ratio of OTS Optical Power Transmitted and the power measured at the “OSA Monitor Out” port	dB	Yes	No
OPR to OSA Ratio pre-EDFA (BMM only; not applicable to BMM1H-4-CX2)	Expected ratio of OTS Optical Power Received (at the OTS input, prior to the receive EDFA) to the power expected at the “OSA Monitor In” port.	dB	Yes	No
OPR to OSA Ratio	Expected ratio of OTS Optical Power Received to the power expected at the “OSA Monitor In” port.	dB	Yes	No
DCF Parameters (collected on OAM/ORM/BMM) **NOTE: DCF PMs are not supported on BMM2P**				
DCF Optical Power Received	Optical power received from the DCF PTP input.	dBm	Yes	No

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
DCF Optical Power Received Min DCF Optical Power Received Avg DCF Optical Power Received Max	Optical power received from the DCF PTP input (measured as minimum, average, and maximum).	dBm	No	Yes
DCF Optical Power Transmitted	Optical power transmitted from the DCF PTP.	dBm	Yes	No
DCF Optical Power Transmitted Min DCF Optical Power Transmitted Avg DCF Optical Power Transmitted Max	Optical power transmitted from the DCF PTP (measured as minimum, average, and maximum).	dBm	No	Yes
OTS Layer Parameters (collected on RAM and ORM)				
Optical Power Transmitted OPT Min OPT Max OPT Ave	Average optical output power transmitted onto the Line output. This is the sum of C-Band + L-Band (when L-Band supported) + OSCT output power.	dBm	Yes	Yes
Optical Power Received OPR Min OPR Max OPR Ave	Average optical power received from the Line input. This is the sum of C-Band + L-Band (when L-Band supported) + OSCT received power.	dBm	Yes	Yes
LBCn (n=1-2 for RAM-1 n=1-4 for RAM-2-OR, REM-2, and ORM) LBCnMIN LBCnMAX LBCnAVG	Laser bias current of the optical transmitter, displayed for line-side (L1) OTS PTPs only.	mA	Yes	Yes
LPWRn (n=1-2 for RAM-1 n=1-4 for RAM-2-OR, REM-2, and ORM) LPWRnMIN LPWRnMAX LPWRnAVG	Laser pump power, displayed for line-side (L1) OTS PTPs only.	mW	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
ALS Pilot Optical Power Received Min Max Avg	Optical Power Received by the ALS pilot laser	dBm	Yes	Yes
OTS Layer Parameters (collected on SCM)				
Optical Power Transmitted OPT Min OPT Max OPT Ave	Optical power transmitted on the BMM/OAM or line port.	dBm	Yes	Yes
Optical Power Received OPR Min OPR Max OPR Ave	Optical power received on the BMM/OAM or line port.	dBm	Yes	Yes
Optical Parameters (collected on SCM Idler)				
Optical Power Transmitted OPT Min OPT Max OPT Ave	Optical power transmitted on the Idler OUT port.	dBm	Yes	Yes
Optical Power Received OPR Min OPR Max OPR Ave	Optical power received on the Idler IN port.	dBm	Yes	Yes
Total Laser Power	Laser power on the SCM Idler port.	dBm	Yes	Yes
Band Layer Parameters (collected on BMM/OAM/ORM)				
C-Band Total Optical Power Received Min Avg Max	Total C-Band optical power received (measured as minimum, average, and maximum) from the OTS input.	dBm	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
C-Band Total Optical Power Transmitted Min Avg Max	Total C-Band optical power transmitted (measured as minimum, average, and maximum) onto the OTS output.	dBm	Yes	Yes
C-Band Span Loss	Measured per C-Band channel span loss between the adjacent nodes (approximate difference between C-Band Optical Power Transmitted and C-Band Optical Power Received between the adjacent network elements).	dB	Yes	Yes
C-Band EDFA LBC	Measured laser bias current of the EDFA's optical transmitter towards the OTS output.	mA	Yes	No
C-Band Rx EDFA LBC1 (BMM only)	Measured laser bias current of the first stage receive EDFA.	mA	Yes	No
C-Band Rx EDFA LBC2 (BMM with DCM mid-stage access only)	Measured laser bias current of the second stage receive EDFA.	mA	Yes	No
C-Band Rx EDFA LBC1 (OAM/ORM only)	Measured laser bias current of the first stage receive EDFA.	mA	Yes	No
C-Band Rx EDFA LBC2 (OAM/ORM with DCM mid-stage access only)	Measured laser bias current of the second stage receive EDFA.	mA	Yes	No
C-Band Rx EDFA Optical Power Transmitted (BMM only)	C-Band power transmitted toward the line module	dBm	Yes	Yes
C-Band Rx Expected OSA Ratio (BMM only)	Expected ratio of C-Band Rx EDFA Optical Power Transmitted to the power measured at the "OSA RX AMP OUT" monitor port.	dB	Yes	No
Net Span Loss NetSpanLossMin NetSpanLossMax NetSpanLossAvg	Span loss incurred when Raman is deployed across the span. (Supported on the Band CTP of BMM/OAM/ORM circuit pack which is connected to the Raman module.)	dB	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
BAND CTP Layer Parameters (collected on base BMM2P-8-CH1-MS, BMM2-8-CH3-MS, BMM2H-4-R3-MS and expansion BMM2P-8-CEH1, BMM2-8-CEH3, and BMM2H-4-B3 only)				
Band Extender Optical Power Transmitted Band Extender OPT Minimum Band Extender OPT Maximum Band Extender OPT Average	For the base BMM: C-band optical power transmitted by the base BMM to the expansion BMM card. For the expansion BMM: C-band optical power transmitted by the expansion BMM card to the base card.	dBm	Yes	Yes
Band Extender Optical Power Received Band Extender OPR Minimum Band Extender OPR Maximum Band Extender OPR Average	For the base BMM: C-band optical power received by the base BMM from the expansion BMM card. For the expansion BMM: C-band optical power received by the expansion BMM card from the base card.	dBm	Yes	Yes
BAND CTP Layer Parameters (collected on expansion BMM2P-8-CEH1, BMM2-8-CEH3, and BMM2H-4-B3 only)				
BMM Rx EDFA Laser Bias Current *n* (n=1,2)	Measured laser bias current of the receive EDFA.	mA	Yes	No
BMM Extender Receive Post-EDFA Power Extender Post-EDFA Power Minimum Extender Post-EDFA Power Maximum Extender Post-EDFA Power Average	Optical power at the receive EDFA output.	dBm	Yes	Yes
BMM Band OPR to OSA Ratio	The expected ratio of the receive EDFA output power to the power measured at the OSA in tap.	dB	Yes	No
C-Band Tx EDFA LBC (BMM2P-8-CEH1 only)	Measured laser bias current of the EDFA's optical transmitter towards the OTS output.	mA	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
Band Layer Parameters (collected on RAM and ORM)				
C-Band Total Optical Power Received C-Band Total Optical Power Received Min C-Band Total Optical Power Received Avg C-Band Total Optical Power Received Max	Total C-Band optical power received (measured as minimum, average, and maximum) from the OTS input.	dBm	Yes	Yes
C-Band Total Optical Power Transmitted C-Band Total Optical Power Transmitted Min C-Band Total Optical Power Transmitted Avg C-Band Total Optical Power Transmitted Max	Total C-Band optical power transmitted (measured as minimum, average, and maximum) onto the OTS output.	dBm	Yes	Yes
OCG Layer Parameters (collected on BMM)				
OCG Total Optical Power Received Min Avg Max	Total OCG optical power arriving at the BMM (measured as minimum, average, maximum) from the local line module, LM-80, CMM, or GAM, or from its associated BMM (for Optical Express connections). One attribute for each OCG.	dBm	Yes	Yes
OCG Total Optical Power Transmitted Min Avg Max	Total OCG optical power leaving the BMM (measured as minimum, average, and maximum) towards its attached line module, LM-80, CMM, or GAM, or towards its attached BMM (for Optical Express connections). One attribute for each OCG.	dBm	Yes	Yes
OCG Layer Parameters (collected on CMM)				
OCG Total Optical Power Transmitted	Total OCG optical power leaving the CMM towards its associated BMM.	dBm	Yes	No

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
OCG Total Optical Power Received OCG Total Optical Power Received Min OCG Total Optical Power Received Avg OCG Total Optical Power Received Max	Total OCG optical power arriving at the CMM from its associated BMM.	dBm	Yes	No
Tx EDFA LBC Tx EDFA LBC Min Tx EDFA LBC Avg Tx EDFA LBC Max	Measured laser bias current of the EDFA's optical transmitter towards its associated BMM.	mA	Yes	Yes
OCG Layer Parameters (collected on GAM)				
OCG Optical Power Transmitted	OCG optical power transmitted by the GAM to the BMM.	dBm	Yes	Yes
OCG Optical Power Received	OCG optical power received by the GAM from the line module.	dBm	Yes	Yes
LBC MIN MAX AVG	OCG Laser bias current	mA	Yes	Yes
OCG Layer Parameters (collected on Line Module AOLM, SOLM, AOLX, SOLM)				
Tx EDFA Power Transmitted Min Avg Max	Measured power at the output of Tx and Rx EDFA	dBm	Yes	Yes
Rx EDFA Power Transmitted Min Avg Max				

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
Tx EDFA Power Received Min Avg Max	Measured power at the input of Tx and Rx EDFA.	dBm	Yes	Yes
Rx EDFA Power Received Min Avg Max				
Rx EDFA Power LBC Min Avg Max	Measured laser bias current of the EDFA's power received towards its associated line module	mA	Yes	Yes
Tx EDFA Power LBC Min Avg Max	Measured laser bias current of the EDFA's power transmitter towards its associated line module.			
OCh Layer Parameters (collected on Line Module (AOLM, SOLM, AOLX, SOLM OCHCTP)				
OCh Optical Power Transmitted OCh Optical Power Transmitted Min OCh Optical Power Transmitted Avg OCh Optical Power Transmitted Max	Optical channel power transmitted by the line module (measured as minimum, average, maximum). One measurement for each of the optical channels within an OCG. One measurement for each optical channel.	dBm	Yes	Yes
OCh Laser Bias Current OCh Laser Bias Current Min OCh Laser Bias Current Avg OCh Laser Bias Current Max	Measured laser bias current of the channel optical transmitter (measured as minimum, average, maximum). One measurement for each optical channel.	mA	Yes	Yes
OCh Measured Wavelength	Measured channel wavelength of the channel. One measurement for each optical channel.	Ghz	Yes	Yes
Q-Value	The current Q-factor of the channel. One measurement for each optical channel.	N/A	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
Chromatic Dispersion	Measured chromatic dispersion of the channel optical transmitter (measured as minimum, average, maximum). One measurement for each optical channel.	ps/nm	Yes	Yes
OCh Layer Parameters (collected on Line Module (DLM, XLM, ADLM, AXLM OCHCTP)				
OCh Optical Power Received OCh Optical Power Received Min OCh Optical Power Received Avg OCh Optical Power Received Max	Optical channel power received (measured as minimum, average, maximum) by the line module. One measurement for each optical channel.	dBm	Yes	Yes
OCh Optical Power Transmitted OCh Optical Power Transmitted Min OCh Optical Power Transmitted Avg OCh Optical Power Transmitted Max	Optical channel power transmitted by the line module (measured as minimum, average, maximum). One measurement for each of the optical channels within an OCG. One measurement for each optical channel.	dBm	Yes	Yes
OCh Laser Bias Current OCh Laser Bias Current Min OCh Laser Bias Current Avg OCh Laser Bias Current Max	Measured laser bias current of the channel optical transmitter (measured as minimum, average, maximum). One measurement for each optical channel.	mA	Yes	Yes
OCh Measured Wavelength	Measured channel wavelength of the channel. One measurement for each optical channel.	Ghz	Yes	Yes
OCh FEC UnCorrected BER	Uncorrected bit error rate prior to FEC correction. Note: Integrated over one second	Yes	Yes	Yes Default Value=10 e-4
OCh FEC Corrected BER	Corrected bit error rate Note: Integrated over one second	Yes	Yes	Yes
OCh FEC Corrected Bits	Corrected number of zeros and ones	Yes	Yes	Yes
OCh FEC UnCorrectable Codewords	Uncorrected number of codewords	Yes	Yes	Yes
OCh Total CodeWords	Total number of codewords	Yes	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
DTF CV-S	Count of BIP errors detected at the DTF Section layer. Up to 8 BIP errors can be detected per frame, with each error incrementing the DTF CV-S current register.	Yes	Yes	Yes
DTF ES-S	Count of the number of seconds during which (at any point during the second) at least one DTF Section layer BIP error was detected or an LOF or OLOS defect was present.	Yes	Yes	Yes
DTF SES-S	Count of the seconds during which K (=10000) or more DTF Section layer BIP errors were detected or an LOF or OLOS defect was present.	Yes	Yes	Yes
OCh Layer Parameters (collected on LM -80 OCHPTP)				
OCh Optical Power Received OCh Optical Power Received Min OCh Optical Power Received Avg OCh Optical Power Received Max	Optical channel power received (measured as minimum, average, maximum) by the LM-80. One measurement for each optical channel.	dBm	Yes	Yes
OCh Optical Power Transmitted OCh Optical Power Transmitted Min OCh Optical Power Transmitted Avg OCh Optical Power Transmitted Max	Optical channel power transmitted by the LM-80 (measured as minimum, average, maximum). One measurement for each of the optical channels within an OCG. One measurement for each optical channel.	dBm	Yes	Yes
OCh Laser Bias Current OCh Laser Bias Current Min OCh Laser Bias Current Avg OCh Laser Bias Current Max	Measured laser bias current of the channel optical transmitter (measured as minimum, average, maximum). One measurement for each optical channel.	mA	Yes	Yes
OCh Chromatic Dispersion OCh Chromatic Dispersion Min OCh Chromatic Dispersion Avg OCh Chromatic Dispersion Max	Measured chromatic dispersion of the channel optical transmitter (measured as minimum, average, maximum). One measurement for each optical channel.	ps/nm	Yes	Yes

Table A-1 Optical PM Parameters Supported on the DTN-X, DTN, and Optical Line Amplifier

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hour) data
OCh Layer Parameters (collected on CMM OCHPTP)				
OCh Optical Power Received OCh Optical Power Received Min OCh Optical Power Received Avg OCh Optical Power Received Max	Optical channel power received (measured as minimum, average, maximum) by the CMM from the LM-80. One measurement for each optical channel.	dBm	Yes	Yes
DSE PTP PMs (collected on DSE)				
DSE Optical Power Received DSE Optical Power Received Min DSE Optical Power Received Avg DSE Optical Power Received Max	Optical power received (measured as minimum, average, and maximum) from the DSE PTP input.	dBm	Yes	Yes
DSE Optical Power Transmitted DSE Optical Power Transmitted Min DSE Optical Power Transmitted Avg DSE Optical Power Transmitted Max	Optical power transmitted (measured as minimum, average, and maximum) onto the DSE output.	dBm	Yes	Yes
OSA PTP PMs (collected on DSE)				
OSA Optical Power Received	Optical power received from the OSA PTP input.	dBm	Yes	No
OSA Optical Power Received Min OSA Optical Power Received Avg OSA Optical Power Received Max	Optical power received (measured as minimum, average, and maximum) from the OSA PTP input.	dBm	No	Yes
OPM Tap Ratio	Ratio of the power at the OSA PTP input to the power at the OSA monitor output. This value indicates the insertion loss between the OSA PTP input port on the DSE and the OSA monitor port on the DSE.	dB	Yes	No

Thresholding is supported for some of the optical PM parameters. Table A-2 lists those PM parameters, corresponding thresholds and alarms reported when thresholds are exceeded.

Table A-2 Optical PM Thresholds

PM Parameter	Description	Units and Ranges	Alarms
C-Band Expected Span Loss (ESL)	C-band average optical channel span loss	dB	
	Low threshold setting for C-Band ESL PM parameter	dB	Span Loss Out of Range - Low (SL-OORL)
	High threshold setting for C-Band ESL PM parameter	dB	Span Loss Out of Range - High (SL-OORH)
C-Band Out of Range Low	(Threshold configuration is applicable for BMM2s in SLTE mode only) Low threshold setting for C-Band Total Optical Power Received	dB	C-band Out of Range - Low (OPR OORL - Band)
C-Band Out of Range High	(Threshold configuration is applicable for BMM2s in SLTE mode only) High threshold setting for C-Band Total Optical Power Received	dB	C-band Out of Range - High (OPR OORH - Band)

DTF PM Parameters and Thresholds

Note: Unless specifically noted otherwise, all references to “line module” will refer to either the OLM (AOLM/SOLM), OLX (AOLX/SOLX), DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the AXLM-80, ADLM-80 and/or SLM-80 interchangeably. Note that the term “line module” does not refer to TEMs, as they do not have line-side capabilities and are used for tributary extension.

Infinera DTN and DTN-X supports extensive digital PM data collection at DTF Section layer and DTF Path layer. The digital PM data is analogous to the SONET/SDH PM data and it is collected on the line module/ LM-80 in the DTN and DTN-X.

Thresholding is supported for all system digital PM data. Since digital PM data is transient in nature, TCAs are reported when PM parameters exceed the provisioned threshold values within a collection period.

Figure A-1 gives a summary of the Digital PM and FEC PM parameters collected on the DTN.

Figure A-1 DTF PM Data Collected on the Line Module/LM-80 and TAM

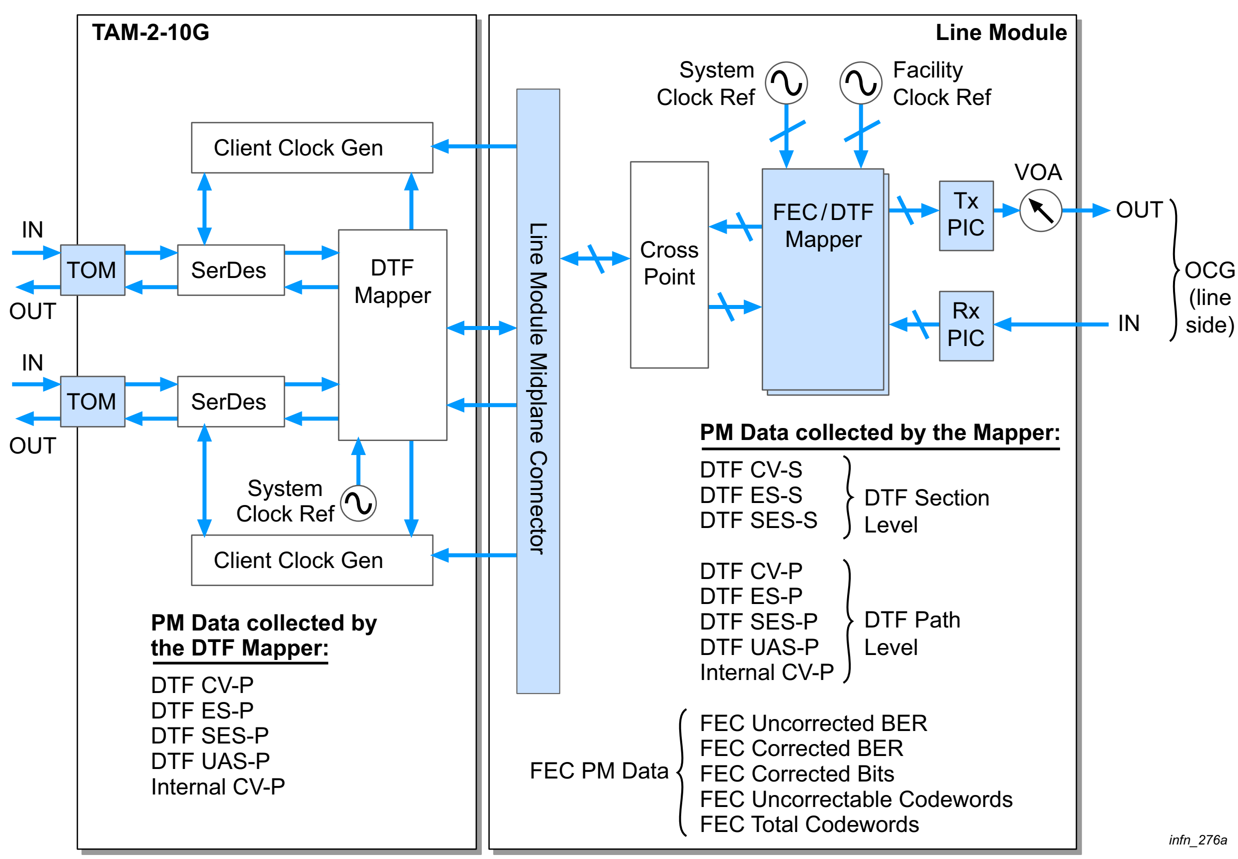


Table A-3 captures the PM parameters and corresponding thresholds defined for the DTF Section and DTF Path layers.

Table A-3 DTF PM Parameters and Thresholds Supported on the Line Module/LM-80

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	TCA Reporting supported	Default Threshold Values	
					15-min	24-hour
DTF Section Layer Parameters						
DTF CV-S	Count of BIP errors detected at the DTF Section layer. Up to 8 BIP errors can be detected per frame, with each error incrementing the DTF CV-S current register.	Yes	Yes	Yes	1500	15000
DTF ES-S	Count of the number of seconds during which (at any point during the second) at least one DTF Section layer BIP error was detected or an LOF or OLOS defect was present.	Yes	Yes	Yes	120	1200
DTF SES-S	Count of the seconds during which K (=10000) or more DTF Section layer BIP errors were detected or an LOF or OLOS defect was present.	Yes	Yes	Yes	3	7
Near-end DTF Path Layer Parameters Collected on Line Module/LM-80[a]						
DTF CV-P	Count of BIP errors detected at the DTF Path layer. Up to 8 path BIP errors can be detected per frame, with each error incrementing the DTF-DLM-CV-S current register.	Yes	Yes	Yes	1500	15000
DTF ES-P	Count of the number of seconds during which (at any point during the second) at least one DTF Path layer BIP error was detected or an AIS-P defect was present.	Yes	Yes	Yes	120	1200
DTF SES-P	Count of the seconds during which K (= 2,400 as specified in GR-253-CORE Issue 3 specification) or more DTF Path layer BIP errors were detected or an AIS-P defect was present.	Yes	Yes	Yes	3	7

Table A-3 DTF PM Parameters and Thresholds Supported on the Line Module/LM-80

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	TCA Reporting supported	Default Threshold Values	
					15-min	24-hour
DTF UAS-P	Count of the seconds during which the DTF Path considered unavailable. A DTF Path becomes unavailable at the onset of 10 consecutive seconds that qualify as DTF-DLM-SES-P, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as DTF-DLM-SES-P.	Yes	Yes	Yes	10	10
Internal CV-P	Count of BIP errors detected in the DTP encapsulation between the local TAM/ TOM, midplane, cross-point, and the line module side for the connected path when cross-connect or Subnetwork Connection (SNC) services are established.	Yes	No	No	N/A	N/A
Near-end DTF Path Layer Parameters Collected on the TAM						
DTF CV-P	Count of BIP errors detected at the DTF Path layer. Up to 8 path BIP errors can be detected per frame, with each error incrementing the DTF-DLM-CV-S current register.	Yes	Yes	Yes	1500	15000
DTF ES-P	Count of the number of seconds during which (at any point during the second) at least one DTF Path layer BIP error was detected or an AIS-P, DTP-LOF or POST FEC SF BER defect was present.	Yes	Yes	Yes	120	1200
DTF SES-P	Count of the seconds during which K (= 2,400 as specified in GR-253-CORE Issue 3 specification) or more DTF Path layer BIP errors were detected or an AIS-P, DTP-LOF or POST FEC SF BER defect was present.	Yes	Yes	Yes	3	7

Table A-3 DTF PM Parameters and Thresholds Supported on the Line Module/LM-80

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	TCA Reporting supported	Default Threshold Values	
					15-min	24-hour
DTF UAS-P	Count of the seconds during which the DTF Path is considered unavailable. A DTF Path becomes unavailable at the onset of 10 consecutive seconds that qualify as DTF SES-P, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as DTF SES-P.	Yes	Yes	Yes	10	10
Internal CV-P	Count of BIP errors detected in the DTP encapsulation between the local TAM/ TOM, midplane, cross-point, and the line module side for the connected path when cross-connect or Subnetwork Connection (SNC) services are established.	Yes	No	No	N/A	N/A
DTF PRBS (bit) Errors Trib Side	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS monitoring is enabled.	Yes	Yes	No	N/A	N/A
DTF PRBS Synch Errors Trib Side	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS monitoring is enabled.	Yes	Yes	No	N/A	N/A

a. Note that the DTF Path path PM data is available only when a circuit is provisioned. The DTF Path PM data collected on the TAM is nearly identical to the ones collected on its associated line module/LM-80. The difference is due to errors introduced on the backplane between the FEC chips in the line module/LM-80 and BMM.

FEC PM Parameters and Thresholds

Note: Unless specifically noted otherwise, all references to “line module” will refer to either the OLM (AOLM/SOLM), OLX (AOLX/SOLX), DLM, XLM, ADLM, AXLM, and/or SLM interchangeably. All references to the “LM-80” will refer to the AXLM-80, ADLM-80 and/or SLM-80 interchangeably. Note that the term “line module” does not refer to TEMs, as they do not have line-side capabilities and are used for tributary extension.

The DTN and DTN-X performs FEC (Forward Error Correction) encoding/decoding function for every optical channel on the line side. The DTN supports FEC PM data collection to compute the effective BER for all of the channels that are regenerated in a DTN. Table A-4 describes the supported FEC PM data.

Table A-4 FEC PM Parameters and Thresholds Supported on the Line Module/LM-80

FEC PM Parameter	Description	Real-time data	15-min and 24-hr data	Threshold Supported
FEC UnCorrected BER	Uncorrected bit error rate prior to FEC correction.	Yes (integrated over one second)	Yes	Yes Default Value=$10e^{-4}$
FEC Corrected BER	Corrected bit error rate	Yes (integrated over one second)	Yes	No
FEC Corrected Bits	Corrected number of zeros and ones	Yes	Yes	No
FEC UnCorrectable Codewords	Uncorrected number of code-words	Yes	Yes	No
Total CodeWords	Total number of codewords	Yes	Yes	No

The thresholding is supported only for the pre-FEC BER (the FEC UnCorrected BER parameter). If the BER before error correction is equal to or greater than the user configured value over an interval associated with the configured value, a ‘Pre-FEC BER-based Signal Degrade’ alarm is reported. The alarm is cleared when the pre-FEC BER is below the threshold.

DCh Parameters and Thresholds

This command is used to modify a digital channel (DCH) on the DTN and DTN-X. The Digital channel (DCH) is similar to the Optical Channel (OCH), without the optical parameters. There are two types of DCH:

- Trib-side DCH used by the TAM-2-10GT to provide a Layer 1 Optical Private Network (OPN) for end-customers building Digital Optical Networks across a service provider's Infinera Digital Optical Network.
- Line-side DCH created within the Optical Channel PTP on the LM-80 (4 digital channels are created within 40G OCHPTPs; 2 digital channels are created within 20G OCHPTPs)

Table A-5 and Table A-6 on page A-23 describe the PMs supported for Digital Channels on the DTN.

Note: The DCh also supports the FEC parameters described in Table A-4 on page A-21.

Table A-5 PMs Supported for Layer 1 OPN via the TAM-2-10GT and for Digital Channel on LM-80s

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	TCA Reporting supported	Default Threshold Values	
					15-min	24-hour
CVS	Count of BIP errors detected at the DTF Section layer. Up to 8 BIP errors can be detected per frame, with each error incrementing the DTF CV-S current register.	Yes	Yes	Yes	1500	15000
ESS	Count of the number of seconds during which (at any point during the second) at least one DTF Section layer BIP error was detected or an LOF or OLOS defect was present.	Yes	Yes	Yes	120	1200
SESS	Count of the seconds during which K (=10000) or more DTF Section layer BIP errors were detected or an LOF or OLOS defect was present.	Yes	Yes	Yes	3	7
BERPREFEC	Uncorrected bit error rate prior to FEC correction.	Yes	Yes	No	N/A	N/A
BERPOSTFEC	Corrected bit error rate	Yes	Yes	No	N/A	N/A
Q-Value	The current Q-factor of the channel. One measurement for each optical channel.	Yes	No	No	N/A	N/A
FECBITS	Corrected number of zeros and ones	Yes	Yes	No	N/A	N/A

Table A-5 PMs Supported for Layer 1 OPN via the TAM-2-10GT and for Digital Channel on LM-80s

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	TCA Reporting supported	Default Threshold Values	
					15-min	24-hour
UCWORDS	Uncorrected number of code words	Yes	Yes	No	N/A	N/A
FECCODEWORDS	Total number of code words	Yes	Yes	No	N/A	N/A

Table A-6 PRBS Parameters Collected for the Digital Channel on the TAM-2-10GT

PM Parameter	Description	Real-time data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
PRBSERR	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A
PRBSSYNCERR	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A

Client Signal PM Parameters and Thresholds

The DTN-X, DTN, and Optical Line Amplifier supports PM data collection for all of the supported interfaces (OC-768, OC192, STM-16 and 64, 10GbE LAN Phy, 10GbE WAN, OTU2,OTU1e,OTU2e, etc.).

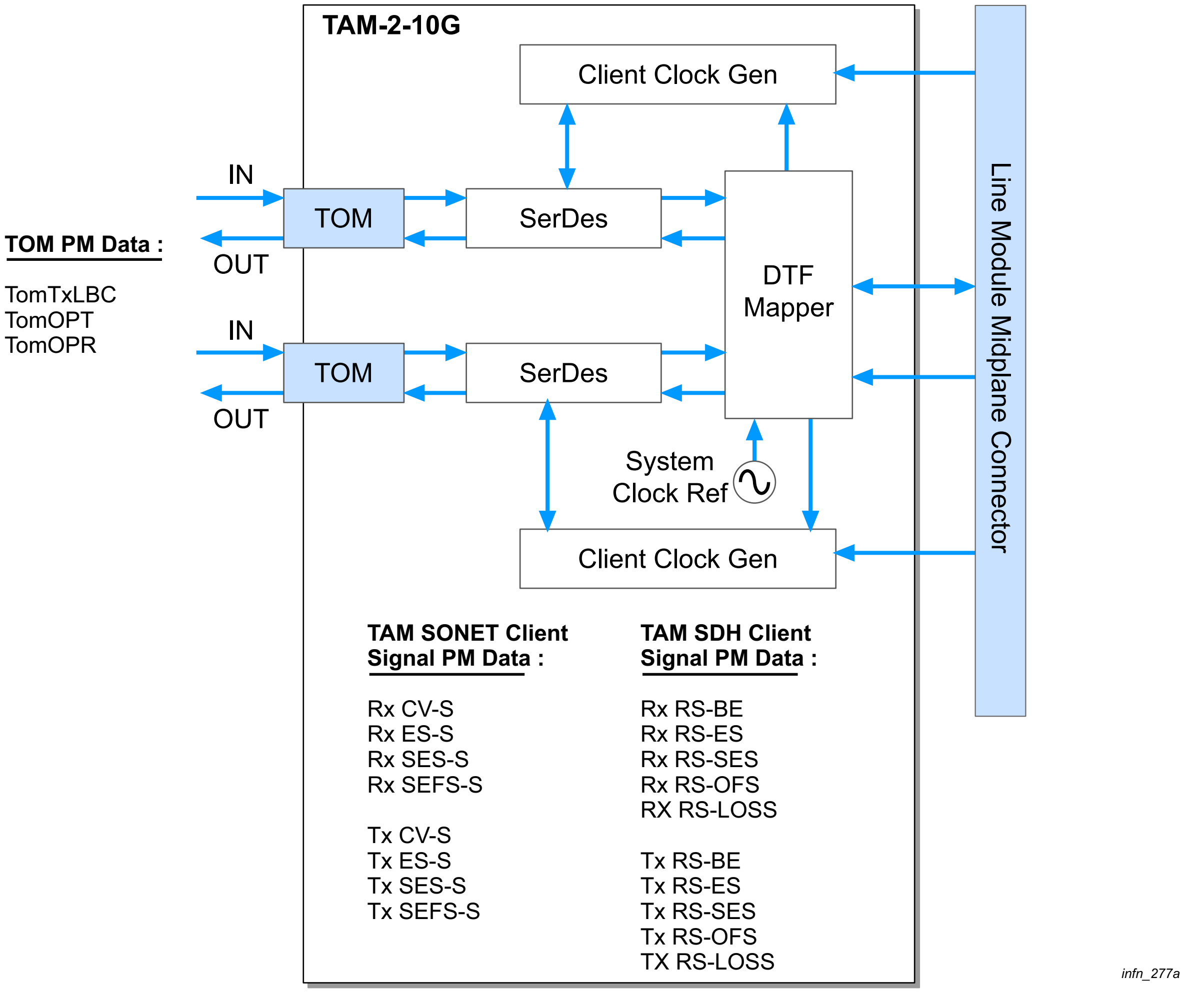
Note: 10GbE WAN Phy interfaces will not be supported for DTN

At the TAMs and TIMs, PM data collected for the client signals received at the ingress port are referred to as the Rx PM parameters; PM data collected for client signals transmitted at the egress port are referred to as the Tx PM parameters. Rx and Tx PM data can be used to determine the number of errors occurring in the various segments of the network:

- Between the client equipment and the ingress port
- Within the Digital Optical Network
- Between the egress port and the client equipment

The optical PM data collected at the TOMs are payload independent, and are collected as minimum, maximum, and average values. Figure A-2 on page A-25 gives a summary of the SONET and SDH client signal PM data collected on the DTN and DTN-X for TAMs, TIMs, and TOMs.

Figure A-2 Client Signal (SONET and SDH) PM Parameters



The type of client signal will determine the types of PM parameters that are supported. See the following sections for the PM parameters supported on each type of client signal:

- "PM Collected for SONET Interfaces on the XTC" on page A-26
- "PM Collected for SONET Interfaces on the DTC/MTC" on page A-28
- "PM Collected for SDH Interfaces on the XTC" on page A-30
- "PM Collected for SDH Interfaces on the DTC/MTC" on page A-31
- "PM Collected for OTN Interfaces" on page A-33
- "PM Collected for Ethernet Interfaces on the XTC" on page A-35
- "PM Collected for Ethernet Interfaces on the DTC/MTC" on page A-42
- "PM Collected for OTUk on the XTC" on page A-54

- "PM Collected for ODUk on the XTC" on page A-55
- "PM Collected for ODUk CTP on the XTC" on page A-57
- "PM Collected for Fibre Channel Interfaces on TAM-2-10GM and TAM-8-2.5GMs" on page A-59

Specific PM parameters are supported for Virtual Concatenation Groups (VCGs), as described in the following section:

- "PM Collected for Virtual Concatenation Groups (VCGs)" on page A-61

There are also specific PM parameters for the Layer 1 Optical Private Network supported on the TAM-2-10GTs, as described in the following section:

- "DCh Parameters and Thresholds" on page A-22

In addition, there are client signal PM parameters that are supported in the TOMs, as described in the following section:

- "PM Collected on the TOMs" on page A-61

PM Collected for SONET Interfaces on the XTC

Table A-7 describes the PM parameters supported for SONET interfaces.

Table A-7 SONET Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Analog Parameters Collected for SONET OC-192/10GbE WAN Trib Interfaces (TIM-5-10GM only)					
Rx BER	Count of Received and Transmitted for bit error ratio detected	Yes	No	N/A	N/A
Tx BER					

Table A-7 SONET Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
SONET Section Parameters Collected on the TIM for SONET OC-192/10GbE WAN Trib Interfaces					
RxCV-S	Count of BIP errors detected at the Section layer on the incoming client's SONET signal. Up to eight Section BIP errors can be detected per STS-N frame, with each error incrementing the Sonet-Rx-CV current second register.	Yes	Yes	1500	15000
TxCV-S	Count of BIP errors detected at the Section layer in the SONET signal received from the line/system side and to be transmitted to the receiving client. Up to eight Section BIP errors can be detected per STS-N frame, with each error incrementing the Sonet-Rx-CV current second register.				
RxSES-S	Count of the seconds during which *K* or more Section layer BIP errors were detected or an SEF or LOF defect was present.	Yes	Yes	120	1200
TxSES-S	Count of the seconds during which *K* or more Section layer BIP errors were detected or an LOF or SEF defect was present at the signal de-encapsulation point.				
RxES-S	Count of the number of seconds during which (at any point during the second) at least one Section layer BIP error was detected or an SEF or LOF defect was present.	Yes	Yes	3	7
TxES-S	Count of the number of seconds during which (at any point during the second) at least one Section layer BIP error was detected or an LOF or SEF defect was present at the signal de-encapsulation point.				
RxSEFS-S	Count of seconds during which an SEF defect is present.	Yes	Yes	3	7
TxSEFS-S	Count of seconds during which an SEF defect is present at the signal de-encapsulation point.				

PM Collected for SONET Interfaces on the DTC/MTC

Table A-8 describes the PM parameters supported for SONET interfaces.

Table A-8 SONET Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
SONET Section Parameters Collected on the TAM for SONET OC-768/OC-192/OC-48/OC-12/OC-3 Trib Interfaces					
Rx CV-S	Count of BIP errors detected at the Section layer on the incoming client's SONET signal. Up to eight Section BIP errors can be detected per STS-N frame, with each error incrementing the Sonet-Rx-CV-S current second register.	Yes	Yes	1500	15000
Tx CV-S	Count of BIP errors detected at the Section layer in the SONET signal received from the line/system side and to be transmitted to the receiving client. Up to eight Section BIP errors can be detected per STS-N frame, with each error incrementing the Sonet-Tx-CV-S current second register.				
Rx ES-S	Count of the number of seconds during which (at any point during the second) at least one Section layer BIP error was detected or an SEF or LOF defect was present.	Yes	Yes	120	1200
Tx ES-S	Count of the number of seconds during which (at any point during the second) at least one Section layer BIP error was detected or an LOF or SEF defect was present at the signal de-encapsulation point.				
Rx SES-S	Count of the seconds during which *K* or more Section layer BIP errors were detected or an SEF or LOF defect was present.	Yes	Yes	3	7
Tx SES-S	Count of the seconds during which *K* or more Section layer BIP errors were detected or an LOF or SEF defect was present at the signal de-encapsulation point.				
Rx SEFS-S	Count of seconds during which an SEF defect is present.	Yes	Yes	3	7
Tx SEFS-S	Count of seconds during which an SEF defect is present at the signal de-encapsulation point.				

Table A-8 SONET Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
PRBS Parameters Collected for SONET OC-768/OC-192/OC-48/OC-12/OC-3 Trib Interfaces (TAM-8-2.5GM, TAM-2-10GM, and TAM-1-40G only)					
PRBS Error	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A
PRBS Sync Error	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A
Line PRBS Errors (Not supported for OC-768) Trib PRBS Errors	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A
Line PRBS Sync Errors (Not supported for OC-768) Trib PRBS Sync Errors	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A

PM Collected for SDH Interfaces on the XTC

Table A-9 describes the PM parameters supported for SDH interfaces.

Table A-9 SDH Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
SDH Regenerator Section Parameters Collected on the TIM for SDH STM-64 Trib Interfaces					
Rx BE-RS	Count of the number of errors within a block in the incoming client's SDH signal. NOTE: All Infinera SDH interfaces use 8000 blocks/sec, regardless of signal rate.	Yes	Yes	1500	15000
Tx BE-RS	Count of the number of errors within a block in the SDH signal received from the network and to be transmitted to the receiving client. NOTE: All Infinera SDH interfaces use 8000 blocks/sec, regardless of signal rate				
Rx ES-RS	Count of the number of seconds during which (at any point during the second) at least one RS block error was detected or an LOS or LOF defect is present	Yes	Yes	120	1200
Tx ES-RS	Count of the number of seconds during which (at any point during the second) at least one Tx RS block error was detected or a de-encap (Tx) LOS or LOF defect was present.				
Rx SES-RS	Count of the seconds during which 30% or more RS block errors (BE) were detected or an LOF or LOS defect was present	Yes	Yes	3	7
Tx SES-RS	Count of the seconds during which 30% or more Tx RS block errors (BE) were detected or a de-encap (Tx) LOF or LOS defect was present.				
Rx OFS-RS	Regenerator Section - Out of Frame Seconds. Count of seconds during which an OOF defect is present (at any point in the second)	Yes	Yes	3	7
Tx OFS-RS	Regenerator Section - Out of Frame Seconds. Count of seconds during which a de-encap (Tx) OOF defect was present				
Rx LOSS-RS	Regenerator Section - Loss of Signal Seconds. Count of seconds during which any LOS defect existed, including optical loss of light (OLOS) or de-encapsulated loss of light (DLOS)	Yes	Yes	3	7
Rx UAS-RS	Regenerator Section - Unavailable Seconds. Count of seconds during which the regenerator section was unavailable	Yes	Yes	1	10
Tx UAS-RS	Regenerator Section - Unavailable Seconds. Count of seconds during which the regenerator section was unavailable.				

PM Collected for SDH Interfaces on the DTC/MTC

Table A-10 describes the PM parameters supported for SDH interfaces.

Table A-10 SDH Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values 15-min	Default Threshold Values 24-hour
SDH Regenerator Section Parameters Collected on the TAM for SDH STM-256/STM-64/STM-16/STM-4/STM-1 Trib Interfaces					
Rx RS-BE	Count of the number of errors within a block in the incoming client's SDH signal. NOTE: All Infinera SDH interfaces use 8000 blocks/sec, regardless of signal rate.	Yes	Yes	1500	15000
Tx RS-BE	Count of the number of errors within a block in the SDH signal received from the network and to be transmitted to the receiving client. NOTE: All Infinera SDH interfaces use 8000 blocks/sec, regardless of signal rate.				
Rx RS-ES	Count of the number of seconds during which (at any point during the second) at least one RS block error was detected or an LOS or LOF defect is present.	Yes	Yes	120	1200
Tx RS-ES	Count of the number of seconds during which (at any point during the second) at least one Tx RS block error was detected or a de-encap (Tx) LOS or LOF defect was present.				
Rx RS-SES	Count of the seconds during which 30% or more RS block errors (BE) were detected or an LOF or LOS defect was present.	Yes	Yes	3	7
Tx RS-SES	Count of the seconds during which 30% or more Tx RS block errors (BE) were detected or a de-encap (Tx) LOF or LOS defect was present.				
Rx RS-OFS	Regenerator Section - Out of Frame Seconds. Count of seconds during which an OOF defect is present (at any point in the second).	Yes	Yes	3	7
Tx RS-OFS	Regenerator Section - Out of Frame Seconds. Count of seconds during which a de-encap (Tx) OOF defect was present.				
Rx RS-LOSS	Regenerator Section - Loss of Signal Seconds. Count of seconds during which any LOS defect existed, including optical loss of light (OLOS) or de-encapsulated loss of light (DLOS).	Yes	Yes	3	7
Rx RS-UAS	Regenerator Section - Unavailable Seconds. Count of seconds during which the regenerator section was unavailable.	Yes	Yes	1	10
Tx RS-UAS	Regenerator Section - Unavailable Seconds. Count of seconds during which the regenerator section was unavailable.				

Table A-10 SDH Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
PRBS Parameters Collected for SDH STM-256/STM-64/STM-16/STM-4/STM-1 Trib Interfaces (applicable to TAM-8-2.5GM, TAM-2-10GM and TAM-1-40G only)					
PRBS Error	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A
PRBS Sync Error	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS monitoring is enabled.	Yes	Yes	N/A	N/A
Line PRBS Errors (Not supported for STM-256)	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A
Trib PRBS Errors					
Line PRBS Sync Errors (Not supported for STM-256)	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A
Trib PRBS Sync Errors					

PM Collected for OTN Interfaces

Table A-11 describes the PM parameters supported for OTN interfaces.

Note: All transmit parameters are displayed as not applicable (N/A) when the Service Mode Qualifier is set to With FEC Error Forwarding for OTU, ODU and ODUkT CTPs for 10GM TAMs.

Table A-11 OTN Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
PM Parameters Collected for OTUk Trib Interfaces					
Code Words	Total number of code words	Yes	Yes	N/A	N/A
Uncorrected Code Words	Uncorrected number of code words	Yes	Yes	N/A	N/A
FEC Zero	Corrected number of zeros	Yes	Yes	N/A	N/A
FEC One	Corrected number of ones	Yes	Yes	N/A	N/A
Rx CV-S Tx CV-S	Count of BIP errors detected on the OTUk client CTP (via section monitoring overhead).	Yes	Yes	N/A	N/A
Rx Errored Blocks Tx Errored Blocks	Number of errored blocks detected on the OTUk client CTP (via section monitoring overhead). An OTUk block shall be counted as an errored block if one or more errors are detected by the OTUk BIP-8 in a given second.	Yes	Yes	1500	15000
Rx Defect Seconds Tx Defect Seconds	Number of defect seconds detected on the OTUk client CTP (via section monitoring overhead). A second is declared a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable.	Yes	Yes	120	1200
Rx Uncorrected BER	Count of uncorrected BIP errors detected on the OTUk client CTP.	No	Yes		
Rx Corrected BER	Count of corrected BIP errors detected on the OTUk client CTP.	No	Yes		
Line PRBS Errors Trib PRBS Errors	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A

Table A-11 OTN Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values 15-min	Default Threshold Values 24-hour
Line PRBS Sync Errors Trib PRBS Sync Errors	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS is enabled.	Yes	Yes	N/A	N/A
Rx BEI Count	Backward error indication count.	Yes	Yes	1500	15000
Tx BEI Count		Yes	Yes	1500	15000
PM Parameters Collected for ODUk Trib Interfaces					
Rx CV-P Tx CV-P	Count of BIP errors detected on the ODUk client CTP (via section monitoring overhead).	Yes	Yes	N/A	N/A
Rx Errored Blocks Tx Errored Blocks	Number of errored blocks detected on the ODUk client CTP (via section monitoring overhead). An ODUk block shall be counted as an errored block, if one or more errors are detected by the ODUk BIP-8 in a given second.	Yes	Yes	1500	15000
Rx DS Tx DS	Number of defect seconds detected on the ODUk client CTP (via section monitoring overhead). A second is declared a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable.	Yes	Yes	120	1200
Rx BEI Count	Backward error indication count.	Yes	Yes	1500	15000
Tx BEI Count		Yes	Yes	1500	15000
PM Parameters Collected for Tandem Connection Monitoring (TCM) ODUkT Facilities					
Rx CV-T	Count of BIP-8 errors detected on the Tandem Connection.	Yes	Yes	N/A	N/A
Rx Errored Blocks	Number of errored blocks detected on the ODUkT CTP (via the TCM overhead).	Yes	Yes	1500	15000
Rx BEI Count	The number of Backward Error Indications on the ODUkT CTP (via the TCM overhead).	Yes	Yes	1500	15000
Defect Seconds	Number of defect seconds detected on the ODUkT CTP (via the TCM overhead).	Yes	Yes	120	1200
Defect Seconds FEND	Number of defect seconds detected on the ODUkT CTP (via the TCM overhead).	Yes	Yes	120	1200

PM Collected for Ethernet Interfaces on the XTC

Table A-12 describes the PM parameters supported for Ethernet interfaces.

Note: Support of some Ethernet PM parameters are dependent on the service type (10GbE and 100GbE), but also dependent on the type of TIM that is supporting the service (TIM-5-10GM and/or TIM-1-100GE). The right-most columns in the following table indicate which service types and TIM types support each PM parameter.

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Analog PM Parameters Collected Ethernet Client Signal							
Rx Link Utilization Pkts	Number of packets received for link utilization.	Yes	No	0	0	Yes	Yes
Tx Link Utilization Pkts	Number of packets transmitted for link utilization.						
Digital PM Parameters Collected Ethernet Client Signal							
Rx Utilization Pkts	Number of packets received during the usage.	No	Yes	0	0	Yes	Yes
Tx Utilization Pkts	Number of packets transmitted during the usage						
Rx Utilization Octets	Number of data octets received during the usage.	No	Yes	0	0	Yes	Yes
Tx Utilization Octets	Number of data octets transmitted during the usage.						
Rx PCS ICG	Invalid Code Group - Receive	Yes	Yes	1500	15,000	Yes	Yes
Tx PCS ICG	Invalid Code Group - Transmit						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx PCS ES	Errored Seconds The number of seconds in which at least one ICG was detected, or the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present).	Yes	Yes	120	1200	Yes	Yes
Tx PCS ES	Errored Seconds The number of seconds in which at least one de-encapsulation ICG was detected, or the TP was in de-encap LOSS OF SYNC (defect) state (including when an de-encap LOS defect was present).						
Rx PCS SES	Severely Errored Seconds Number of seconds in which at least *N* ICGs were detected, or the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present). *N* = 1250 (1GbE), 12500 (10GbE), or 125000 (100GbE)	Yes	Yes	3	7	Yes	Yes
Tx PCS SES	Severely Errored Seconds Number of seconds in which at least *N* de-encap ICGs were detected, or the TP was in de-encap LOSS OF SYNC (defect) state (including when an de-encap LOS defect was present). (See Rx SES for *N* values.)						
Rx PCS SESS	Severely Errored Sync Seconds Number of seconds in which the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present).	Yes	Yes	3	7	Yes	Yes
Tx PCS SESS	Severely Errored Sync Seconds Number of seconds in which the TP was in the de-encap LOSS OF SYNC (defect) state (including when a de-encap LOS defect was present).						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx PCS CV 1 to CV 20	Count of errors detected on Physical Coding Sublayer	Yes	Yes	0	0	No	Yes
Tx PCS CV 1 to CV 20	Count of errors detected on Physical Coding Sublayer						
Rx Err Octets	Errored octet Number of data octets that are part of an Errored Packet (i.e., the FCS is in error, resulting in incrementing the Fragment counter, the Jabber counter, or the CRCAlignError counter), on the receive client interface	Yes	Yes	256	512	Yes	Yes
Tx Err Octets	Errored octet Number of data octets that are part of an Errored Packet (i.e., the FCS is in error, resulting in incrementing the Fragment counter, the Jabber counter, or the CRCAlignError counter), at the signal de-encapsulation point before the client-side transmit interface.						
Rx Jabber	Jabber count Number of packets received that are longer than the maximum frame length octets (excluding framing bits, but including FCS octets) and has either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error).	Yes	Yes	1	2	Yes	Yes
Tx Jabber	Jabber count Number of packets transmitted that are longer than the maximum frame length octets (excluding framing bits, but including FCS octets) and has either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error)						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx Fragment	Fragment packet count Number of packets received that are less than 64 octets long (excluding framing bits, but including FCS octets) and have either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error), on the receive client interface.	Yes	Yes	1	2	Yes	Yes
Tx Fragment	Fragment packet count Number of packets transmitted that are less than 64 octets long (excluding framing bits, but including FCS octets) and have either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error), on the receive client interface						
Rx CRC Aligned	Cyclical redundancy check align error count Number of packets received that have a length (excluding framing bits, but including FCS octets) of between 64 and MaxFrame-Length octets, inclusive, but have either a bad FCS with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error), on the receive client interface.	Yes	Yes	1	2	Yes	Yes
Tx CRC Aligned	Cyclical redundancy check align error count Number of packets transmitted that have a length (excluding framing bits, but including FCS octets) of between 64 and MaxFrame-Length octets, inclusive, but have either a bad FCS with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error), on the receive client interface.						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx Undersized	Undersize packet count Number of received packets that are less than 64 octets long (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface.	Yes	Yes	1	2	Yes	Yes
Tx Undersized	Undersize packet count Number of transmitted packets that are less than 64 octets long (excluding framing bits, but including FCS octets) and are otherwise well formed.	Yes	Yes	1	2	Yes	Yes
Rx Oversize	Oversize packet count Number of received packets that are longer than the maximum frame length (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface	Yes	Yes	1	2	Yes	Yes
Tx Oversize	Oversize packet count Number of transmitted packets that are longer than the maximum frame length (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface	Yes	Yes	1	2	Yes	Yes
Rx Jabber Seconds	Jabber Seconds Number of seconds in which a jabber state was detected sometime in that second.	Yes	Yes	1	2	Yes	Yes
Tx Jabber Seconds	Jabber Seconds Number of seconds in which a jabber state was detected sometime in that second on the de-encapsulated signal.	Yes	Yes	1	2	Yes	Yes
Rx MAC SES	Severely Errored Seconds.	Yes	Yes	3	7	Yes	Yes
Tx MAC SES	Severely Errored Seconds.	Yes	Yes	3	7	Yes	Yes

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx Broadcast	A count of frames that are successfully received and are directed to the broadcast group address. This does not include frames received with frame-too-long, FCS, length, or alignment errors, or frames lost due to internal MAC sublayer error.	Yes	Yes	0	0	Yes	Yes
Tx Broadcast	A count of the frames that were successfully transmitted, as indicated by the transmit status “transmit OK”, to the broadcast address. Frames transmitted to multicast addresses are not broadcast frames and are excluded.						
Rx Multicast	A count of frames that are successfully received and are directed to an active non-broadcast group address. This does not include frames received with frame-too-long, FCS, length, or alignment errors, or frames lost due to internal MAC sublayer error	Yes	Yes	0	0	Yes	Yes
Tx Multicast	A count of frames that are successfully transmitted, as indicated by the status value “transmit OK”, to a group destination address other than broadcast						
Rx InPause	A count of MAC Control frames received on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode.	Yes	Yes	0	0	Yes	Yes
Tx OutPause	A count of MAC Control frames transmitted on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode.						
Rx Packets Size 64	Received packets (including bad packets) of 64 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 64	Transmitted packets of 64 octets						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Rx Packets Size 65 to 127	Received packets (including bad packets) from 65 to 128 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 65 to 127	Transmitted packets from 65 to 128 octets						
Rx Packets Size 128 to 255	Received packets (including bad packets) from 128 to 255 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 128 to 255	Transmitted packets from 128 to 255 octets						
Rx Packets Size 256 to 511	Received packets (including bad packets) from 256 to 511 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 256 to 511	Transmitted packets from 256 to 511 octets						
Rx Packets Size 512 to 1023	Received packets (including bad packets) from 512 to 1023 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 512 to 1023	Transmitted packets from 512 to 1023 octets						
Rx Packets Size 1024 to 1518	Received packets (including bad packets) from 1024 to 1518 octets	Yes	Yes	0	0	No	Yes
Tx Packets Size 1024 to 1518	Transmitted packets from 1024 to 1518 octets						
Rx Packets Size 1519 to Jumbo	Received packets (including bad packets) of 1519 or more octets	Yes	Yes	0	0	No	Yes
Tx Packets Size 1519 to Jumbo	Transmitted packets of 1519 or more octets						
Rx Packets Size 1024 to 1522	Received packets (including bad packets) from 1024 to 1522 octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 1024 to 1522	Transmitted packets from 1024 to 1522 octets						
Rx Packets Size 1523 to Jumbo	Received packets (including bad packets) of 1523 or more octets	Yes	Yes	0	0	Yes	Yes
Tx Packets Size 1523 to Jumbo	Transmitted packets of 1523 or more octets						

Table A-12 Ethernet Client Signal PM Parameters Supported on the TIM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TIM-5-10GM/	TIM-1-100GE
				15-min	24-hour		
Line Test Signal Sync Error Trib Test Signal Sync Error	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when trib/line test is enabled.	Yes	Yes	N/A	N/A	No	No
Line Test Signal Error Trib Test Signal Error	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when trib/line test is enabled.	Yes	Yes	N/A	N/A	No	No

PM Collected for Ethernet Interfaces on the DTC/MTC

Table A-13 on page A-43 describes the PM parameters supported for Ethernet interfaces.

Note: Support of some Ethernet PM parameters are dependent on the service type (40GbE vs. 1GbE, etc.), but also dependent on the type of TAM that is supporting the service (TAM-8-1G, TAM-8-2.5GM, TAM-1-100GE, etc.). The right-most columns in the following table indicate which service types and TAM types support each PM parameter.

Note: For 10GbE on TAM-2-10GM, when the incoming frame has a packet length of 54 or less, the RX Undersize counter does not increment correctly.

Note: For 10GbE on TAM-2-10GM with a maximum packet length of Extreme Jumbo (18742), when the incoming frame has a packet length of 18744 or larger (with either a valid or invalid CRC), the RX Jabbers and RX MAC SES counters increment but the Oversized counter does not increment.

For 1GbE on TAM-8-2.5GM with a maximum packet length of Extreme Jumbo (18742), when the incoming frame has a packet length of 18743 or larger (with either a valid or invalid CRC), the RX Jabbers and RX MAC SES counters increment but the Oversized counter does not increment.

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

<table>
<tr><th rowspan="2">PM Parameter</th><th rowspan="2">Description</th><th rowspan="2">Real-time Data</th><th rowspan="2">15-min and 24-hr Data</th><th colspan="2">Default Threshold Values</th><th rowspan="2">TAM-8-1G</th><th rowspan="2">TAM-8-2.5GM</th><th rowspan="2">TAM-2-10GR</th><th rowspan="2">TAM-2-10GM</th><th rowspan="2">TAM-1-40GR/TAM-1-100GR</th><th rowspan="2">TAM-1-40GE/TAM-1-100GE</th></tr>
<tr><th>15-min</th><th>24-hour</th></tr>
<tr><td>Rx Broadcast Packets</td><td>A count of frames that are successfully received and are directed to the broadcast group address. This does not include frames received with frame-too-long, FCS, length, or alignment errors, or frames lost due to internal MAC sub-layer error.</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">No</td><td rowspan="2">No</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">No</td></tr>
<tr><td>Tx Broadcast Packets</td><td>A count of the frames that were successfully transmitted, as indicated by the transmit status “transmit OK”, to the broadcast address. Frames transmitted to multicast addresses are not broadcast frames and are excluded.</td></tr>
<tr><td>Rx Multicast Packets</td><td>A count of frames that are successfully received and are directed to an active non-broadcast group address. This does not include frames received with frame-too-long, FCS, length, or alignment errors, or frames lost due to internal MAC sublayer error.</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">No</td><td rowspan="2">No</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">No</td></tr>
<tr><td>Tx Multicast Packets</td><td>A count of frames that are successfully transmitted, as indicated by the status value “transmit OK”, to a group destination address other than broadcast.</td></tr>
</table>

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values 15-min	Default Threshold Values 24-hour	TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
Rx InPause Frame	A count of MAC Control frames received on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode.	Yes	Yes	0	0	No	Yes	Yes	Yes	Yes	No
Tx OutPause Frame	A count of MAC Control frames transmitted on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode.										
Rx ICG	Invalid Code Group - Receive	Yes	Yes	1500	15,000	Yes	Yes	Yes	Yes	Yes	Yes
Tx ICG	Invalid Code Group - Transmit										
CVS-PCS	PCS BIP errors.	Yes	Yes	N/A	N/A	No	No	No	No	Yes	Yes
CVS-PCS*n*	PCS BIP errors on lane *n*. For 40GBE: *n*=01 to 04 For 100GBE: *n*=01 to 20	Yes	Yes	N/A	N/A	No	No	No	No	Yes	Yes

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
				15-min	24-hour						
Rx ES	Errored Seconds The number of seconds in which at least one ICG was detected, or the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present).	Yes	Yes	120	1200	Yes	Yes	Yes	Yes	Yes	Yes
Tx ES	Errored Seconds The number of seconds in which at least one de-encapsulation ICG was detected, or the TP was in de-encap LOSS OF SYNC (defect) state (including when an de-encap LOS defect was present).										
Rx SES	Severely Errored Seconds Number of seconds in which at least *N* ICGs were detected, or the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present). *N* = 1250 (1GbE), 12500 (10GbE), 50000 (40GbE), or 125000 (100GbE)	Yes	Yes	3	7	Yes	Yes	Yes	Yes	Yes	Yes
Tx SES	Severely Errored Seconds Number of seconds in which at least *N* de-encap ICGs were detected, or the TP was in de-encap LOSS OF SYNC (defect) state (including when an de-encap LOS defect was present). (See Rx SES for *N* values.)										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values: 15-min	Default Threshold Values: 24-hour	TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
Rx SESS	Severely Errored Sync Seconds Number of seconds in which the TP was in ingress LOSS OF SYNC (defect) state (including when an ingress optical LOS defect was present).	Yes	Yes	3	7	Yes	Yes	Yes	Yes	Yes	Yes
Tx SESS	Severely Errored Sync Seconds Number of seconds in which the TP was in the de-encap LOSS OF SYNC (defect) state (including when a de-encap LOS defect was present).										
Rx JS	Jabber Seconds Number of seconds in which a jabber state was detected sometime in that second.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx JS	Jabber Seconds Number of seconds in which a jabber state was detected sometime in that second on the de-encapsulated signal.										
Rx Packets	Number of received data packets.	Yes	Yes	N/A	N/A	Yes	Yes	Yes	Yes	Yes	No
Tx Packets	Number of transmitted data packets.										
Rx Packets/second	Number of received packets per second	Yes	Yes	N/A	N/A	Yes	Yes	Yes	Yes	Yes	No
Tx Packets/second	Number of transmitted packets per second										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
				15-min	24-hour						
Rx Octets	Number of received data octets.	Yes	Yes	N/A	N/A	Yes	Yes	Yes	Yes	Yes	No
Tx Octets	Number of transmitted data octets.										
Rx Octets/second	Number of octets received per second	Yes	Yes	N/A	N/A	Yes	Yes	Yes	Yes	Yes	No
Tx Octets/second	Number of octets transmitted per second										
Rx Err Octet	Errored octet Number of data octets that are part of an Errored Packet (i.e., the FCS is in error, resulting in incrementing the Fragment counter, the Jabber counter, or the CRCAlignError counter), on the receive client interface.	Yes	Yes	256	512	Yes	Yes	No	No	Yes	No
Tx Err Octet	Errored octet Number of data octets that are part of an Errored Packet (i.e., the FCS is in error, resulting in incrementing the Fragment counter, the Jabber counter, or the CRCAlignError counter), at the signal de-encapsulation point before the client-side transmit interface.										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
				15-min	24-hour						
Rx Jabber	Jabber count Number of packets received that are longer than the maximum frame length octets (excluding framing bits, but including FCS octets) and has either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error).	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx Jabber	Jabber count Number of packets transmitted that are longer than the maximum frame length octets (excluding framing bits, but including FCS octets) and has either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error).										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
				15-min	24-hour						
Rx Fragment	Fragment packet count Number of packets received that are less than 64 octets long (excluding framing bits, but including FCS octets) and have either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error), on the receive client interface.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx Fragment	Fragment packet count Number of packets transmitted that are less than 64 octets long (excluding framing bits, but including FCS octets) and have either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error), on the receive client interface.										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values: 15-min	Default Threshold Values: 24-hour	TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
Rx CRC Aligned	Cyclical redundancy check align error count Number of packets received that have a length (excluding framing bits, but including FCS octets) of between 64 and MaxFrameLength octets, inclusive, but have either a bad FCS with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error), on the receive client interface.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx CRC Aligned	Cyclical redundancy check align error count Number of packets transmitted that have a length (excluding framing bits, but including FCS octets) of between 64 and MaxFrame-Length octets, inclusive, but have either a bad FCS with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error), on the receive client interface.										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values: 15-min	Default Threshold Values: 24-hour	TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
Rx Undersized	Undersize packet count Number of received packets that are less than 64 octets long (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx Undersized	Undersize packet count Number of transmitted packets that are less than 64 octets long (excluding framing bits, but including FCS octets) and are otherwise well formed.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Rx Oversize	Oversize packet count Number of received packets that are longer than the maximum frame length (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Tx Oversize	Oversize packet count Number of transmitted packets that are longer than the maximum frame length (excluding framing bits, but including FCS octets) and are otherwise well formed, on the receive client interface.	Yes	Yes	1	2	Yes	Yes	Yes	Yes	Yes	No
Rx MAC SES	Severely Errored Seconds	Yes	Yes	3	7	Yes	Yes	Yes	Yes	Yes	No
Tx MAC SES	Severely Errored Seconds	Yes	Yes	3	7	Yes	Yes	Yes	Yes	Yes	No

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values		TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
				15-min	24-hour						
Rx Packets Size 64	Received packets (including bad packets) of 64 octets	Yes	Yes	0	0	Yes	Yes	Yes	Yes	Yes	No
Tx Packets Size 64	Transmitted packets of 64 octets										
Rx Packets Size 65 to 127	Received packets (including bad packets) from 65 to 127 octets	Yes	Yes	0	0	Yes	Yes	Yes	Yes	Yes	No
Tx Packets Size 65 to 127	Transmitted packets from 65 to 127 octets										
Rx Packets Size 128 to 255	Received packets (including bad packets) from 128 to 255 octets	Yes	Yes	0	0	Yes	Yes	Yes	Yes	Yes	No
Tx Packets Size 128 to 255	Transmitted packets from 128 to 255 octets										
Rx Packets Size 256 to 511	Received packets (including bad packets) from 256 to 511 octets	Yes	Yes	0	0	Yes	Yes	Yes	Yes	Yes	No
Tx Packets Size 256 to 511	Transmitted packets from 256 to 511 octets										
Rx Packets Size 512 to 1023	Received packets (including bad packets) from 512 to 1023 octets	Yes	Yes	0	0	Yes	Yes	Yes	Yes	Yes	No
Tx Packets Size 512 to 1023	Transmitted packets from 512 to 1023 octets										
Rx Packets Size 1024 to 1518	Received packets (including bad packets) from 1024 to 1518 octets	Yes	Yes	0	0	Yes	Yes	No	Yes	Yes	No
Tx Packets Size 1024 to 1518	Transmitted packets from 1024 to 1518 octets										
Rx Packets Size 1519 to Jumbo	Received packets (including bad packets) of 1519 or more octets	Yes	Yes	0	0	Yes	Yes	No	Yes	Yes	No
Tx Packets Size 1519 to Jumbo	Transmitted packets of 1519 or more octets										

Table A-13 Ethernet Client Signal PM Parameters Supported on the TAM

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values 15-min	Default Threshold Values 24-hour	TAM-8-1G	TAM-8-2.5GM	TAM-2-10GR	TAM-2-10GM	TAM-1-40GR/TAM-1-100GR	TAM-1-40GE/TAM-1-100GE
Rx Packets Size 1024 to 1522	Received packets (including bad packets) from 1024 to 1522 octets	Yes	Yes	0	0	No	No	Yes	No	Yes	No
Tx Packets Size 1024 to 1522	Transmitted packets from 1024 to 1522 octets										
Rx Packets Size 1523 to Jumbo	Received packets (including bad packets) of 1523 or more octets	Yes	Yes	0	0	No	No	Yes	No	Yes	No
Tx Packets Size 1523 to Jumbo	Transmitted packets of 1523 or more octets										
Line Test Signal Sync Error	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when trib/line test is enabled.	Yes	Yes	N/A	N/A	Yes	Yes	No	Yes	No	No
Trib Test Signal Sync Error											
Line Test Signal Error	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when trib/line test is enabled.	Yes	Yes	N/A	N/A	Yes	Yes	No	Yes	No	No
Trib Test Signal Error											

PM Collected for OTUk on the XTC

Table A-14 describes the PM parameters supported for OTUk client tributary port on the TIMs.

Table A-14 OTUk PMs Supported on the TIMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx CodeWords	Total number of code words	Yes	Yes	0	0
Rx UncorrectedWords	Uncorrected number of code words	Yes	Yes	0	0
Rx Corrected Zeroes	Received Count of corrected Zeroes	Yes	Yes	0	0
Rx Corrected Ones	Received Count of corrected Ones	Yes	Yes	0	0
Rx CV-P Tx CV-P	Count of BIP errors detected on the ODUk client CTP (via section monitoring overhead).	Yes	Yes	0	0
Rx Errored Blocks Tx Errored Blocks	Number of errored blocks detected on the ODUk client CTP (via section monitoring overhead). An ODUk block shall be counted as an errored block, if one or more errors are detected by the ODUk BIP-8 in a given second	Yes	Yes	1500	15000
Rx DefectSeconds Tx DefectSeconds	Number of defect seconds detected on the ODUk client CTP (via section monitoring overhead). A second is declared a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable	Yes	Yes	120	1200
Rx BEICount Tx BEICount	The number of Backward Error Indications on the ODUk CTP	Yes	Yes	1500	15000
Rx Uncorrected BER	Count of uncorrected BIP errors detected on the OTUk client CTP.	Yes	Yes	0	0
Rx Corrected BER	Count of corrected BIP errors detected on the OTUk client CTP.	Yes	Yes	0	0
Line PRBS Err	Count of the number of bits not matching the expected pattern (whether synch has been achieved or not). Incremented only when PRBS is enabled.	Yes	Yes	0	0
Trib PRBS Err		Yes	Yes	0	0
LinePRBSSyncErr	Count of the number of times re-sync has been attempted after initial sync was achieved. Incremented only when PRBS is enabled.	Yes	Yes	0	0
TribPRBSSyncErr		Yes	Yes	0	0

PM Collected for ODUk on the XTC

Table A-15 describes the PM parameters supported for ODUk client tributary port on the TIMs.

Table A-15 ODUk PMs Supported on the TIMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx CV -P Tx CV-P	Count of BIP errors detected on the ODUk client CTP (via section monitoring overhead).	Yes	Yes	0	0
Rx ErroredBlocks Tx ErroredBlocks	Number of errored blocks detected on the ODUk client CTP (via section monitoring overhead). An ODUk block shall be counted as an errored block, if one or more errors are detected by the ODUk BIP-8 in a given second.	Yes	Yes	1500	15000
Rx BEICount Tx BEICount	The number of Backward Error Indications on the ODUkT CTP (via the TCM overhead).	Yes	Yes	120	1200
Rx DefectSeconds Tx DefectSeconds	Number of defect seconds detected on the OTUk client CTP (via section monitoring overhead). A second is declared a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable.	Yes	Yes	1500	15000

PM Collected for OTUki Section on the XTC

Table A-16 describes the PM parameters supported for OTUki Section for AOLM/AOLX line modules.

Table A-16 OTUki Section Digital PMs Supported on AOLM and AOLX Line Modules

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values 15-min	Default Threshold Values 24-hour
Rx CodeWords	Received Total number of code words	Yes	Yes	NA	NA
Rx UncorrectedWords	Received Uncorrected number of code words	Yes	Yes	NA	NA
Rx CorrectedZeroes	Received Count of corrected Zeroes	Yes	Yes	0	0
Rx CorrectedOnes	Received Count of corrected Ones	Yes	Yes	0	0
Rx Errored Blocks	Number of errored blocks detected on the OTUki client CTP (via section monitoring overhead). An OTUki block shall be counted as an errored block if one or more errors are detected by the OTUki BIP-8 in a given second.	Yes	Yes	1500	15000
Rx BEI Count	The number of Backward Error Indications on the OTUki CTP (via the TCM overhead).	Yes	Yes	1500	15000
Rx Defect Seconds FEND Rx Defect Seconds NEND	Number of defect seconds detected on the OTUk client CTP in Far End and Near End (via section monitoring overhead). A second is declared a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable.	Yes	Yes	120	1200

Table A-17 OTUki Section Analog PMs Supported on AOLM and AOLX Line Modules

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
BER Pre FEC Min Avg Max	FEC UnCorrected BER parameter	Yes	Yes	N/A	N/A
BER Post FEC Min Avg Max	FEC Corrected BER parameter	Yes	Yes	N/A	N/A
Q-Value Min Avg Max	The current Q-factor of the channel. One measurement for each optical channel.	Yes	Yes	N/A	N/A

PM Collected for ODUk CTP on the XTC

Table A-18 describes the PM parameters supported for AOLM and AOLX line modules.

Table A-18 ODUk CTP PMs Supported on AOLM and AOLX Line Modules

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx CV-P	Count of BIP errors detected on the ODUk client CTP (via section monitoring overhead).	Yes	Yes	0	0

Table A-18 ODUk CTP PMs Supported on AOLM and AOLX Line Modules

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx Errored Blocks	Number of errored blocks detected on the ODUk client CTP (via section monitoring overhead). An ODUk block shall be counted as an errored block, if one or more errors are detected by the ODUk BIP-8 in a given second.	Yes	Yes	1500	15000
Rx Defect Seconds NEND	Number of defect seconds detected on the ODUk client CTP (via section monitoring overhead). A second is declared as a defect second if at least *X* number of errored blocks are detected in that second. The value *X* (Defect Second Degraded Threshold) is user-configurable.	Yes	Yes	120	1200
Rx Defect Seconds FEND					
Rx BEI Count	The number of Backward Error Indications on the OTUki CTP (via the TCM overhead).	Yes	Yes	1500	15000

PM Collected for Fibre Channel Interfaces on the XTC

Table A-19 describes the PM parameters supported for Fibre Channel services on TIM-5-10GMs.

Table A-19 Fibre Channels PMs Supported on TIM-5-10GMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx PCS ICG	Physical Coding Sublayer Invalid Code Group	Yes	Yes	1500	15000
Tx PCS ICG					
Rx PCS SESS	Physical Coding Sublayer Severely Errored Sync Seconds	Yes	Yes	3	7
Tx PCS SESS					
Rx PCS SES	Physical Coding Sublayer Severely Errored Seconds	Yes	Yes	3	7
Tx PCS SES					

Table A-19 Fibre Channels PMs Supported on TIM-5-10GMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx PCS ES	Physical Coding Sublayer Errored Seconds	Yes	Yes	120	1200
Tx PCS ES					
Rx FC Frames	Fibre Channel Frames. FC frames of any size shall are counted, including valid and errored frames.	Yes	Yes	120	1200
Tx FC Frames					
Rx FC Errored Frames	Fibre Channel Errored Frames.	Yes	Yes	256	512
Tx FC Errored Frames					
Rx FC Octets	Fibre Channel Octets. Number of octets accumulated, included octets inside errored frames.	Yes	Yes	120	1200
Tx FC Octets					
Rx FC Errored Octets	Fibre Channel Errored Octets. FC octets that are part of an errored frame.	Yes	Yes	256	512
Tx FC Errored Octets					
Rx FC SES	Fibre Channel Severely Errored Seconds	Yes	Yes	3	7
Tx FC SES					

PM Collected for Fibre Channel Interfaces on TAM-2-10GM and TAM-8-2.5GMs

Table A-20 describes the PM parameters supported for Fibre Channel services on TAM-2-10GM and TAM-8-2.5GMs.

Table A-20 Fibre Channels PMs Supported on TAM-2-10GM and TAM-8-2.5GMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx PCS ICG	Physical Coding Sublayer Invalid Code Group	Yes	Yes	1500	15000
Tx PCS ICG					

Table A-20 Fibre Channels PMs Supported on TAM-2-10GM and TAM-8-2.5GMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Rx PCS SESS Tx PCS SESS	Physical Coding Sublayer Severely Errored Sync Seconds	Yes	Yes	3	7
Rx PCS SES Tx PCS SES	Physical Coding Sublayer Severely Errored Seconds	Yes	Yes	3	7
Rx PCS ES Tx PCS ES	Physical Coding Sublayer Errored Seconds	Yes	Yes	120	1200
Rx FC Frames Tx FC Frames	Fibre Channel Frames. FC frames of any size shall are counted, including valid and errored frames.	Yes	Yes	120	1200
Rx FC Errored Frames Tx FC Errored Frames	Fibre Channel Errored Frames.	Yes	Yes	256	512
Rx FC Octets Tx FC Octets	Fibre Channel Octets. Number of octets accumulated, included octets inside errored frames.	Yes	Yes	120	1200
Rx FC Errored Octets Tx FC Errored Octets	Fibre Channel Errored Octets. FC octets that are part of an errored frame.	Yes	Yes	256	512
Rx FC SES Tx FC SES	Fibre Channel Severely Errored Seconds	Yes	Yes	3	7

PM Collected for Virtual Concatenation Groups (VCGs)

Table A-21 describes the skew value PMs for the sub-clients of a VCG on the TAM-1-40G-VSR, TAM-1-100GE, TAM-1-100GR, TAM-1-40GE, and TAM-1-40GR.

Table A-21 Skew Value PMs for the 40G and 100G TAMs

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Differential Delay *N*	Real-time skew value for the sub-client CTPs (*N*=1-4) in micro seconds. When the VCG is in LOA alarmed state, the constant value of 99.9 is assigned for the skew value of the sub-clients to indicate that the real time differential delay value is invalid.	Yes	No	N/A	N/A

PM Collected on the TOMs

Table A-22 describes the PM parameters supported on the TOMs

Table A-22 Client Signal PM Parameters Supported on TOMs

PM Parameter	Description	Unit	Real-time data	15-min and 24-hr data
TOM Transmitted Laser Bias Current TOM Transmitted Laser Bias Current, Min TOM Transmitted Laser Bias Current, Max TOM Transmitted Laser Bias Current, Ave	Minimum, maximum, and average measured laser bias current of the channel optical transmitter.	mA	Yes	Yes

Table A-22 Client Signal PM Parameters Supported on TOMs

PM Parameter	Description	Unit	Real-time data	15-min and 24-hr data
TOM Optical Power Transmitted TOM Optical Power Transmitted, Min TOM Optical Power Transmitted, Max TOM Optical Power Transmitted, Ave	Minimum, maximum, and average total optical power transmitted from the TOM.	dBm	Yes	Yes
TOM Optical Power Received TOM Optical Power Received, Min TOM Optical Power Received, Max TOM Optical Power Received, Ave	Minimum, maximum, and average total optical power received by the TOM.	dBm	Yes	Yes

OSC PM Parameters

Infinera DTNs and Optical Line Amplifiers support OSC, a dedicated 1510nm optical channel, to carry traffic and management traffic between adjacent network elements. The OSC is terminated on the BMM on the DTN and OAM/ORM on Optical Line Amplifier. The PM parameters supported for the OSC are described in Table A-23.

Table A-23 OSC PM Parameters Supported on the BMM/OAM/ORM

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hr) data
OSC Optical PM Parameters				
Laser Bias Current Laser Bias Current Min Laser Bias Current Avg Laser Bias Current Max	Minimum, average, and maximum measured laser bias current of the OSC optical transmitter.	mA	Yes	Yes
Optical Power Transmitted Optical Power Transmitted Min Optical Power Transmitted Avg Optical Power Transmitted Max	Average optical output power (measured as minimum, average, and maximum) transmitted by the OSC optical transmitter.	dBm	Yes	Yes
Optical Power Received Optical Power Received Min Optical Power Received Avg Optical Power Received Max	Average optical power (measured as minimum, average, and maximum) received by the OSC optical receiver from the Line input.	dBm	Yes	Yes
Crossover Receive Power (ORM and OAM only)	Real-time measure of optical power received at OSC crossover fiber port.	dBm	Yes	No
OSC Ethernet Packet PM Data **NOTE:** OSC Packet PMs are not available on the OAM-CXH1-MS configured as a booster amplifier, nor on the OAM-CXH1-MS, ORM-CXH1-MS, or ORM-CXH1 configured as a preamplifier with the OSC loopback fiber.				
Transmitted Bytes	The number of bytes transmitted by this network element on the OSC channel.	Bytes	Yes	No
Transmitted Packets	The number of Ethernet packets transmitted by this network element on the OSC channel.	Packets	Yes	No
Packets Dropped at Transmitter	The number of transmit Ethernet packets dropped by this network element.	Packets	Yes	No

Table A-23 OSC PM Parameters Supported on the BMM/OAM/ORM

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hr) data
Received Bytes	The number of bytes received by this network element on the OSC channel.	Bytes	Yes	No
Received Packets	The number of Ethernet packets received by this network element on the OSC channel.	Packets	Yes	No
Packets Dropped at Receiver	The number of received Ethernet packets dropped by this network element.	Packets	Yes	No

Additional PM Data for Raman

In addition to the optical PM data described in Table A-1 on page A-5, Raman modules on the DTN and Optical Line Amplifier support PMs for the Transparent Optical Supervisory Channel (OSCT), and the pilot laser for Automatic Laser Shutdown (ALS). These parameters are described in Table A-24.

Note: REM-2 has one OSCT object. For RAM-1 and RAM-2-OR, there are two OSCT objects: The OSCT-1 object with an AID ending in “O1” (e.g., 1-A-2-O1) indicates PMs from the line side to the RAM. The OSCT-2 object with an AID ending in “O2” (e.g., 1-A-2-O2) indicates PMs from the BMM/OAM/ORM side to the RAM.

Table A-24 Additional PM Parameters Supported on RAMs

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hr) data
OSCT CTP PM data				
OSCT OPT OPTMIN OPTMAX OPTAVG	For OSCT-1 objects: Optical power transmitted by the RAM to the line side. For OSCT-2 objects: Optical power transmitted by the RAM to the BMM/OAM/ORM.	dBm	Yes	Yes
OSCT OPR OPRMIN OPRMAX OPRAVG	For OSCT-1 objects: Optical power received by the RAM from the line side. For OSCT-2 objects: Optical power received by the RAM from the BMM/OAM/ORM.	dBm	Yes	Yes
ALS Pilot Laser PM data				
OPR-ALSP OPR-ALSPMIN OPR-ALSP-MAX OPR-ALSPAVG	Optical power received by the ALS pilot laser	dBm	Yes	Yes

Table A-24 Additional PM Parameters Supported on RAMs

PM Parameter	Description	Unit	Real-time data	Current & historical (15-min & 24-hr) data
OPT-ALSP OPT-ALSPMIN OPT-ALSPMAX OPT-ALSPAVG	Optical power transmitted by the ALS pilot laser	dBm	Yes	Yes
LBC-ALSP LBC-ALSPMIN LBC-ALSPMAX LBC-ALSPAVG	Laser biased current of the ALS pilot laser	dBm	Yes	Yes

PM Collected for PEM Feed PTP on the XTC

Table A-25 describes the PM parameters supported for Power Entry Module (PEM) feed PTP on the XTC.

Table A-25 PEM Feed PTP PMs Supported on the XTC

PM Parameter	Description	Real-time Data	15-min and 24-hr Data	Default Threshold Values	
				15-min	24-hour
Input Voltage Min Avg Max	Input voltage per PEM every second based on the min, max and avg value the event is raised.	Yes	Yes	0	0

Appendix B

Acronyms

List of Acronyms

Acronym	Definition
A	
AAM	ATN Amplifier Module
ACLI	application command line interface
ACO	alarm cutoff
ACT	active
AD	add/drop
ADLM	Amplified Digital Line Module
ADM	add/drop multiplexer
ADPCM	adaptive differential pulse code modulation
AGC	Automated Gain Control
AID	access identifier
AINS	automatic in-service
AIS	alarm indication signal
ALS	Automatic Laser Shutdown
AMM	ATN Management Module
AMP	amplifier
ANSI	American National Standards Institute
AOLM	Advanced OTN Line Module

Acronym	Definition
AOLX	Advanced OTN Switching Line Module
APD	avalanche photo diode
API	application programming interface
APS	automatic protection switching
ARC	Alarm Reporting Control
ARP	address resolution protocol
ASAP	Alarm Severity Assignment Profile Settings (for ATN)
ASCII	American Standard Code for Information Interchange
ASE	amplified spontaneous emission
ASIC	application-specific integrated circuit
ASPS	Alarm Severity Profile Settings
ATC-A	ATN Transport Chassis - Active
ATC-P	ATN Transport Chassis - Passive
ATM	asynchronous transfer mode
AU	administrative unit
AUX	auxiliary port
AVC	attribute value change
AWG	array waveguide gating; american wire gauge
AXLM	Amplified Switching Line Module
B	
BDFB	battery distribution fuse bay
BDI	backward defect indication
BEI	backward error indication
BER	bit error rate; bit error ratio
BERT	bit error rate testing
BIP-8	bit interleaved parity
BITS	building-integrated timing supply
BLSR	bi-directional line switched ring
BMM	Band Multiplexing Module
BNC	bayonet Neill-Concelman; British Naval Connector
BOL	beginning of life
BOM	bill of material
BOOTP	bootstrap protocol
BPF	Band Pass Filter
BPOST	Boot Power On Self Test

Acronym	Definition
bps	bits per second
BPV	bipolar violations
C	
C	Celsius
CBN	Common Bonding Network
CBS	committed burst size
CCITT	Consultative Committee on International Telegraph and Telephone (now known as the ITU-T)
CCLI	commissioning command line interface
CDE	chromatic dispersion equalizer
CDR	clock and data recovery
CDRH	Center for Devices and Radiological Health
cDTF	Clear Channel Digital Transport Frame
CET	Channel Engineering Tool
CFP	100G* form factor pluggable *(C = 100 in Roman numerals; Centum)
CFR	code for federal regulations
CH/Ch/ch	channel
CID	circuit identifier
CIR	committed information rate
CIT	craft interface terminal
CLEI	common language equipment identifier
CLI	command line interface
CLM	C-band and L-band Coupler
CMM	Channel Multiplexing Module
CO	central office
CODEC	coder and decoder
COM	communication
CORBA	Common Object Request Broker Architecture
CoS	class of service
CPC	common processor complex
CPE	customer premises equipment
CPLD	complex programmable logic device
CPU	central processing unit
CRC	cyclic redundancy check
CRM	customer relationship management

Acronym	Definition
CSM	Customer Service Module
CSPF	constraint-based shortest path first algorithm
CSV	comma separated value
CTAG	correlation tag
CTP	connection termination point, channel trail termination point, client termination point
CTS	clear to send
CV	coding violation
CV-L	coding violation-line
CV-P	coding violation-path
CV-S	coding violation-section
CWDM	coarse wavelength division multiplexing
D	
DA	digital amplifier
DB	database
dB	decibel
DCC	data communications channel
DCE	data communications equipment
DCF	dispersion compensation fiber
DCM	Dispersion Compensation Module
DCN	data communication network
DDR	double data rate
DEMUX	de-multiplexing
DFB	distributed feedback
DFE	decision feedback equalizer
DGE	dynamic gain equalization; dynamic gain equalizer
DHCP	dynamic host configuration protocol
DLM	Digital Line Module
DLV	Digital Link View
DMC	Dispersion Management Chassis
DNA	Digital Network Administrator
DPSK	differential phase shift keying
DQPSK	differential quadrature phase shift keying
DR	digital repeater
DSE	Dynamic Spectrum Equalizer
DSF	dispersion shifted fiber

Acronym	Definition
DSNCP	Digital Subnetwork Connection Protection
DSP	digital signal processor
DT	digital terminal
DTC	Digital Transport Chassis
DTC-B	Digital Transport Chassis-B
DTE	data terminal equipment
DTF	Digital Transport Frame
DTL	digital transport line; designated transit list
DTP	digital transport path
DTS	digital transport section
DV	digital video
DVB	digital video broadcasting
DWDM	dense wavelength division multiplexing
E	
EBS	excess burst size
ECC	error-correcting code; error correction code
EDFA	erbium doped fiber amplifier
EEPROM	electrically-erasable programmable read-only memory
EFEC	enhanced forward error correction
EIR	excess information rate
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EML	element management layer
EMS	element management system
EOL	end of life
EOS	end of shipping
EPL	ethernet private line
ES-L	line-errored seconds
ES-P	path-errored seconds
ES-S	section-errored seconds
ESCON	Enterprise Systems Connection
ESCON	Enterprise Systems Connection
ESD	electrostatic discharge; electrostatic-sensitive device
ETS	IEEE European Test Symposium
ETSI	European Telecommunications Standards Institute

Acronym	Definition
EVC	ethernet virtual connection
F	
F	Fahrenheit
FA	frame alignment
FAS	frame alignment signal
FBG	fiber Bragg grating
FC	Fibre Channel; fiber channel; failure count
FCAPS	fault management, configuration management, accounting, performance monitoring, and security administration
FCC	Federal Communications Commission (USA)
FDA	Food and Drug Administration
FDI	forward defect indication
FDR	flight data recorder
FEC	forward error correction
FICON	Fibre Connectivity
FIFO	first-in-first-out
FIS	Fault Integration Server
FIT	failure in time
FLT	fault
FPGA	field programmable gate array
FRU	field replaceable unit
FTP	file transfer protocol; floating termination point
G	
GAM	Gain Adapter Module
GbE	gigabit Ethernet
Gbps	gigabits per second
GCC	general communication channel
GFEC	general forward error correction
GFP	generic framing protocol
GHz	gigahertz
GMPLS	generalized multi protocol label switching
GNE	gateway network element
GNM	Graphical Node Manager
GRE	generic routing encapsulation

Acronym	Definition
GTP	group termination point
GUI	graphical user interface
H/I	
HD	high definition
HDLC	high-level data link control
HTML	hypertext markup language
HTTP	hypertext transfer protocol
I/O	input/output
I2C	inter-integrated circuit
IAP	input, output, and alarm panel
ICG	invalid code group
ID	identification
IDF	invalid data flag
IEC	International Electrical Commission
IFF	Intermittent Fault Flag
IMS	Infinera Management Suite
IOP	input/output panel
IP	Internet protocol
IQ	see IQ NOS
IQ NOS	Infinera IQ Network Operating System
IQA NOS ATN	Infinera IQA Network Operating System ATN
IR	intermediate reach
IS	in-service
ITU-T	International Telecommunications Union - Telecommunications
J/K/L	
JDK	Java Development Kit
JRE	Java Runtime Environment
JS	jabber seconds
LAN	local area network
LBC	laser bias current
LC	fiber optic cable connector type
LCK	locked
LED	light-emitting diode
LOC	loss of communication

Acronym	Definition
LOF	loss of frame
LOL	loss of light
LOP	loss of pointer
LOS	loss of signal; loss of synch
LP	launch power
LR	long reach
LSB	least significant bit
LTE	line-terminating equipment
M	
MA	monitoring access
MAC	media access control
MAP	management application proxy
MB	megabyte
Mbps	megabits per second
MCM	Management Control Module
MEMS	micro electro mechanical systems
µEDFA	micro-erbium doped fiber amplifier
MFAS	multi frame alignment signal
MIB	management information base
MMF	multimode fiber
MPO	multiple-fibre push-on/pull-off
MS	multiplex section
MSA	multi source agreement
MSB	most significant bit
MSO	multi-service operator
MSOH	multiplex section overhead
MTBF	mean time between failure
MTU	maximum transmission unit
MUX	multiplex; multiplexer; multiplexing
N	
NA	network administrator
NAND	flash type
NC	normally closed; node controller; nodal control
NCT	nodal control and timing

Acronym	Definition
NDSF	non zero dispersion shifted fiber
NE	network engineer
NEBS	network equipment building standards
NEC	National Electrical Code
NECG	net electrical coding gain
NEL	network element layer
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
nm	nanometer
NML	network management layer
NMS	network management system
NNI	network-to-network interface
NO	normally open
NOC	network operations center
NPS	Network Planning System
NRZ	non-return to zero
NSA	non-service affecting
NTP	network time protocol
NVRAM	nonvolatile random access memory
O	
OA	Optical Amplifier
OAM	Optical Amplification Module
OAM&P	operation, administration, maintenance and provisioning
OC-12	optical carrier signal at 622.08Mbps
OC-192	optical carrier signal at 9.95328Gbps
OC-3	optical carrier signal at 155.52Mbps
OC-48	optical carrier signal at 2.48832Gbps
OC-768	optical carrier signal at 39.81312Gbps
OCG	optical carrier group
Och	optical channel
OCI	open connection indication
ODF	optical distribution frame
ODU	optical data unit
OE	Optical Engine
OEO	optical-electrical-optical

Acronym	Definition
OER	optical engineering route
OFC	open fiber control
OFM	Optical Filter Module
OH	overhead
OIF	Optical Internetworking Forum
OLOS	optical loss of signal
OMA	optical modulation amplitude
OMM	Optical Management Module
OMS	optical multiplex section
OOK	on-off keying
OOS	out-of-service
OOS-MT	out-of-service maintenance
OPM	optical power monitor
OPN	Optical Private Network
OPR	optical power received
OPSW	Optical Power Switch
OPT	optical power transmitted
OPU	optical payload unit
ORL	optical return loss
ORM	Optical Raman Module
OS	operating system
OSA	optical spectrum analyzer
OSC	Optical Supervisory Channel
OSNR	optical signal-to-noise ratio
OSPF	open shortest path first
OSS	operations support system
OTC	Optical Transport Chassis
OTDR	optical time domain reflectometer
OTM	OTN Tributary Module
OTN	Optical Transport Network
OTS	optical transport section
OTU	optical transport unit
OW	orderwire
OWM	Orderwire Module
OXM	OTN Switch Module

Acronym	Definition
P/Q	
PC	personal computer
PCM	Power Conversion Module
PCPM	per channel power monitoring
PCS	physical coding sublayer
PD	photo diode
PDU	protocol data unit; power distribution unit
PEM	Power Entry Module
PG	protection group
PHY	physical
PIC	Photonic Integrated Circuit
PID	protocol identifier
PIN	positive-intrinsic negative
PJO	positive justification opportunity
PL	point loss
PLC	Planar Lightwave Circuit
PLD	programmable logic device
PLL	phase locked loop
PLO	point loss offset
PM	performance monitoring; phase modulation; polarization multiplexed
PM-BPSK	polarization multiplexed-bi phase shift keying
PM-DQPSK	polarization multiplexed-differential quadrature phase shift keying
PM-QPSK	polarization multiplexed-quadrature phase shift keying
PMD	polarization mode dispersion
POH	path overhead
PON	product ordering name
POP	point-of-presence
POST	Power On Self Test
PPM	part per million
PPP	point-to-point protocol
PR	provisioning
PRBS	pseudo random binary sequence
PROV	provisioning
ps	pico second (unit of measure for dispersion)
PSBT	phase shaped binary transmission

Acronym	Definition
PSC	protection switch completion; protection switch count
PSD	protection switch duration
PSE	Passive Spectrum Equalizer
PSTN	public switched telephone network
PTP	physical termination point; point-to-point
PU	protection unit
PWR	power
QOS	quality of service
R	
RADIUS	Remote Authentication Dial-In User Service
RAM	Raman Amplifier Module; random access memory
RBM	Red/Blue Band Mux/Demux
RDI	remote defect indication
REI-L	remote error indication-line
REI-P	remote error indication-path
REM	Raman Extender Module
RFI	remote failure indication
RLL	Receive Light Level
RMA	return material authorization
ROADM	reconfigurable optical add/drop multiplexer
ROM	read-only memory
RS	regenerator section; Reed-Solomon
RSOH	regenerator section overhead
RSTP	rapid spanning tree protocol
RTC	real time clock
RTN	return lead
RTS	ready to send
RU	rack unit
Rx	receiver; receive
Rx Q	receiver quality
RZ	return to zero
RZ-DQPSK	return to zero-differential quadrature phase shift keying
S	
SA	service affecting; security administrator

Acronym	Definition
SAPI	source access point identifier
SC	square shaped fiber optic cable connector
SCM	Submarine Control Module
SD	signal degrade; standard definition
SDH	synchronous digital hierarchy
SDI	serial digital interface
SDRAM	synchronized dynamic random access memory
SEF	severely errored frame
SEFS	severely errored frame second
SELV	safety extra low voltage
SERDES	serializer and deserializer
SES	severely errored seconds
SF	signal fail
SFP	small form factor pluggable
SFTP	secure file transfer protocol
SID	source identifier; system identifier
SIM	Service Interface Module
SLL	Send Light Level
SLM	Submarine Line Module
SLTE	submarine line terminal equipment
SMF	single-mode fiber
SML	service management layer
SMPTE	Society of Motion Picture and Television Engineers
SNC	subnetwork connection
SNCP	subnetwork connection protection
SNE	subtending network element
SNMP	simple network management protocol
SNR	signal-to-noise ratio
SOH	section overhead
SOL	start of life
SOLM	Submarine OTN Line Module
SOLX	Submarine OTN Switching Line Module
SONET	synchronous optical network
SPE	synchronous payload envelope
SQ	signal quality
SR	short reach

Acronym	Definition
SSHv2	Secure Shell version 2
SSL	secure sockets layer
STE	section terminating equipment
STM	synchronous transfer mode
STM-1	SDH signal at 155.52Mbps
STM-16	SDH signal at 2.48832Gbps
STM-256	SDH signal at 39.81312Gbps
STM-4	SDH signal at 622.08Mbps
STM-64	SDH signal at 9.95328Gbps
STM-n	synchronous transfer module of level n (for example, STM-64, STM-16)
STP	spanning tree protocol
STS	synchronous transport signal
STS-n	synchronous transport signal of level n (for example, STS-12, STS-48)
SW	software
T/U/V	
TAC	technical assistance center
TAM	Tributary Adapter Module
TAP	Timing and Alarm Panel
TCA	threshold crossing alert
TCC	threshold crossing condition
TCM	tandem connection monitoring
TCP	transmission control protocol
TE	traffic engineering
TEC	thermo-electric cooler
TEM	TAM Extender Module
TERM	terminal
TFTP	trivial file transfer protocol
TID	target identifier
TIM	Tributary Interface Module; trace identifier mismatch
TL1	Transaction Language 1
TLA	terminal line amplifier
TLS	tunable laser source
TMF	TeleManagement Forum
TMN	telecommunications management network
TOM	Tributary Optical Module

Acronym	Definition
TP	termination point
TR	transceiver
TSM	Timing Synchronization Module
TT	test and turn-up
TTI	trail trace identifier
TWC	true-wave-classic
Tx	transmitter; transmit
UA	unavailable seconds
UART	universal asynchronous receiver transmitter
UAS	unavailable seconds
UAS-L	unavailable seconds, near-end line
UAS-P	unavailable seconds, near-end STS path
UDP	user datagram protocol
ULH	ultra long haul
UNI	user-network interface
UPC	ultra physical contact
UPSR	unidirectional path switched ring
URL	universal resource locator
USB	Universal Serial Bus
UTC	Coordinated Universal Time
V	volt
VCG	virtual concatenation group
VGA	variable gain amplifier
VLAN	virtual local area network
VOA	variable optical attenuator
VPN	virtual private network
VSR	very short reach
W/X/Y/Z	
WAN	wide area network
WDM	wavelength division multiplexing
WPCS	Wet Plant Control and Surveillance System
WPLM	Wet Plant Link Manager
WTR	wait to restore, wait to revert
WTR	wait to restore
XC	cross-connect

Acronym	Definition
XCM	DTN-X Control Module
XFP	10Gbps small form factor pluggable
XLM	Switching Line Module
XML	extensible markup language
XTC	Switching Transport Chassis
XTF	DTN-X Transport Frame
XTL	XTF Transport Line
XTP	XTF Transport Path
XTS	XTF Transport Section
MISC	
1R	re-amplification
2R	re-amplification, re-shape
3R	re-amplification, re-shape, re-time
4R	re-amplification, re-shape, re-time, re-code