OptiX OSN 1800 Compact Multi-Service Edge Optical Transport Platform

V100R003

Hardware Description

Issue 05

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HUAWEI TECHNOLOGIES CO., LTD.

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About This Document

Related Versions

The following table lists the product versions related to this document.

Product Name	Version
OptiX OSN 1800	V100R003C01 and later
iManager U2000	V100R006C00 and later

Intended Audience

The document is intended for:

- Network planning engineer
- Hardware installation engineer
- Installation and commissioning engineer
- Field maintenance engineer
- Data configuration engineer
- Network monitoring engineer
- System maintenance engineer

Symbol Conventions

The following symbols may be found in this document. They are defined as follows:

Symbol	Description
DANGER	**DANGER** indicates a hazard with a high level or medium level of risk which, if not avoided, could result in death or serious injury.
WARNING	**WARNING** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Symbol	Description
CAUTION	**CAUTION** indicates a potentially hazardous situation that, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.
TIP	Provides a tip that may help you solve a problem or save time.
NOTE	Provides additional information to emphasize or supplement important points in the main text.

GUI Conventions

Convention	Description
Boldface	Buttons, menus, parameters, tabs, window, and dialog titles are in **boldface**. For example, click **OK**.
>	Multi-level menus are in **boldface** and separated by the ">" signs. For example, choose **File** > **Create** > **Folder**.

Change History

Updates between document versions are cumulative. Therefore, the latest document version contains all updates made to previous versions.

Updates in Issue 05 (2013-03-30) Based on Product Version V100R003

This issue is the fifth official release. Compared with the 04 issue, updating of V100R003C03SPC100 is added.

Update	Description
AC Power Requirement	Modified a note to explain the limitations on reporting the power-off event for the APIU board.
Optical Transponder Unit	Added a note in the ELOM **10.1.2 Application Overview** and **10.1.10.1 Application** topic to explain the limitations on configuring the ELOM board.

Updates in Issue 04 (2013-01-10) Based on Product Version V100R003

This issue is the fourth official release. Compared with the 03 issue, updating of SPC300 is added.

Update	Description
DC Power Distribution Box (PDU)	Changed the working voltage ranges. -48 V power source: -40 V to -57.6 V; -60 V power source: -48 V to 72.0 V
AC Power Requirement	Added a note to explain the limitations on reporting the power-off event for the APIU board.
Optical Transponder Unit	● Revised the substitution relationship descriptions for the LQM, LQM2, and LDGF2 boards. ● Added the multirate-40km-SFP+ optical module to the TNF2LSX, TNF1LDX, and TNF2ELOM specifications topics. ● Added a note in the ELOM **10.1.15 Valid Slots** topic to explain the limitations on configuring the ELOM board. ● Added a note in the LQM2 **10.11.6 Valid Slots** topic to explain the limitations on configuring the LQM2 board.
System Control and Communication Board	● Added the 155M-1600ps/nm-fixed-APD-eSFP and 155M-3000ps/nm-fixed-APD-eSFP optical modules for the SCC board. ● Deleted the information claiming that the SCC board supports CF cards.

Updates in Issue 03 (2012-05-20) Based on Product Version V100R003

This issue is the third official release. Compared with the 02 issue, updating of SPC200 is added.

Update	Description
The whole manual	● Deleted "Power Supply Access Unit", and moved the contents to **Chassis**. ● Deleted "Heat Dissipation Board", and moved the contents to **Chassis**. ● Added the chapters **N63E Cabinet**, **N63B Cabinet** and **19-Inch Open Rack**. ● Added the chapter **Pluggable Optical Modules**. ● Added the chapter **Indicators**. ● Added the chapter **Loopbacks for OTUs**.

Update	Description
Optical Transponder Board	- Adjusted the content structure of **ELOM** according to board working modes. - Added "Protocol or standard compliance" to "Functions and Features" for each board. - Replaced "Parameters" with "Parameters on the NMS". Deleted "Prerequisite", "Tools, Equipment, and Materials", "Precautions", and "Navigation Path". Moved "Background Information" to "Application". - Added a table listing the supported modules to "Specifications" for each board, and moved "Laser Level" to "Front Panel". - Deleted "Precautions" and "Board Maintenance", and moved the contents in "Precautions" to other sections.
Optical Multiplexer and Demultiplexer	Deleted "Precautions" and "Board Maintenance".
Optical Add and Drop Multiplexing	Deleted "Precautions" and "Board Maintenance".
Optical Amplifying Board	Deleted the "Precautions" and "Board Maintenance".
Optical Protection Board	Deleted "Precautions" and "Board Maintenance".

Updates in Issue 02 (2011-12-30) Based on Product Version V100R003

This issue is the second official release. Compared with the issue 01 of OptiX OSN 1800 V100R003C01, the manual of this issue provides the following updates.

Update	Description
Optical Transponder Board	- Added the **ELQM** board. - In the **ELOM(STND)**, added the section **ODUk ADM**. - In the **ELOM(STND)**, deleted the Infiniband 2.5G service. - In the **ELOM(STND)**, changed "1*AP2 ODUflex mode" into "1*AP1 ODUflex mode". - Added the "Module Description" section to each board specification page, and updated some module names. - Added the following modules to support GE services: 1000BASE-BX-40km (SM1310) and 1000BASE-BX-40km (SM1490).
The whole manual	Changed "GE(TTT-AGMP)" into "GE(TTT-GMP)".

Updates in Issue 01 (2011-10-20) Based on Product Version V100R003

This issue is the first official release. Compared with the issue 03 of OptiX OSN 1800 V100R003C00, the manual of this issue provides the following updates.

Update	Description
Optical Transponder Board	• Added the **ELOM(STND)** logical board. • Added the **TNF2LDGF2**, **TNF2LQM**, **TNF2LQM2** and **TNF2LSX**. • Added the **LDX** board.
Optical Amplifying Board	Added the **OBU** board.

Contents

1 N63E Cabinet

About This Chapter

The product provides the structure, configuration, and specifications of the N63E cabinet.

1.1 Cabinet Structure
The OptiX OSN 1800 series can be installed in an N63E cabinet, which meets the requirements of ETSI300-119.

1.2 Cabinet Arrangement
Cabinets are usually installed in a row inside a room. They are arranged in a face-to-face or a back-to-back mode.

1.3 Configuration of the Integrated N63E Cabinet
This section describes the configuration principle of the cabinet with a fiber management tray (FMT) and the related hardware.

1.4 Specifications
The cabinet specifications of the OptiX OSN 1800 series include dimensions and weight.

1.1 Cabinet Structure

The OptiX OSN 1800 series can be installed in an N63E cabinet, which meets the requirements of ETSI300-119.

Figure 1-1 shows the appearance of the N63E cabinet.

Figure 1-1 Appearance of the N63E cabinet

1.2 Cabinet Arrangement

Cabinets are usually installed in a row inside a room. They are arranged in a face-to-face or a back-to-back mode.

Cabinets are usually installed in a row inside a room, their positions are shown in **Figure 1-2** and **Figure 1-3**.

To meet the requirements of heat dissipation and maintenance, the space around a cabinet should be reserved according to the following principles:

- The space reserved before a cabinet should not be less than 1000 mm (39.4 in.).
- The space reserved beside both sides of a cabinet should not be less than 800 mm (31.5 in.).

- The space reserved behind a cabinet should not be less than 50 mm. (In back-to-back mode, it is not required.)

Figure 1-2 Top view of cabinets in face-to-face mode

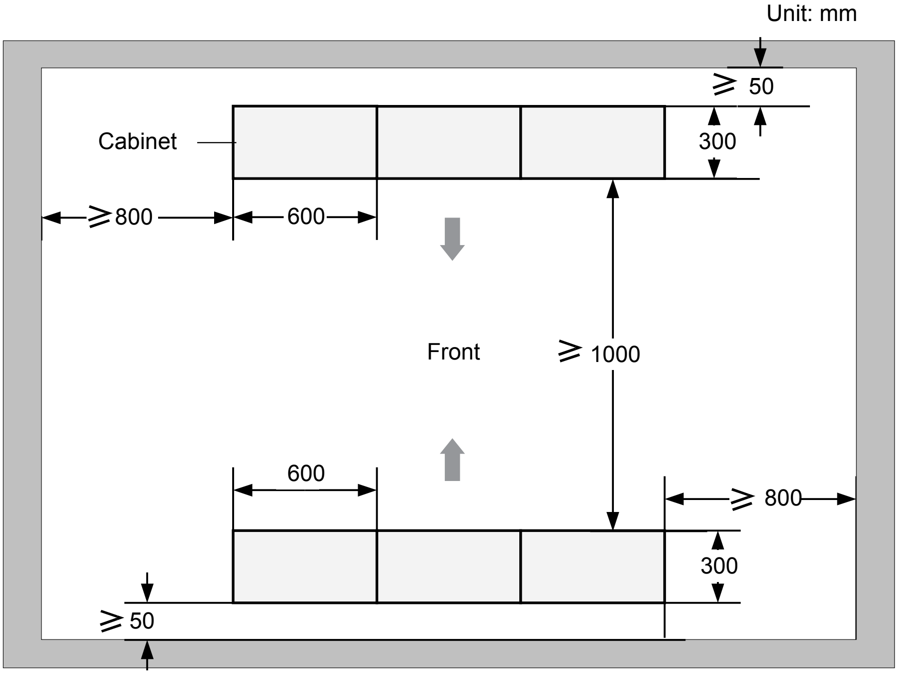
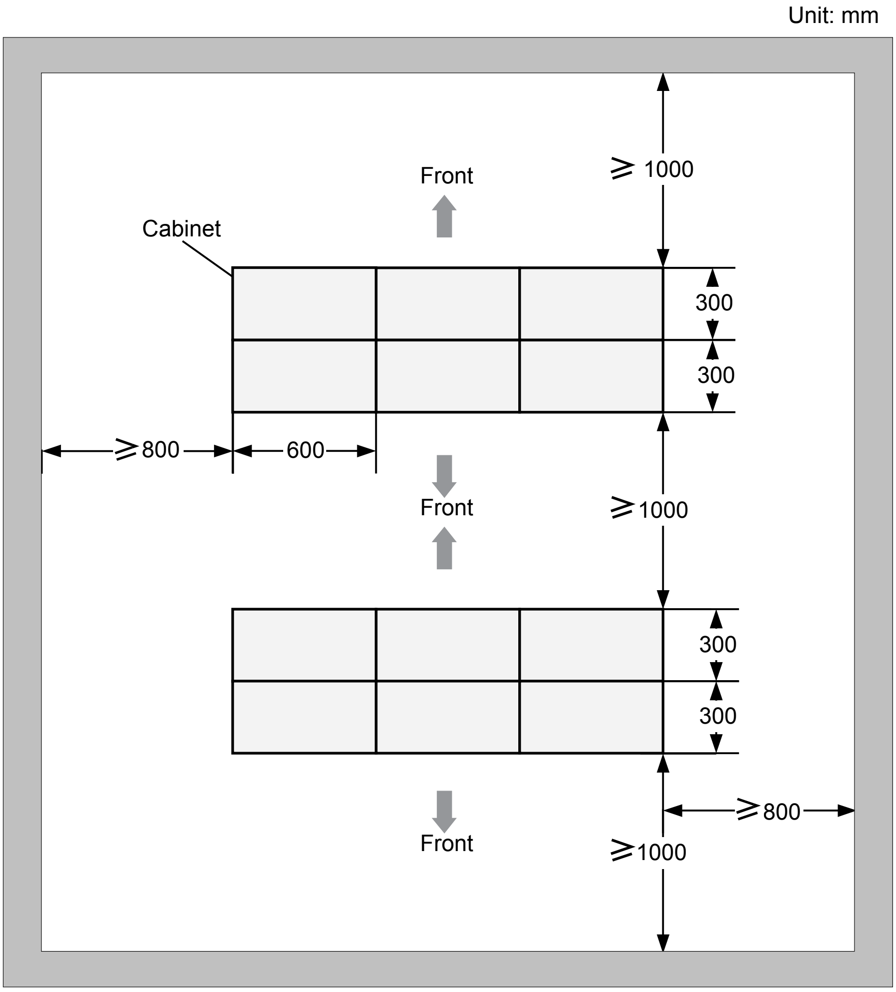


Figure 1-3 Top view of cabinets in back-to-back mode



1.3 Configuration of the Integrated N63E Cabinet

This section describes the configuration principle of the cabinet with a fiber management tray (FMT) and the related hardware.

Available Space in the Cabinet and Space Required by the Hardware

Table 1-1 Available space in various cabinets

Cabinet Type	Cabinet Height	Valid Height
N63E	2200 mm	45U
NOTE 1 U = 44.5 mm		

Space Required by The Hardware

Table 1-2 Space required by the hardware

Hardware	Required Space
Ordinary OptiX OSN 1800 I chassis	1 U
OptiX OSN 1800 I chassis integrated with an FMT	2 U
Ordinary OptiX OSN 1800 II chassis	2 U
OptiX OSN 1800 II chassis integrated with an FMT	3 U
PDU	3 U
FMT	1 U
External power supply unit	1 U
DCM frame	1 U
NOTE 1 U = 44.5 mm	

Configuration Principles (for N63E Cabinets)

- A DC power distribution unit (PDU) can provide power supplies for four chassis.
- One FMT is configured for each OptiX OSN 1800 II chassis and each two OptiX OSN 1800 I chassis.
- A 47 mm space needs to be reserved between two OptiX OSN 1800 II chassis and a 32 mm space needs to be reserved between two OptiX OSN 1800 I chassis for fiber routing.
- No space needs to be reserved between chassis and the FMTs configured for the chassis.
- The number of devices that can be installed in an N63E cabinet is as follows:
  - Four DC PDUs, eight FMTs, and sixteen OptiX OSN 1800 I ordinary chassis
  - Two DC PDUs, eight FMTs, and eight OptiX OSN 1800 II ordinary chassis
  - Three DC PDUs and twelve OptiX OSN 1800 I chassis integrated with FMTs
  - Two PDUs and eight OptiX OSN 1800 II chassis integrated with FMTs

NOTE

In actual conditions, if the DCM frame and external power supply unit are required or if other configuration is adopted, see the previous information for the space required by the hardware and calculate the total required space.

1.4 Specifications

The cabinet specifications of the OptiX OSN 1800 series include dimensions and weight.

The technical specifications of the N63E cabinet is as follows:

- Dimensions (Height x Width x Depth): 2200 mm x 600 mm x 300 mm
- Weight: 45 kg (99.1 lb.)

2 N63B Cabinet

About This Chapter

The product provides the structure, configuration, and specifications of the N63B cabinet.

2.1 N63B Cabinet Structure

The OptiX OSN 1800 series can be installed in an N63B cabinet, which meets the requirements of ETS 300-119.

Figure 2-1 shows the appearance of the N63B cabinet.

Figure 2-1 Appearance of the N63B cabinet

2.2 Cabinet Arrangement

Cabinets are usually installed in a row inside a room. They are arranged in a face-to-face or a back-to-back mode.

Cabinets are usually installed in a row inside a room, their positions are shown in **Figure 2-2** and **Figure 2-3**.

To meet the requirements of heat dissipation and maintenance, the space around a cabinet should be reserved according to the following principles:

- The space reserved before a cabinet should not be less than 1000 mm (39.4 in.).
- The space reserved beside both sides of a cabinet should not be less than 800 mm (31.5 in.).

- The space reserved behind a cabinet should not be less than 50 mm. (In back-to-back mode, it is not required.)

Figure 2-2 Top view of cabinets in face-to-face mode

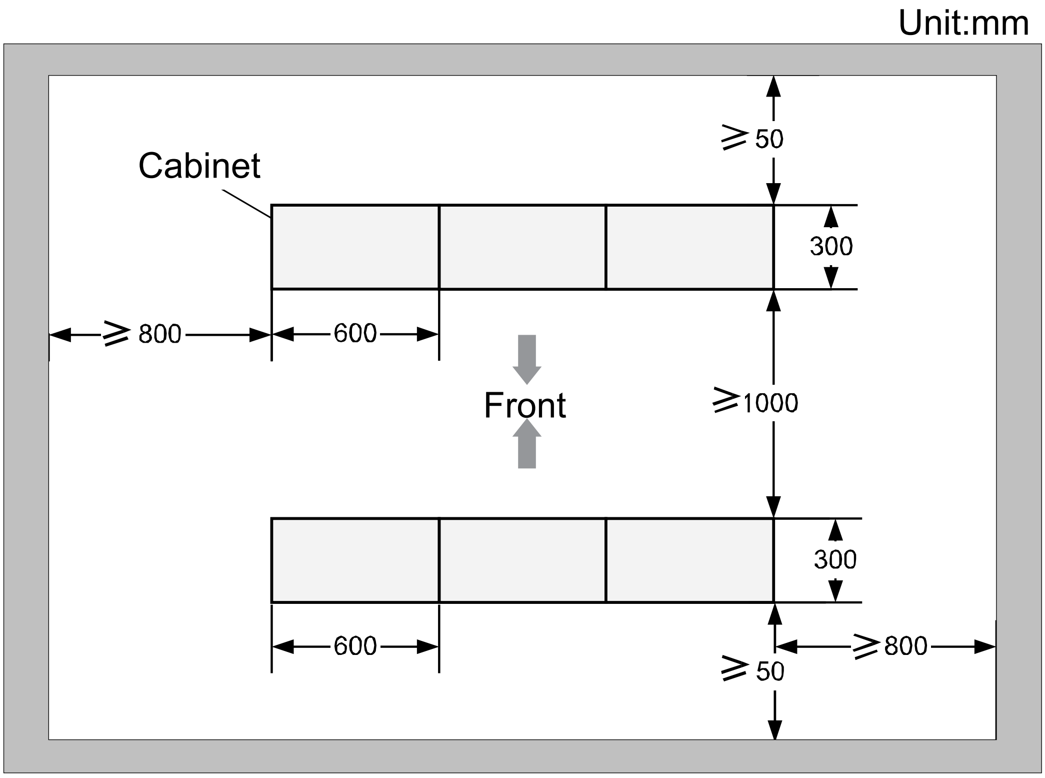
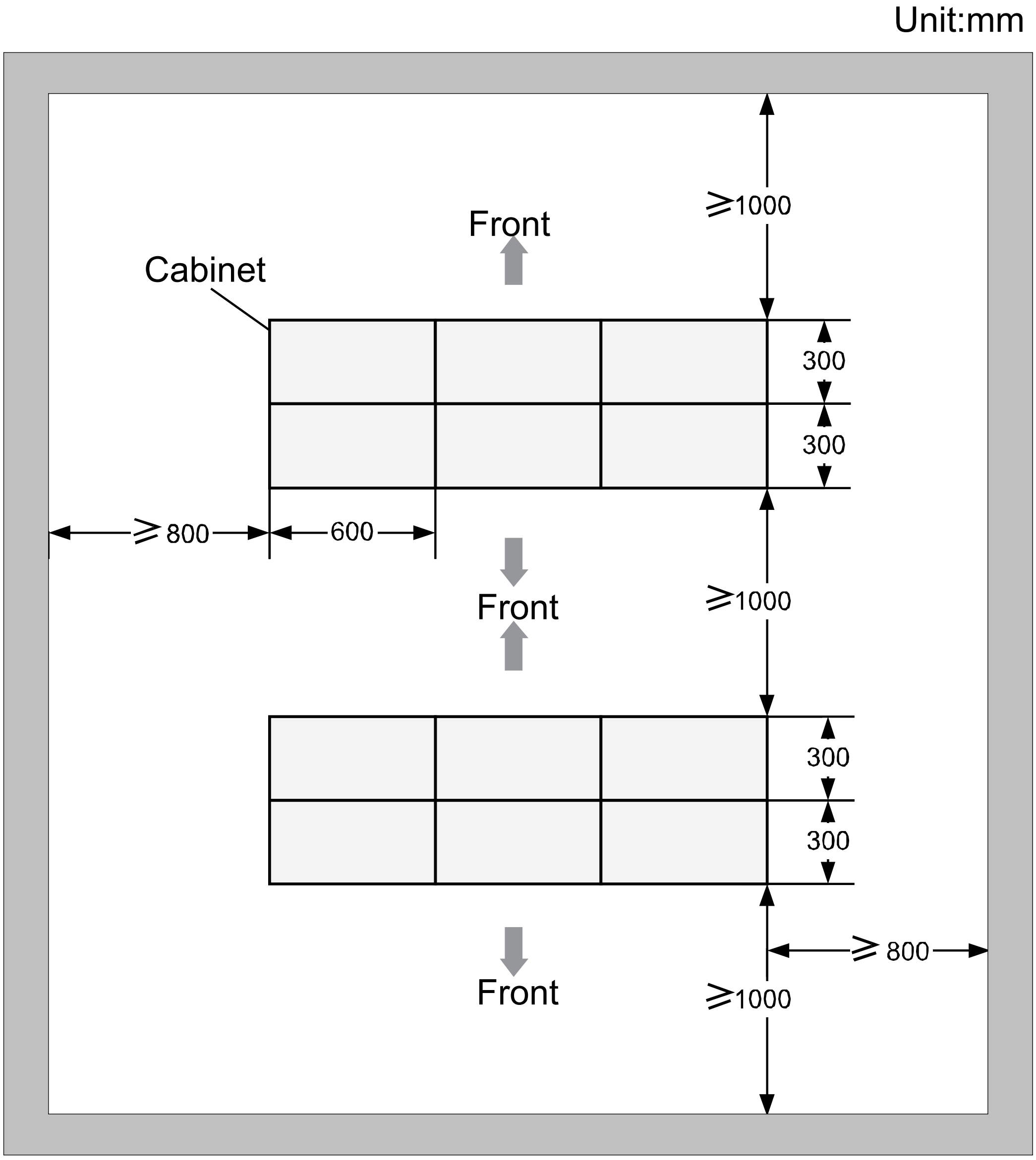


Figure 2-3 Top view of cabinets in back-to-back mode



2.3 Configuration of the Integrated N63B Cabinet

This section describes the configuration principle of the cabinet with a fiber management tray (FMT) and the related hardware.

Available Space in the Cabinet and Space Required by the Hardware

Table 2-1 Available space in various cabinets

Cabinet Type	Cabinet Height	Valid Height
N63B	2200 mm	45U
NOTE 1 U = 44.5 mm		

Space Required by The Hardware

Table 2-2 Space required by the hardware

Hardware	Required Space
Ordinary OptiX OSN 1800 I chassis	1 U
OptiX OSN 1800 I chassis integrated with an FMT	2 U
Ordinary OptiX OSN 1800 II chassis	2 U
OptiX OSN 1800 II chassis integrated with an FMT	3 U
PDU	3 U
FMT	1 U
External power supply unit	1 U
DCM frame	1 U
NOTE 1 U = 44.5 mm	

Configuration Principles (for N63B Cabinets)

- A DC power distribution unit (PDU) can provide power supplies for four chassis.
- One FMT is configured for each OptiX OSN 1800 II chassis and each two OptiX OSN 1800 I chassis.
- No space needs to be reserved between devices in a cabinet because fibers can be routed through the space between the column and side panel of the cabinet.
- The maximum number of devices that can be installed in an N63B cabinet is as follows:
  - Eight DC PDUs, nine FMTs, and eighteen OptiX OSN 1800 I ordinary chassis
  - Three DC PDUs, eleven FMTs, and eleven OptiX OSN 1800 II ordinary chassis
  - Three DC PDUs and twelve OptiX OSN 1800 I chassis integrated with FMTs
  - Two PDUs and eight OptiX OSN 1800 II chassis integrated with FMTs

2.4 Specifications

The cabinet specifications of the OptiX OSN 1800 series include dimensions and weight.

The technical specifications of N63B cabinet is as follows:

- Dimensions (Height x Width x Depth): 2200 mm x 600 mm x 300 mm
- Weight: 60 kg (132.3 lb.)

3 Other Racks

About This Chapter

The charter provides the structures, configurations, and specifications of the 19-inch cabinet (IEC60297 compliance) and 19-inch open rack (IEC60297 compliance).

3.1 Cabinet Structure

The OptiX OSN 1800 series can be installed in the 19-inch cabinet and the 19-inch open rack , which meet the requirements of IEC60297.

Figure 3-1 shows the appearance of the 19-inch open rack.

Figure 3-1 Appearance of the 19-inch open rack

Figure 3-2 shows the appearance of the 19-inch cabinet.

Figure 3-2 Appearance of the 19-inch cabinet

3.2 Configuration of the Integrated Cabinet

This section describes the configuration principle of the cabinet with a fiber management tray (FMT) and the related hardware.

Available Space in the Cabinet and Space Required by the Hardware

Table 3-1 Available space in various cabinets

Cabinet Type	Cabinet Height	Valid Height
19-inch cabinet	2200 mm	45U
19-inch open rack	2200 mm	45U
	2000 mm	40U

Cabinet Type	Cabinet Height	Valid Height
NOTE 1 U = 44.5 mm		

Space Required by The Hardware

Table 3-2 Space required by the hardware

Hardware	Required Space
Ordinary OptiX OSN 1800 I chassis	1 U
OptiX OSN 1800 I chassis integrated with an FMT	2 U
Ordinary OptiX OSN 1800 II chassis	2 U
OptiX OSN 1800 II chassis integrated with an FMT	3 U
PDU	3 U
FMT	1 U
External power supply unit	1 U
DCM frame	1 U
NOTE 1 U = 44.5 mm	

Configuration Principles (for 19-inch Cabinet and 19-Inch Open Racks)

- A DC power distribution unit (PDU) can provide power supplies for four chassis.
- One FMT is configured for each OptiX OSN 1800 II chassis and each two OptiX OSN 1800 I chassis.
- No space needs to be reserved between devices in a cabinet because fibers can be routed through the space between the column and side panel of the cabinet.
- The maximum number of devices that can be installed in a 2200 mm 19-inch rack is as follows:
  - Eight DC PDUs, nine FMTs, and eighteen OptiX OSN 1800 I ordinary chassis
  - Three DC PDUs, eleven FMTs, and eleven OptiX OSN 1800 II ordinary chassis
  - Three DC PDUs and twelve OptiX OSN 1800 I chassis integrated with FMTs
  - Two PDUs and eight OptiX OSN 1800 II chassis integrated with FMTs

3.3 Specifications

The cabinet specifications of the OptiX OSN 1800 series include dimensions and weight.

Table 3-3 lists the technical specifications of the different types of cabinets.

Table 3-3 Technical specifications of the cabinets

Type	Dimensions (Height x Width x Depth)	Weight
19-inch cabinet	2200 mm x 600 mm x 600 mm	76 kg (167.4 lb.)
19-inch open rack	2200 mm x 600 mm x 600 mm	25 kg (55.1 lb.)
	2000 mm x 600 mm x 600 mm	22 kg (48.5 lb.)

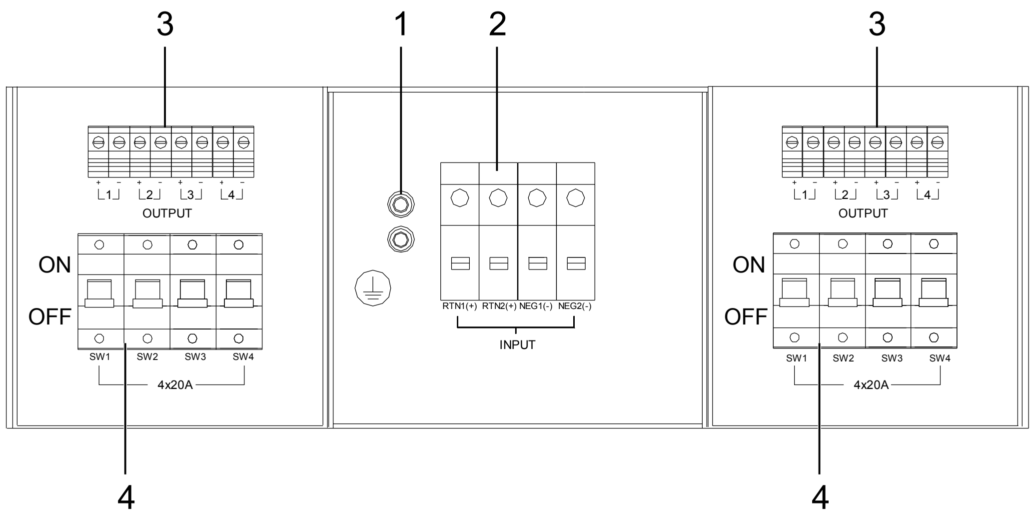
4 DC Power Distribution Box (PDU)

The DC PDU is installed in the upper part of the cabinet and provides power for the four OptiX OSN 1800 subracks in the cabinet. The DC PDU provides two channels of -48V DC power for each subrack to implement the power 1+1 protection.

Overview

Figure 4-1 shows the front panel of a DC power distribution box.

Figure 4-1 Front panel of DC power distribution box



1. Protection grounding screws
2. Input cable terminals
3. Output cable terminals
4. Power switches

For the function of each unit in a DC power distribution box, see Table 4-1.

Table 4-1 Functions of the units in a DC power distribution box

Marking	Function Unit	Function
1	Protection grounding screws	To access the protection ground cables.
2	Input cable terminals	To access two -48V DC or -60V DC power cables and two power ground cables.
3	Output cable terminals	There are four output cable terminals at both the left side and the right side, to access power cables of subracks.
4	Power switches	There are four power switches at both the left side and the right side, corresponding to the output cable terminals above them to control the power supply for each subrack.

Table 4-2 shows the specification of the DC power distribution box.

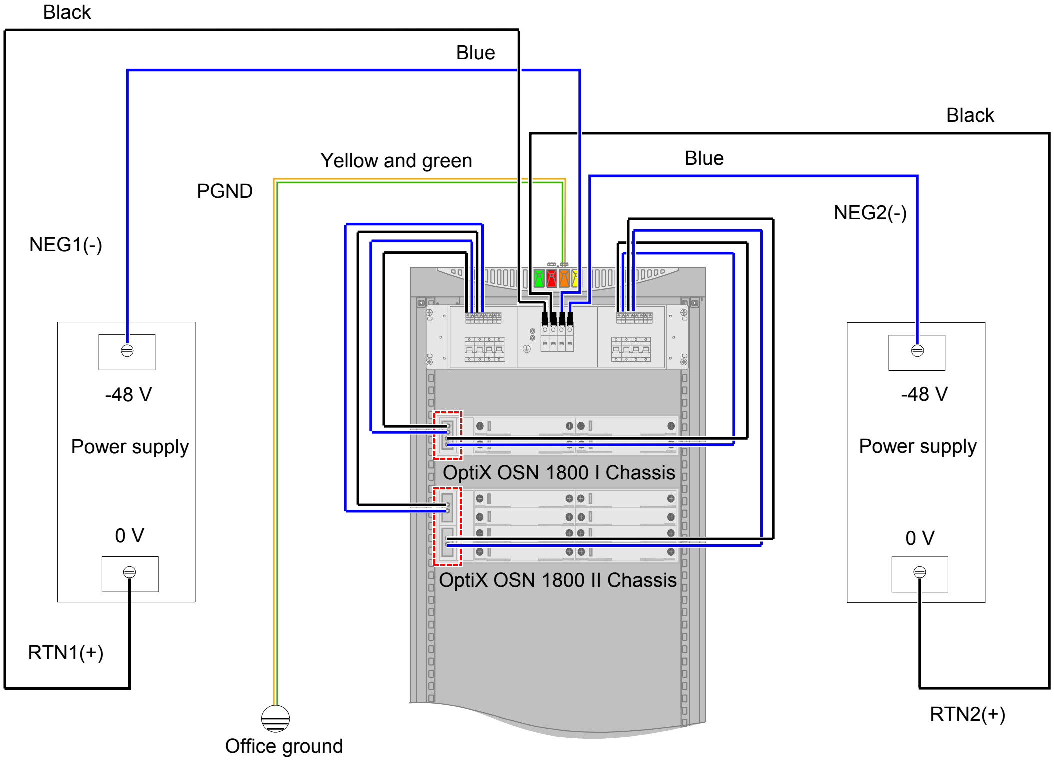
Table 4-2 Technical Specifications of the DC Power Distribution Box

Item	Specifications
Size	132 mm (H) x 400 mm (W) x 80 mm (D)
Maximum capability of power supply	4 x 20 A + 4 x 20 A
Weight	4.4 kg (9.7 lb.)
Maximum power consumption (full configuration)	2000 W
Normal working voltage	-48V DC/-60V DC
Working voltage range	-40 V to -57.6 V (-48 V power supply), -48.0 V to -72.0 V (-60 V power supply)

Connection of Power Cables

The connection of power cables between chassis and DC power distribution box is given in **Figure 4-2**.

Figure 4-2 Connection of Power Cables Between Chassis and DC Power Distribution Box



5 Chassis

About This Chapter

The OptiX OSN 1800 works on a chassis basis, and is available in three types: OptiX OSN 1800 I, OptiX OSN 1800 II, and OptiX OSN 1800 OADM frame. The OptiX OSN 1800 converts wavelengths, multiplexes/demultiplexes wavelengths, adds/drops wavelengths, and amplifies optical power by using different functional boards. In addition, the OptiX OSN 1800 can be housed in different cabinets as required and can be configured with different DC power distribution boxes, fiber management trays, external AC power systems, DCM modules, and DCM frames.

The OptiX OSN 1800 is designed according to IEC60297 and ETS 300 119. The system architecture complies with GR3028 and GR63. It uses the hot standby mode for power supplies, which meets the requirements of DC (-48 V/-60 V) and AC (100 V to 240 V) power supplies and can be installed in the ETSI cabinet (300 mm/600 mm), 19-inch cabinet, open rack, outdoor cabinet. In addition, the OptiX OSN 1800 can be installed on a desk or against a wall.

The OptiX OSN 1800 uses the non-air filter design. In this way, the on-site equipment maintenance is avoided.

As network telecommunication facilities, the OptiX OSN 1800 does not require external lightning arresters when external AC power supplies are applied.

5.1 OptiX OSN 1800 I Chassis
The OptiX OSN 1800 I chassis provides four slots for boards.

5.2 OptiX OSN 1800 II Chassis
The OptiX OSN 1800 II chassis provides eight slots for boards.

5.3 OptiX OSN 1800 OADM Frame
The OptiX OSN 1800 OADM frame, whose height is 1 U, provides four slots for boards.

5.1 OptiX OSN 1800 I Chassis

The OptiX OSN 1800 I chassis provides four slots for boards.

5.1.1 Structure

The OptiX OSN 1800 I chassis provides four slots for boards.

An OptiX OSN 1800 I chassis can be an ordinary chassis or a chassis integrated with a fiber management tray (FMT). An ordinary chassis can be a DC or AC power-supply chassis, but a chassis integrated with an FMT can be an DC power-supply chassis only. A DC power-supply chassis uses the PIU board and an AC power-supply chassis uses the APIU board. On the AC power-supply chassis, the APIU board occupies two service slots and the slot for housing the PIU board is installed with a filler panel.

NOTE

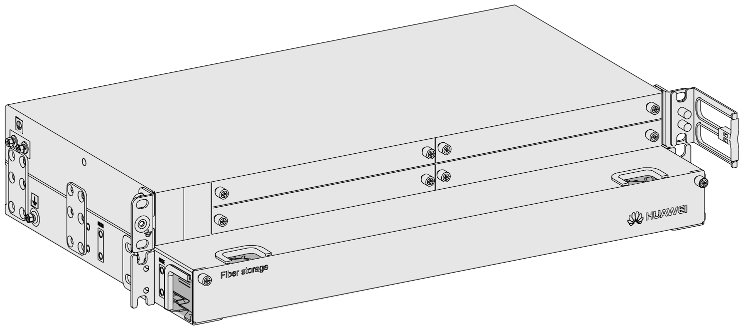
The PIU and APIU boards cannot be installed on the same chassis. Install the PIU board only on a DC power-supply chassis and install the APIU board only on an AC power-supply chassis.

Figure 5-1, **Figure 5-2** and **Figure 5-3** show the appearance of the OptiX OSN 1800 I chassis.

Figure 5-1 Ordinary OptiX OSN 1800 I chassis (DC power-supply chassis)

Figure 5-2 Ordinary OptiX OSN 1800 I chassis (AC power-supply chassis)

Figure 5-3 OptiX OSN 1800 I chassis integrated with an FMT (DC power-supply chassis)



NOTE

An AC power-supply chassis is connected to external AC power supplies and a DC power-supply chassis is connected to external DC power supplies. When no DC power supply is available in a telecommunications room, a DC power-supply chassis can be connected to external AC power supplies through the uninterruptible power module (UPM). For details, see **7.1 UPM of OptiX OSN 1800 I Chassis**.

Table 5-1, **Table 5-2**, **Table 5-3** list the mechanical specifications of the OptiX OSN 1800 I chassis.

Table 5-1 Mechanical specifications of ordinary OptiX OSN 1800 I chassis (DC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	44 mm x 442 mm x 220 mm (1.7 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	2.6 kg (5.7 lb.)

Table 5-2 Mechanical specifications of ordinary OptiX OSN 1800 I chassis (AC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	44 mm x 442 mm x 220 mm (1.7 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	2.6 kg (5.7 lb.)

Table 5-3 Mechanical specifications of OptiX OSN 1800 I chassis integrated with an FMT (DC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	88 mm x 442 mm x 283 mm (3.5 in. x 17.4 in. x 11.1 in.)

Item	Specification
Weight (empty chassis)	5.8 kg (12.8 lb.)

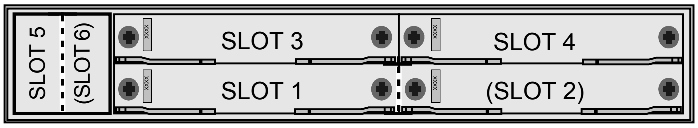
5.1.2 Slot Distribution

All boards in the chassis are installed horizontally in the front of the chassis.

The OptiX OSN 1800 I chassis provides six slots for boards.

- Slots 1, 3 and 4 can be configured with optical transponder (OTU) boards, optical add/drop multiplexer (OADM) boards, optical multiplexer and demultiplexer boards, optical amplifier boards, and protection boards.
- Slot 2 is fixed to house the SCC board.
- Slot 5 is fixed to house the PIU board.
- Slot 6 is fixed to house the FAN board.

Figure 5-4 Slot layout of the OptiX OSN 1800 I chassis



NOTE

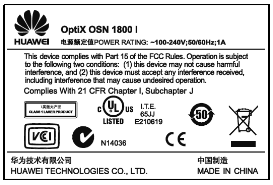
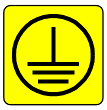
The APIU board occupies two slots. The valid slots of the boards are slots 1 and 3.

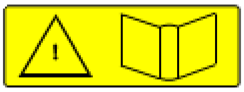
5.1.3 Label

During equipment installation and maintenance, you should notice the warning and take the precautions specified by safety symbols to avoid injury to the human body and damage to the equipment.

Table 5-4 lists the warning and safety symbols on the OptiX OSN 1800 I chassis, and specifies the meaning of them.

Table 5-4 Description of labels on the OptiX OSN 1800 I chassis

Symbol	Meaning
	Product nameplate label Indicates product name and certification of OptiX OSN 1800 I chassis with DC power supply. Specifies the power supply and rated current of the OptiX OSN 1800 I chassis with DC power supply.
	Product nameplate label Indicates product name and certification of OptiX OSN 1800 I chassis with AC power supply. Specifies the power supply and rated current of the OptiX OSN 1800 I chassis with AC power supply.
	Laser class symbol Indicates the class of the laser. Avoid direct exposure to the laser beams launched from the optical port. Otherwise, damage might be caused to your skin or eyes.
	Grounding symbol Indicates where the equipment is grounded.
	Anti-static protection symbol Indicates that you should wear an anti-static wrist strip or gloves when you touch a board. Otherwise, damage might be caused to the board.
	Fan safety warning symbol Indicates that you should not touch the fan leaves when the fan is rotating.

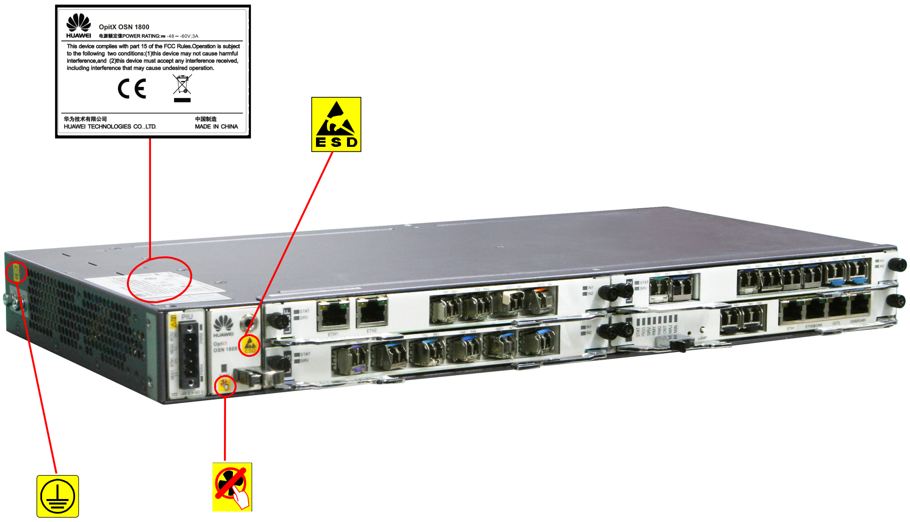
Symbol	Meaning
	Multichannel power supply label Indicates that multiple channels of power supply are input.

Label Position

The anti-static protection symbol and subrack grounding symbol are affixed to the equipment chassis.

Figure 5-5 show the position of labels on the chassis.

Figure 5-5 Position of labels on the OptiX OSN 1800 I chassis



5.1.4 FAN

The FAN board used in the OptiX OSN 1800 I chassis is FAN02, which is equipped with three fans.

Version Description

Table 5-5 describes the version mapping of the FAN board.

Table 5-5 Version description of the FAN

Item	Description
Board hardware version	TNF1

Functions and Features

For detailed functions and features, see **Table 5-6**.

Table 5-6 Functions and features of the FAN

Functions and Features	Description
Basic function	The board enables heat dissipation in the chassis to ensure that the equipment works normally and effectively under the designed temperature.
Speed adjustment	The fan speed can be classified into five levels: low speed, mid-low speed, medium speed, mid-high speed, and high speed. The default level is "low speed". The fan speed can be adjusted manually or automatically. It is adjusted automatically by default.
Rule of speed adjustment	In manual adjustment mode, you can adjust the fan speed in the NMS manually. In automatic adjustment mode, the system adjusts the fan speed according to the highest temperature of the board in the chassis. The rules are as follows: ● If the highest temperature of the board in the chassis is higher than 65ºC, the fan speed is adjusted to a higher level automatically. If the current fan speed level is "high speed", no adjustment is performed. ● If the highest temperature of the board in the chassis is in the range of 60ºC to 65ºC, the fan speed remains the same. ● If the highest temperature of the board in the chassis is in the range of 10ºC to 65ºC, the fan speed is adjusted to a lower level automatically. If the current fan speed level is "low speed", no adjustment is performed. ● If the highest temperature of the board in the chassis is lower than 10ºC, the fan speed is adjusted to "stop" automatically.

CAUTION

The SCC board provides a power supply for the FAN board. If the SCC board is removed, the FAN board will stop working.

CAUTION

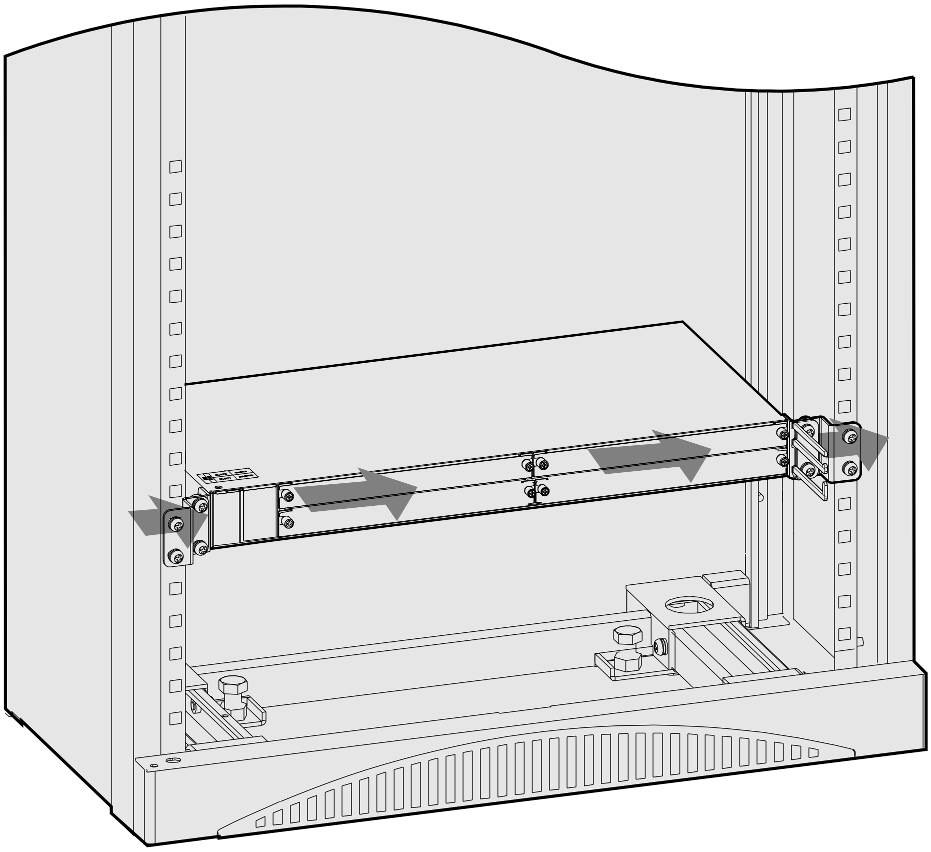
If any one of the three or six fans in the FAN board fails, the OptiX OSN 1800 system can keep on operating for 96 consecutive hours in an environment with temperatures between -5°C to 40°C (23°F to 104°F).

Replace the FAN board immediately if two or more fans fail in the board.

Application

Figure 5-6 shows the schematic diagram of the air intake and air exhaust of OptiX OSN 1800 I chassis. The air intake vent is on the left of the chassis and the air exhaust vent is on the right of the chassis. In this case, a good heat dissipation and ventilation system is formed to facilitate the normal operation of the equipment.

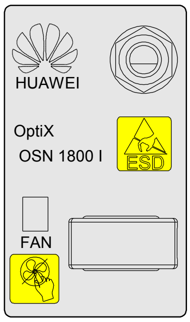
Figure 5-6 Schematic diagram of the air intake and air exhaust in the OptiX OSN 1800 I chassis



Front Panel

Figure 5-7 shows the front panel of the FAN02.

Figure 5-7 Front panel of the FAN



There is one indicator on the front panel of the FAN board, the descriptions of the indicator are shown in **Table 5-7**.

Table 5-7 Descriptions of the indicator on the FAN board

Indicator Status	Description
On (green)	The board works normally.
On (red)	The FAN_FAIL alarm occurs to the board.
Off	The board is not powered on.

There is an port for ESD wrist strap on the front panel of the FAN board.

Valid Slots

The FAN02 board occupies the SLOT 6 in the OptiX OSN 1800 I chassis.

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

FAN Specifications

The mechanical specifications of the FAN02 board are as follows:

- Dimensions (Height x Width x Depth): 41.0 mm x 27.5 mm x 214.3 mm (1.6 in. x 1.1 in. x 8.4 in.)
- Weight: 0.36 kg (0.79 lb.)

The power consumption of the FAN02 board is as follows:

- Maximum power consumption at 25°C (77°F): 3.6 W
- Maximum power consumption at 55°C (131°F): 18.0 W

5.1.5 Power Consumption

The power consumption of OptiX OSN 1800 I Chassis.

Table 5-8, **Table 5-9**, **Table 5-10** list the power consumption of OptiX OSN 1800 I chassis.

Table 5-8 Power consumption of ordinary OptiX OSN 1800 I chassis (DC power-supply chassis)

Item	Specification
Maximum power consumption	150 W

Table 5-9 Power consumption of ordinary OptiX OSN 1800 I chassis (AC power-supply chassis)

Item	Specification
Typical power consumption	100 W

Table 5-10 Power consumption of OptiX OSN 1800 I chassis integrated with an FMT (DC power-supply chassis)

Item	Specification
Typical power consumption	150 W

5.1.6 DC Power Requirement

This section describes the requirements on power supply when the equipment runs on DC power.

Requirements on Voltage

Table 5-11 provides the requirements on voltage of OptiX OSN 1800 I chassis.

Table 5-11 Requirements on Voltage of ordinary OptiX OSN 1800 I chassis (DC power-supply chassis)

Item	Specification
Power supply	-40 to -57.6 (-48 V power supply) -48.0 to -72.0 (-60 V power supply)

TNC1PIU

The PIU board used in OptiX OSN 1800 I chassis is TNC1PIU, which provides two channels of power supply.

Table 5-12 describes the version mapping of the PIU board.

Table 5-12 Version description of the PIU

Item	Description
PIU board hardware version	TNC1

- Functions and Features

  Table 5-13 describes the functions and features of PIU.

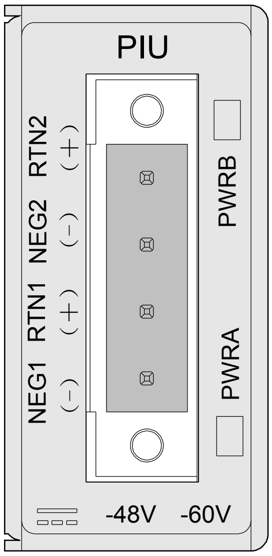
Table 5-13 Functions and features of the PIU

Functions and Features	Description
Lighting protection circuit status monitoring	Receives status signals of the lightning protection circuit and reports alarms of lightning protection failure when the lightning protection circuit is faulty.

- Front Panel

  Figure 5-8 shows the front panel of the TNC1PIU.

Figure 5-8 Front panel of the PIU



There are two indicators on the TNC1PIU front panel, the descriptions of the indicator are shown in **Table 5-14**.

Table 5-14 Descriptions of the indicator on the TNC1PIU board

Indicator	Indicator Status	Description
● The first power supply status indicator (PWRA) ● The second power	On (green)	Indicates that the power is accessed normally.

Indicator	Indicator Status	Description
supply status indicator (PWRB)	Off	Indicates that the power is not accessed.

There are four power supply ports on the front panel of the TNC1PIU, **Table 5-15** lists the function of each port.

Table 5-15 Descriptions of the TNC1PIU ports

Port	Description
NEG1	Access the negative pole of the first channel of power.
RTN1	Access the positive pole of the first channel of power.
NEG2	Access the negative pole of the second channel of power.
RTN2	Access the positive pole of the second channel of power.

- Valid Slots

  The PIU board occupies the SLOT 5 in the OptiX OSN 1800 I chassis.

  The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.
- Specifications

  Mechanical Specifications of TNC1PIU:
  - Dimensions (Height x Width x Depth): 41.4 mm x 20.0 mm x 217.1 mm (1.6 in. x 0.8 in. x 8.5 in.)
  - Weight: 0.18 kg (0.40 lb.)

  Power Consumption of TNC1PIU:
  - Maximum Power Consumption at 25°C (77°F) (W): 2 W

5.1.7 AC Power Requirement

This section describes the requirements on power supply when the equipment runs on AC power.

Requirements on Voltage

Table 5-16 provides the requirements on AC voltage of OptiX OSN 1800 I chassis.

Table 5-16 Requirements on Voltage of ordinary OptiX OSN 1800 I chassis (AC power-supply chassis)

Item	Specification
Power supply	100 V to 240 V AC

APIU

APIU is AC Power Port Unit, provides power for OptiX OSN 1800 I AC power-supply chassis and OptiX OSN 1800 II AC power-supply chassis.

Table 5-17 describes the version mapping of the APIU board.

Table 5-17 Version description of the APIU

Item	Description
Board hardware version	TNF1

- Functions and Features

  The main function of the APIU board is to access the 100 V to 240 V AC power, and convert the AC power into the -53.5 V DC power.

  For detailed functions and features, see Table 5-18.

Table 5-18 Functions and features of the APIU

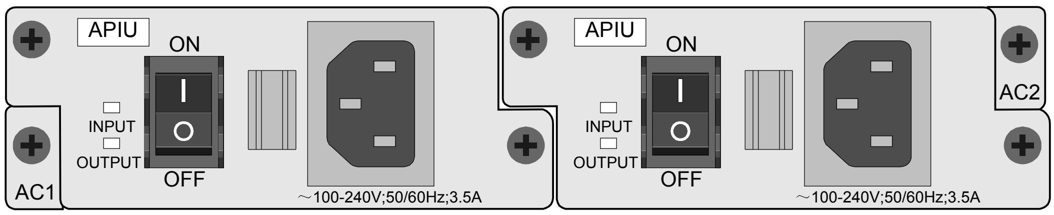
Functions and Features	Description
Basic function	The board accesses the 100 V to 240 V AC power, and converts the AC power into the -53.5 V DC power.
Power supply module	The board supports two power supply modules AC1 and AC2, which are inserted in two separate frames. Both the power supply modules and frames can be removed and installed independently.
Protection	The two power supply modules support hitless switching, thus providing 1+1 power protection. A single module provides protection against input undervoltage, input overvoltage, output overvoltage, output overcurrent, output short-circuit, and over temperature.

Functions and Features	Description
Reports an event in case of a power failure	Non-GNEs that are powered by the TNF1APIU boards will be unreachable by the NMS once the boards undergo a power failure. This new feature enables the non-GNEs to report an NE-DYING-EVENT in this situation so that users can know why these non-GNEs are unreachable by the NMS. **NOTE** This feature applies only to non-GNEs that work in ESC communication mode and are equipped with the VER.B TNF1APIU board and VER.B AC power supply module.

- Front Panel

  Figure 5-9 shows the front panel of the APIU.

Figure 5-9 Front panel of the APIU



There are two indicators on the front panel. For details on the indicators, refer to **Table 5-19**.

Table 5-19 Descriptions of the indicator on the APIU board

Indicator	Meaning	Indicator Status	Description
INPUT	Indicator of the input power status	On (green)	The input power voltage is normal.
		On (red)	The input power voltage is abnormal, under-voltage or over-voltage occurs.
OUTPUT	Indicator of the output power status	On (green)	The output power voltage is normal.
		On (red)	The output power voltage is abnormal, under-voltage or over-voltage occurs.

The two AC power ports on the front panel of the APIU board access the 100 V to 240 V AC power to the system. Otherwise, there are two switches on the front panel, which are used to control the on and off of the two AC power ports respectively.

- Valid Slots

  In the OptiX OSN 1800 I chassis, the valid slots of the board is SLOT3.

  In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT4 and SLOT6.

  NOTE

  The APIU board occupies two slots. The pins on the board are located on the upper part of the board; therefore, the board is inserted into the upper slot between the two slots. Table 5-20 describes the mapping between the slot where the APIU board is inserted and the slots that the APIU board occupies.

Table 5-20 Mapping between the slot where the APIU board is inserted and the slots between the APIU board occupies

Chassis	Valid Slot	Occupied Slots
OptiX OSN 1800 I	SLOT3	SLOT1 and SLOT3
OptiX OSN 1800 II	SLOT4	SLOT2 and SLOT4
	SLOT6	SLOT4 and SLOT6

The board occupies two slots on the U2000.

The slot ID of the board displayed on the NMS is the slot of upper-position between the two slots that the board occupies. For example, if the board is inserted in SLOT4, it occupies SLOT2 and SLOT4, and the slot displayed on the NMS is SLOT4.

- Specifications

  Table 5-21 lists the specifications of the APIU.

Table 5-21 Specifications of the APIU

Item	Description
Dimensions (Height x width x Depth)	40.1 mm x 193.8 mm x 208.7 mm (1.6 in. x 7.6 in. x 8.2 in.)
Weight (with two power supply modules)	1.93 kg (4.25 lb.)
Power Consumption	• Maximum power consumption at 25°C (77°F): 20.0 W • Maximum power consumption at 55°C (131°F): 30.0 W
Input voltage	AC power supply of 100 V to 240 V
Output voltage	DC power supply of -53.5 V
Power	When the ambient temperature is in the range of -25°C to 65°C, the board can provide stable 200 W power.
Power supply efficiency	88%

Item	Description
Operating temperature	The long-term operating temperature of the board is -25°C to 65°C, and the short-term operating temperature of the board is 65°C to 75°C. The board can start when the ambient temperature is above -40°C. **NOTE** Short-term means operating for continuous cannot exceed 72 hours and the total time of short-term operating in a year cannot exceed 15 days.

5.2 OptiX OSN 1800 II Chassis

The OptiX OSN 1800 II chassis provides eight slots for boards.

Compared with the OptiX OSN 1800 I chassis, the OptiX OSN 1800 II chassis can access twice of the service volume accessed by the OptiX OSN 1800 chassis.

5.2.1 Structure

The OptiX OSN 1800 II chassis provides eight slots for boards. Compared with the OptiX OSN 1800 I chassis, the OptiX OSN 1800 II chassis can access twice of the service volume accessed by the OptiX OSN 1800 II chassis.

An OptiX OSN 1800 II chassis can be an ordinary chassis or a chassis integrated with a fiber management tray (FMT). Both an ordinary chassis and a chassis integrated with an FMT can be a DC or AC power-supply chassis. A DC power-supply chassis uses the PIU board and an AC power-supply chassis uses the APIU board. On the AC power-supply chassis, the APIU board occupies two service slots and the slots for housing the PIU boards are installed with two filler panels.

NOTE

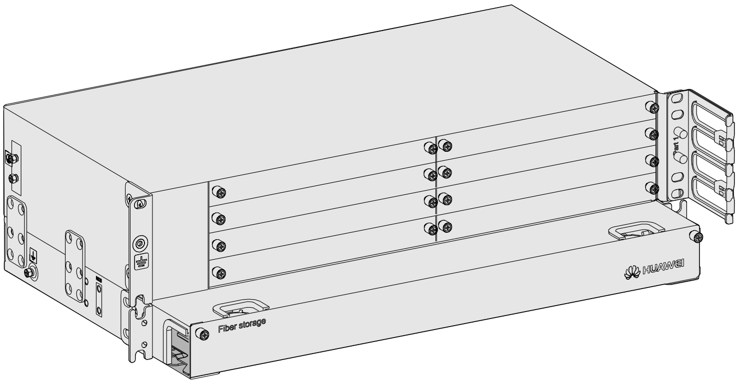
The PIU and APIU boards cannot be installed on the same chassis. Install the PIU board only on a DC power-supply chassis and install the APIU board only on an AC power-supply chassis.

Figure 5-10, **Figure 5-11** and **Figure 5-12** show the appearance of the OptiX OSN 1800 II chassis.

Figure 5-10 Ordinary OptiX OSN 1800 II chassis (DC power-supply chassis)

Figure 5-11 Ordinary OptiX OSN 1800 II chassis (AC power-supply chassis)

Figure 5-12 OptiX OSN 1800 II chassis integrated with an FMT (AC and DC power-supply chassis)



NOTE

An AC power-supply chassis is connected to external AC power supplies and a DC power-supply chassis is connected to external DC power supplies. When no DC power supply is available in a telecommunications room, a DC power-supply chassis can be connected to external AC power supplies through the uninterruptible power module (UPM). For details, see **7.2 UPM of OptiX OSN 1800 II Chassis**.

Table 5-22, **Table 5-23**, **Table 5-24** list the mechanical specifications of the OptiX OSN 1800 II chassis.

Table 5-22 Mechanical specifications of ordinary OptiX OSN 1800 II chassis (DC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	88 mm x 442 mm x 220 mm (3.5 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	3.6 kg (7.9 lb.)

Table 5-23 Mechanical specifications of ordinary OptiX OSN 1800 II chassis (AC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	88 mm x 442 mm x 220 mm (3.5 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	3.6 kg (7.9 lb.)

Table 5-24 Mechanical specifications of OptiX OSN 1800 II chassis integrated with an FMT (AC and DC power-supply chassis)

Item	Specification
Dimensions (Height x Width x Depth)	131.7 mm x 442 mm x 283 mm (5.2 in. x 17.4 in. x 11.1 in.)
Weight (empty chassis)	7.7 kg (17.0 lb.)

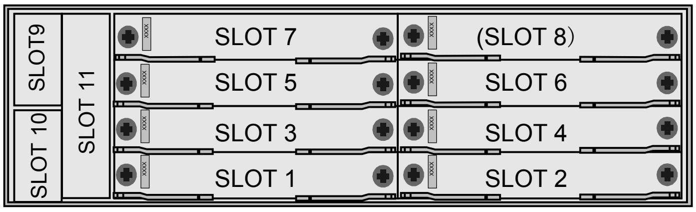
5.2.2 Slot Distribution

All boards in the chassis are installed horizontally in the front of the chassis.

The OptiX OSN 1800 II chassis provides eight slots for boards.

- Slots 1 through 6 can be used to house the optical transponder (OTU) boards, optical add/drop multiplexer (OADM) boards, optical multiplexer/demultiplexer boards, optical amplifier boards, and protection boards.
- Slot 7 is used to house the optical add/drop multiplexer (OADM) boards, optical multiplexer/demultiplexer boards, or SCS board.
- Slot 8 is fixed to house the SCC board.
- Slots 9 and 10 are fixed to house the PIU board.
- Slot 11 is fixed to house the FAN board.

Figure 5-13 Slot layout of the OptiX OSN 1800 II chassis



NOTE

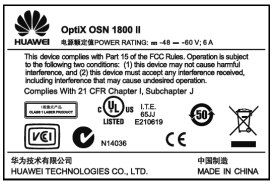
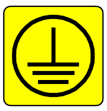
The APIU board occupies two slots. The valid slots of the APIU board are slots 2 and 4, or slots 4 and 6.

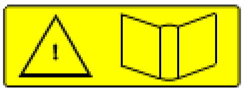
5.2.3 Label

During equipment installation and maintenance, you should notice the warning and take the precautions specified by safety symbols to avoid injury to the human body and damage to the equipment.

Table 5-25 lists the warning and safety symbols on the OptiX OSN 1800 II chassis, and specifies the meaning of them.

Table 5-25 Description of labels on the OptiX OSN 1800 II chassis

Symbol	Meaning
	Product nameplate label Indicates name and certification of OptiX OSN 1800 II chassis with DC power supply. Specifies the power supply and rated current of the OptiX OSN 1800 II chassis with DC power supply.
	Product nameplate label Indicates name and certification of OptiX OSN 1800 II chassis with AC power supply. Specifies the power supply and rated current of the OptiX OSN 1800 II chassis with AC power supply.
	Laser class symbol Indicates the class of the laser. Avoid direct exposure to the laser beams launched from the optical port. Otherwise, damage might be caused to your skin or eyes.
	Grounding symbol Indicates where the equipment is grounded.

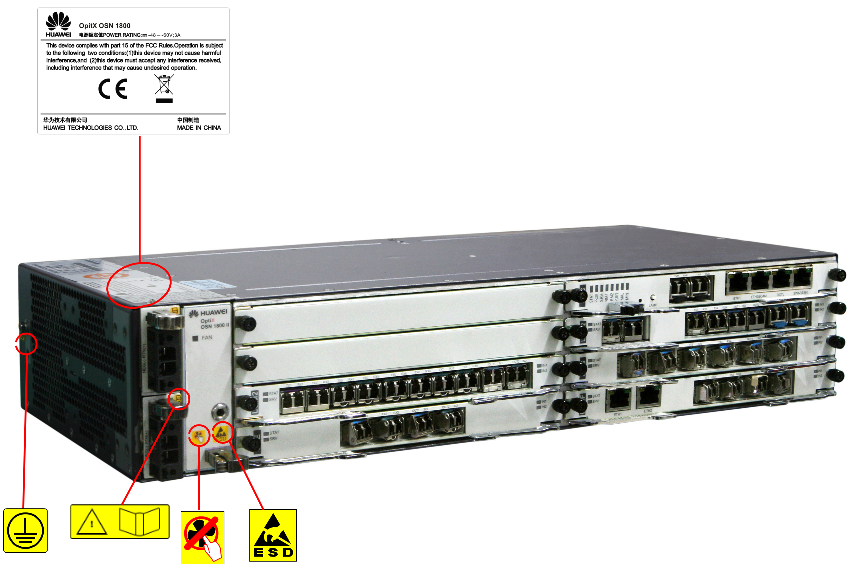
Symbol	Meaning
	Anti-static protection symbol Indicates that you should wear an anti-static wrist strip or gloves when you touch a board. Otherwise, damage might be caused to the board.
	Fan safety warning symbol Indicates that you should not touch the fan leaves when the fan is rotating.
	Multichannel power supply label Indicates that multiple channels of power supply are input.

Label Position

The anti-static protection symbol and subrack grounding symbol are affixed to the equipment chassis.

Figure 5-14 show the position of labels on the chassis.

Figure 5-14 Position of labels on the OptiX OSN 1800 II chassis



5.2.4 FAN

The FAN board used in the OptiX OSN 1800 II chassis is FAN01, which is equipped with six fans.

Version Description

Table 5-26 describes the version mapping of the FAN board.

Table 5-26 Version description of the FAN

Item	Description
Board hardware version	TNF1

Functions and Features

For detailed functions and features, see **Table 5-27**.

Table 5-27 Functions and features of the FAN

Functions and Features	Description
Basic function	The board enables heat dissipation in the chassis to ensure that the equipment works normally and effectively under the designed temperature.
Speed adjustment	The fan speed can be classified into six levels: stop, low speed, mid-low speed, medium speed, mid-high speed, and high speed. The default level is "low speed". The fan speed can be adjusted manually or automatically. It is adjusted automatically by default.

Functions and Features	Description
Rule of speed adjustment	In manual adjustment mode, you can adjust the fan speed in the NMS manually. In automatic adjustment mode, the system adjusts the fan speed according to the highest temperature of the board in the chassis. The rules are as follows: ● If the highest temperature of the board in the chassis is higher than 65ºC, the fan speed is adjusted to a higher level automatically. If the current fan speed level is "high speed", no adjustment is performed. ● If the highest temperature of the board in the chassis is in the range of 60ºC to 65ºC, the fan speed remains the same. ● If the highest temperature of the board in the chassis is in the range of 10ºC to 65ºC, the fan speed is adjusted to a lower level automatically. If the current fan speed level is "low speed", no adjustment is performed. ● If the highest temperature of the board in the chassis is lower than 10ºC, the fan speed is adjusted to "stop" automatically.

CAUTION

The SCC board provides a power supply for the FAN board. If the SCC board is removed, the FAN board will stop working.

CAUTION

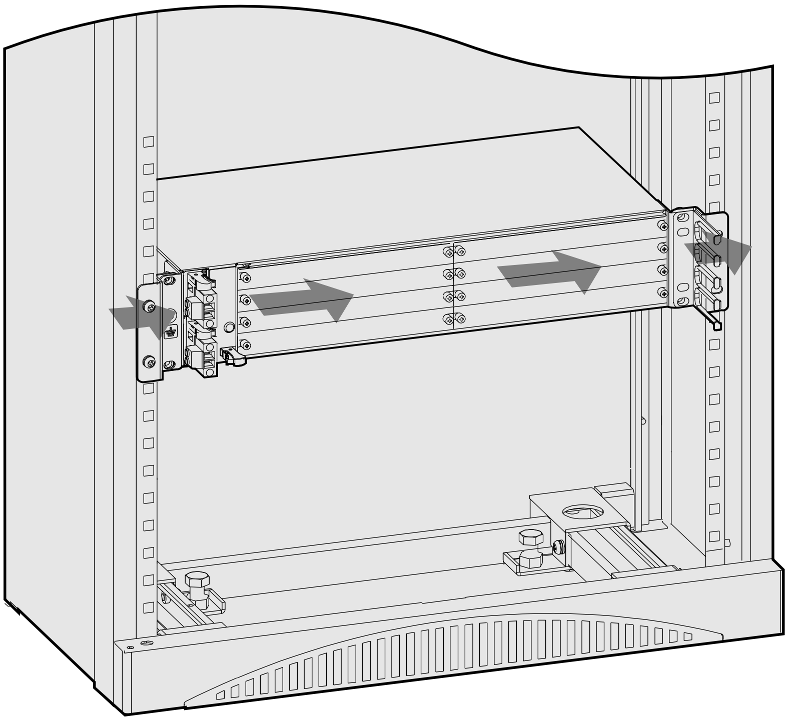
If any one of the three or six fans in the FAN board fails, the OptiX OSN 1800 system can keep on operating for 96 consecutive hours in an environment with temperatures between -5°C to 40°C (23°F to 104°F).

Replace the FAN board immediately if two or more fans fail in the board.

Application

Figure 5-15 shows the schematic diagram of the air intake and air exhaust of OptiX OSN 1800 II chassis. The air intake vent is on the left of the chassis and the air exhaust vent is on the right of the chassis. In this case, a good heat dissipation and ventilation system is formed to facilitate the normal operation of the equipment.

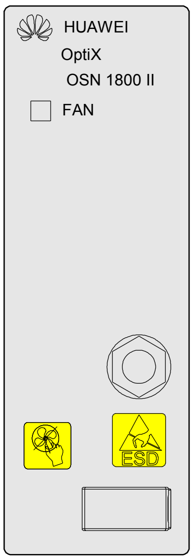
Figure 5-15 Schematic diagram of the air intake and air exhaust in the OptiX OSN 1800 II chassis



Front Panel

Figure 5-16 shows the front panel of the FAN01.

Figure 5-16 Front panel of the FAN



There is one indicator on the front panel of the FAN board, the descriptions of the indicator are shown in **Table 5-28**.

Table 5-28 Descriptions of the indicator on the FAN board

Indicator Status	Description
On (green)	The board works normally.
On (red)	The FAN_FAIL alarm occurs to the board.
Off	The board is not powered on.

There is an port for ESD wrist strap on the front panel of the FAN board.

Valid Slots

The FAN01 board occupies the SLOT 11 in the OptiX OSN 1800 II chassis.

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

FAN Specifications

The mechanical specifications of the FAN01 board are as follows:

- Dimensions (Height x Width x Depth): 85.7 mm x 27.5 mm x 207.5 mm (3.4 in. x 1.1 in. x 8.2 in.)
- Weight: 0.70 kg (1.54 lb.)

The power consumption of the FAN01 board is as follows:

- Maximum power consumption at 25°C (77°F): 7.2 W
- Maximum power consumption at 55°C (131°F): 36.0 W

5.2.5 Power Consumption

The power consumption of OptiX OSN 1800 II Chassis.

Table 5-29, **Table 5-30**, **Table 5-31** list the power consumption of the OptiX OSN 1800 II chassis.

Table 5-29 Power consumption of ordinary OptiX OSN 1800 II chassis (DC power-supply chassis)

Item	Specification
Maximum power consumption	300 W

Table 5-30 Power consumption of ordinary OptiX OSN 1800 II chassis (AC power-supply chassis)

Item	Specification
Typical power consumption	200 W

Table 5-31 Power consumption of OptiX OSN 1800 II chassis integrated with an FMT (AC and DC power-supply chassis)

Item	Specification
Typical power consumption	● For a DC power-supply chassis: 300 W ● For an AC power-supply chassis: 200 W

5.2.6 DC Power Requirement

This section describes the requirements on power supply when the equipment runs on DC power.

Requirements on Voltage

Table 5-32 provides the requirements on voltage of OptiX OSN 1800 II chassis.

Table 5-32 Requirements on Voltage of ordinary OptiX OSN 1800 II chassis (DC power-supply chassis)

Item	Specification
Power supply	-40 to -57.6 (-48 V power supply) -48.0 to -72.0 (-60 V power supply)

TND1PIU

The PIU board used in OptiX OSN 1800 II chassis is TND1PIU, which provides one channel of power supply. Each chassis uses two PIU boards to implement the power 1+1 protection.

Table 5-33 describes the version mapping of the PIU board.

Table 5-33 Version description of the PIU

Item	Description
PIU board hardware version	TND1

- Functions and Features

  For detailed functions and features, see **Table 5-34**.

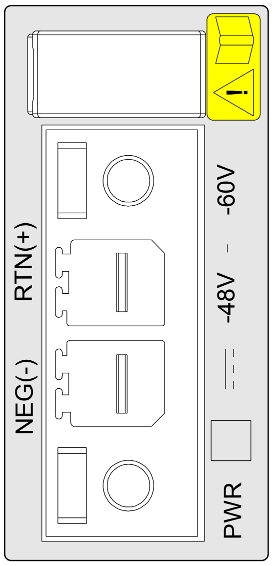
Table 5-34 Functions and features of the PIU

Functions and Features	Description
Lighting protection circuit status monitoring	Receives status signals of the lightning protection circuit and reports alarms of lightning protection failure when the lightning protection circuit is faulty.

- Front Panel

  Figure 5-17 shows the front panel of the TND1PIU.

Figure 5-17 Front panel of the PIU



There is one indicator on the TND1PIU front panel, the descriptions of the indicator are shown in **Table 5-35**.

Table 5-35 Descriptions of the indicator on the TND1PIU board

Indicator	Indicator Status	Description
The power supply status indicator (PWR)	On (green)	The board is in working status.
	Off	The board is not powered on.

There are two power supply ports on the front panel of the TND1PIU, **Table 5-36** lists the function of each port.

Table 5-36 Descriptions of the TND1PIU ports

Port	Description
NEG(-)	Access the negative pole of the power.
RTN(+)	Access the positive pole of the power.

- Valid Slots

  The PIU board occupies the SLOT 9 and SLOT 10 in the OptiX OSN 1800 II chassis.

  The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.
- Specifications

  Mechanical Specifications of TND1PIU:
  - Dimensions (Height x Width x Depth): 41.8 mm x 20.0 mm x 208.9 mm (1.6 in. x 0.8 in. x 8.2 in.)
  - Weight: 0.15 kg (0.33 lb.)

  Power Consumption of TND1PIU:
  - Maximum Power Consumption at 25°C (77°F) (W): 2 W

5.2.7 AC Power Requirement

This section describes the requirements on power supply when the equipment runs on AC power.

Requirements on Voltage

Table 5-37 provides the requirements on AC voltage of the OptiX OSN 1800 II chassis.

Table 5-37 Requirements on Voltage of ordinary OptiX OSN 1800 II chassis (AC power-supply chassis)

Item	Specification
Power supply	100 V to 240 V AC

APIU

APIU is AC Power Port Unit, provides power for OptiX OSN 1800 I AC power-supply chassis and OptiX OSN 1800 II AC power-supply chassis.

For detailed descriptions of APIU, please see **5.1.7 AC Power Requirement**.

5.3 OptiX OSN 1800 OADM Frame

The OptiX OSN 1800 OADM frame, whose height is 1 U, provides four slots for boards.

5.3.1 Structure

The OptiX OSN 1800 OADM frame cannot be used alone. It can be used only as the extended frame for the OptiX OSN 1800 I chassis or for the OptiX OSN 1800 II chassis. In this manner, accessed wavelengths can be added and the networking with low cost is realized.

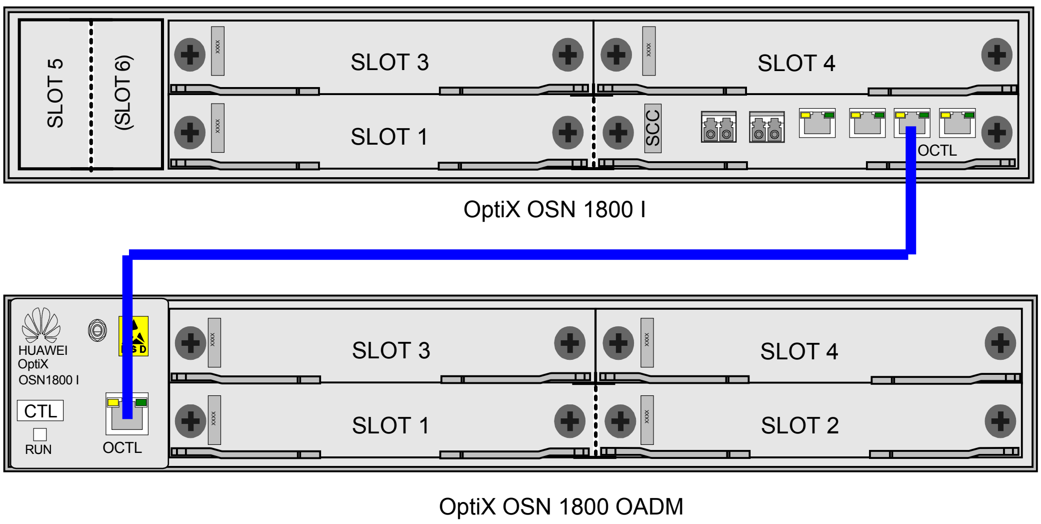
The appearance of the OptiX OSN 1800 OADM frame is similar with that of the OptiX OSN 1800 I chassis, and the **Figure 5-18** shows the appearance of the OptiX OSN 1800 OADM extended frame.

Figure 5-18 OptiX OSN 1800 OADM frame

The OptiX OSN 1800 I chassis or the OptiX OSN 1800 II chassis are interconnected with the OptiX OSN 1800 OADM frame to extend the capacity of the equipment, and the power supply can be provided to the OADM frame and boards in the OADM frame can be managed.

For interconnection, directly connect the OCTL port on the SCC board to the OCTL port on the CTL board by using straight-through cables. See **Figure 5-19**.

Figure 5-19 Interconnection between the OptiX OSN 1800 OADM frame and the OptiX OSN 1800 I chassis



NOTE

In **Figure 5-19**, the OptiX OSN 1800 I chassis is used as an example to show how to interconnect with the OptiX OSN 1800 OADM frame. The method of interconnecting the OptiX OSN 1800 II chassis with the OptiX OSN 1800 OADM frame is similar.

Table 5-38 lists the mechanical specifications of the OptiX OSN 1800 OADM frame.

Table 5-38 Mechanical specifications of the OptiX OSN 1800 OADM frame

Item	Specification
Dimensions (Height x Width x Depth)	44 mm x 442 mm x 220 mm (1.7 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	2.5 kg (5.5 lb.)

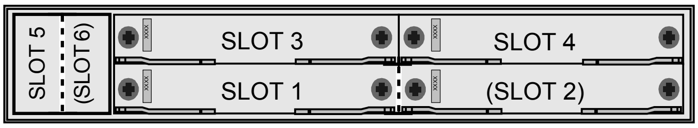
5.3.2 Slot Distribution

All boards in the chassis are installed horizontally in the front of the chassis.

The OptiX OSN 1800 I OADM frame, whose height is 1 U, provides six slots for boards.

- Slots 1 through 4 are fixed to house the optical add/drop multiplexer (OADM) boards, optical multiplexer/demultiplexer boards, or SCS board.
- Slots 5 and 6 are fixed to house the CTL board.

Figure 5-20 Slot layout of the OADM extended frame



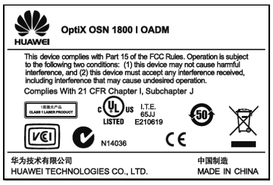
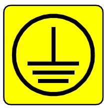
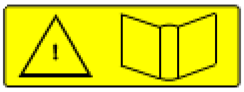
- Slots 5 and 6 are not displayed on the U2000, Web LCT, or command line.
- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or the command line is a digit from 7 to 10.
- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or the command line is a digit from 12 to 15.

5.3.3 Label

During equipment installation and maintenance, you should notice the warning and take the precautions specified by safety symbols to avoid injury to the human body and damage to the equipment.

Table 5-39 lists the warning and safety symbols on the OptiX OSN 1800 OADM Frame, and specifies the meaning of them.

Table 5-39 Description of labels on the OptiX OSN 1800 OADM Frame

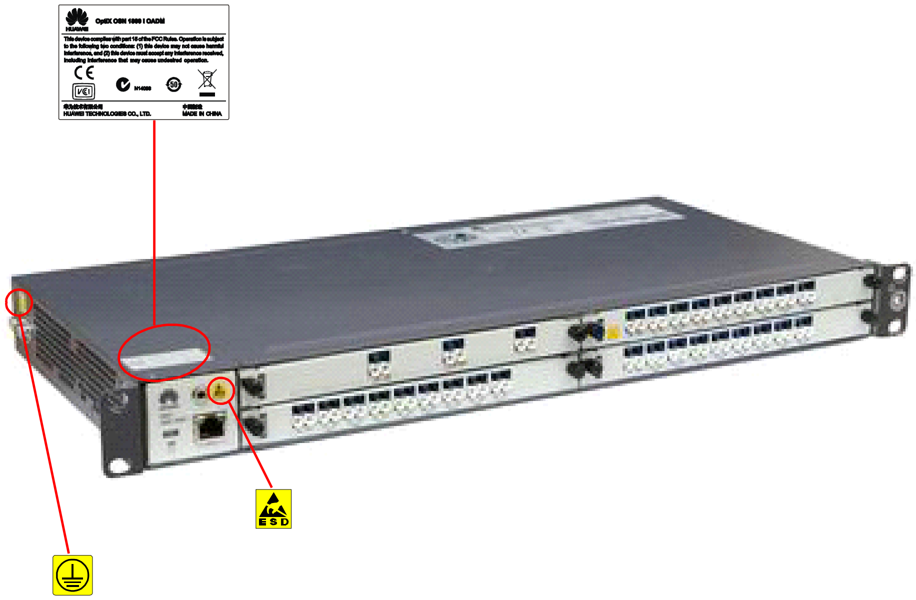
Symbol	Meaning
	Product nameplate label Indicates name and certification of OptiX OSN 1800 OADM Extended Frame.
	Laser class symbol Indicates the class of the laser. Avoid direct exposure to the laser beams launched from the optical port. Otherwise, damage might be caused to your skin or eyes.
	Grounding symbol Indicates where the equipment is grounded.
	Anti-static protection symbol Indicates that you should wear an anti-static wrist strip or gloves when you touch a board. Otherwise, damage might be caused to the board.
	Fan safety warning symbol Indicates that you should not touch the fan leaves when the fan is rotating.
	Multichannel power supply label Indicates that multiple channels of power supply are input.

Label Position

The anti-static protection symbol and subrack grounding symbol are affixed to the equipment chassis.

Figure 5-21 show the position of labels on the chassis.

Figure 5-21 Position of labels on the OptiX OSN 1800 OADM Frame



5.3.4 Chassis Specifications

Specifications include dimensions, power consumption, power supply and so on.

Table 5-40 lists the technical specifications of the OptiX OSN 1800 OADM frame.

Table 5-40 Technical specifications of the OptiX OSN 1800 OADM frame

Item	Specification
Dimensions (Height x Width x Depth)	44 mm x 442 mm x 220 mm (1.7 in. x 17.4 in. x 8.7 in.)
Weight (empty chassis)	2.5 kg (5.5 lb.)
Maximum power consumption	3.6 W
Power supply	12 V DC

6 Fiber Management Tray

About This Chapter

The product provides the fiber management tray, which coils up the redundant fiber jumpers. The fiber management tray is the optional equipment. If you need this equipment, contact Huawei.

6.1 Structure of Fiber Management Tray
The fiber management tray can be used to coil up the redundant fiber jumpers.

6.2 Technical Specifications
Specifications include dimensions and weight.

6.1 Structure of Fiber Management Tray

The fiber management tray can be used to coil up the redundant fiber jumpers.

Figure 6-1 and **Figure 6-2** show the appearance of a fiber management tray.

Figure 6-1 Fiber management tray

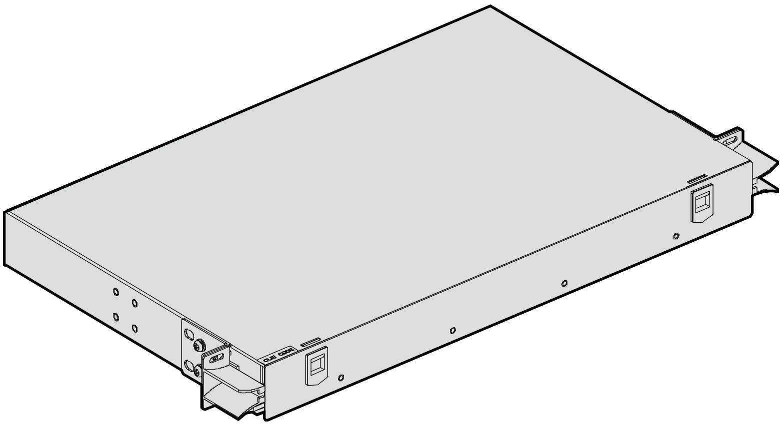
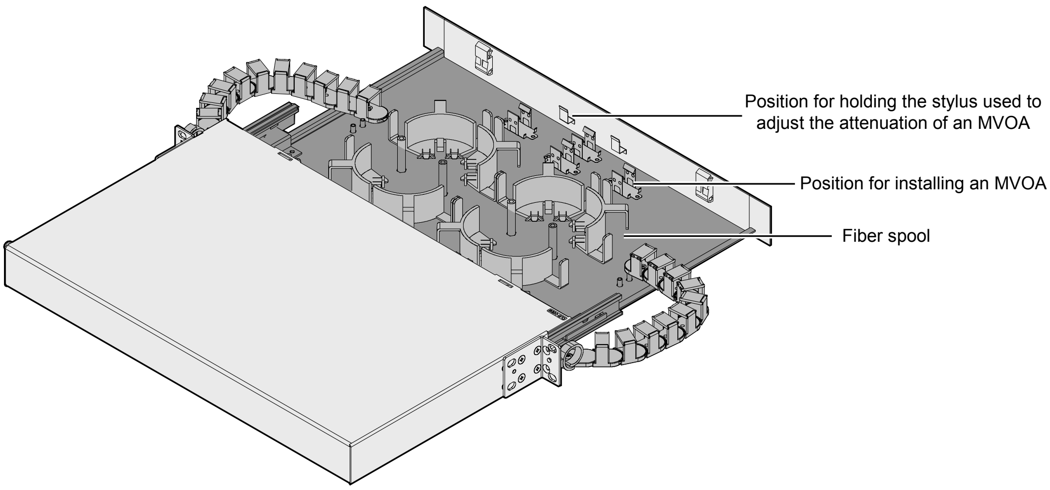


Figure 6-2 Drawing out the tray



NOTE

- Fibers are pulled in and pulled out though the fiber management tray at the right side. When you spool fibers, raise the cap of the fiber through hole.
- If too many fibers need to be pulled out from the left side, reroute the fibers to the right from the bottom of the tray.

6.2 Technical Specifications

Specifications include dimensions and weight.

Table 6-1 list the technical specifications of the fiber management tray. You can choose a fiber management tray with proper specifications according to the fibers on site and the capacity of the fiber management tray.

Table 6-1 Technical specifications of the fiber management tray

Item	Specification
Dimensions	44 mm (Height) x 435 mm (Width) x 278 mm (Depth)
Weight (empty chassis)	2.7 kg (5.9 lb.)
Capacity	40 fibers with the length of 50 m can be rotated in the fiber management tray.

7 Uninterruptible Power Module

About This Chapter

The product provides the uninterruptible power modules (UPM), which can convert the alternating current (AC) to the direct current (DC) required by the transmission equipment. Hence, the product can be applied to the equipment room without DC power supply. If you need this equipment, contact Huawei.

7.1 UPM of OptiX OSN 1800 I Chassis

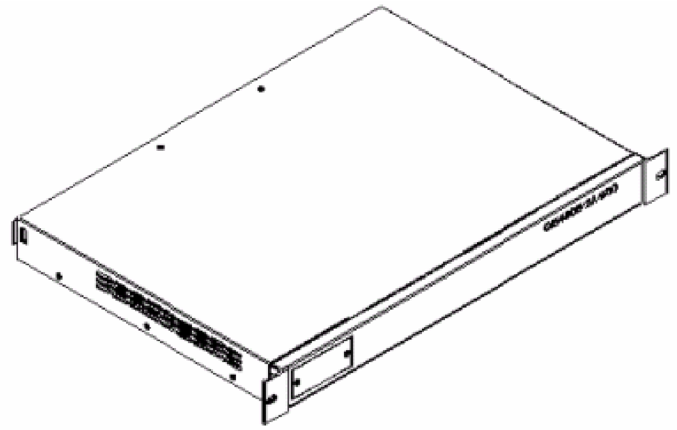
The OptiX OSN 1800 I chassis adopts GIE4805S uninterruptible power modules.

7.1.1 Structure

The power supply system is composed of rectifier module, monitoring module and AC/DC power distribution subrack. The rectifier module and monitoring module adopt hot swappable design, and the damaged rectifier and monitoring module can be replaced when the system is on operation.

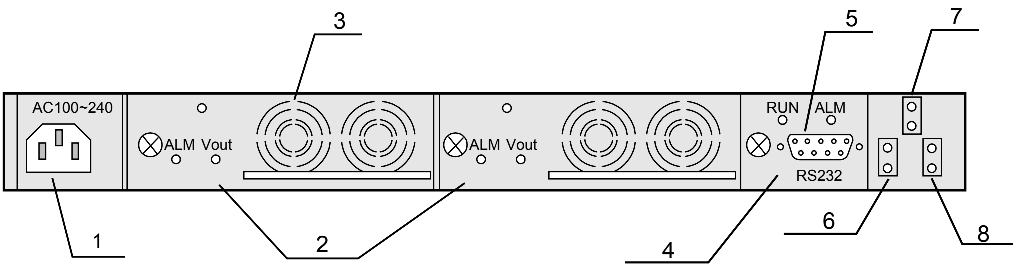
Figure 7-1 shows the appearance of the UPM used in OptiX OSN 1800 I chassis.

Figure 7-1 Appearance of the UPM used in OptiX OSN 1800 I chassis



The front panel of the UPM used in OptiX OSN 1800 I chassis is shown in **Figure 7-2**, and the function descriptions of each part are shown in **Table 7-1**.

Figure 7-2 Front panel of the UPM used in OptiX OSN 1800 I chassis



1. AC input socket 2. Rectifier module 3. Outlet 4. Monitoring module
5. Communication port 6. Load port 7. Battery port 8. Load port

Table 7-1 Function description of each part on the panel of UPM

No.	Name	Description
1	AC input socket	It is the AC mains supply input socket, which can access the AC.
2	Rectifier module	The UPM has two AC/DC rectifier modules, which can convert AC mains supply to DC communication power supply.
3	Outlet	Heat dissipation for the equipment.
4	Monitoring module	It can monitor and control the parameters and status of the rectifier modules, AC/DC power distribution box and the battery box in real time. It also can report the result to the transmission network management in real time.
5	Communication port	It is the RS-232 communication port, through which the UPM can communicate with the OptiX OSN 1800 equipment to report alarms and perform remote control.
7	Battery port	It can connect to the input socket on the back panel of the battery box through cables.
6, 8	Two load ports	It can power on the OptiX OSN 1800 through the power cable.

The descriptions of the indicators on the modules are shown in **Table 7-2** and **Table 7-3**.

Table 7-2 Meanings of Indicators on rectifier module

Indicator	Meaning	Color	Normal state	Fault state
RUN	Run indicator	Green	On	Off
ALM	Alarm indicator	Red	Off	On

Table 7-3 Meanings of Indicators on monitoring module

Indicator	Meaning	Color	Normal state	Fault state
RUN	Run indicator	Green	On	Off
ALM	Alarm indicator	Red	Off	On

7.1.2 Technical Specifications

Specifications include dimensions, weight, current, voltage and so on.

Table 7-4 lists the technical specifications of UPM that used in the OptiX OSN 1800 I chassis.

Table 7-4 Technical specifications of the OptiX OSN 1800 I chassis UPM

Item		Specification
Dimensions		42.0 mm (Height) x 436.0 mm (Width) x 240.0 mm (Depth) (excluding handle) 42.0 mm (Height) x 482.0 mm (Width) x 240.0 mm (Depth) (including handle)
Weight		< 10 kg (22.0 lb.)
AC input	Rated input voltage	220 V (90 V to 264 V) AC
	Maximum input current	8.4 A
	Frequency	47 Hz to 63 Hz
Battery input	Rated input voltage	48 V
	Capacity	7 Ah or 12 Ah
DC output	Rated output voltage	54 V ± 0.5 V DC
	Total output current	10 A
Efficiency		≥ 80%
Power factor		≥ 0.95
Operation ambient		-5°C to 55°C
Cooling method		Built-in fan inside the rectifier module: forced air cooling.

7.2 UPM of OptiX OSN 1800 II Chassis

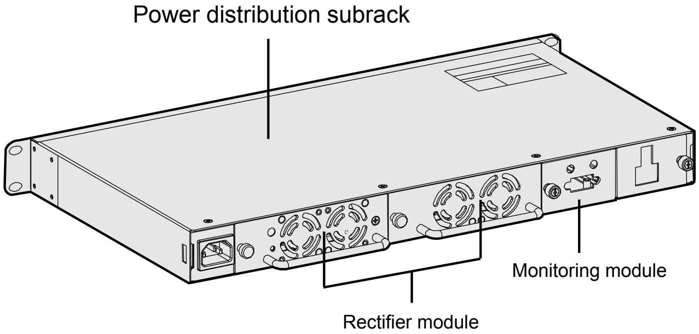
The OptiX OSN 1800 II chassis adopts EPS30-4815AF uninterruptible power modules.

7.2.1 Structure

The power supply system is composed of rectifier module, monitoring module and AC/DC power distribution subrack. The rectifier module and monitoring module adopt hot swappable design, and the damaged rectifier and monitoring module can be replaced when the system is on operation.

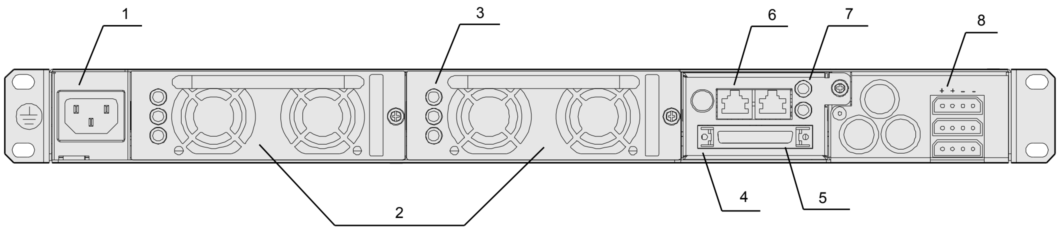
Figure 7-3 shows the appearance of the UPM used in OptiX OSN 1800 II chassis.

Figure 7-3 Appearance of the UPM used in OptiX OSN 1800 II chassis



The front panel of the UPM used in OptiX OSN 1800 II chassis is shown in **Figure 7-4**, and the function descriptions of each part are shown in **Table 7-5**.

Figure 7-4 Front panel of the UPM used in OptiX OSN 1800 II chassis



1. AC input socket 2. Rectifier module 3. Indicators on rectifier module 4. Monitoring module
5. Signal port 6. Communication port 7. Indicators on monitoring module 8. Load port

Table 7-5 Function description of each part on the panel of UPM

No.	Name	Description
1	AC input socket	It is the AC mains supply input socket, which can access the AC.
2	Rectifier module	The UPM has two AC/DC rectifier modules, which can convert AC mains supply to DC communication power supply.
3	Indicators on rectifier module	Indicates the running state of the Rectifier module.
4	Monitoring module	It can monitor and control the parameters and status of the rectifier modules, AC/DC power distribution box and the battery box in real time. It also can report the result to the transmission network management in real time.

No.	Name	Description
5	Signal port	The monitoring module connects to multiple sensors through this port, implementing monitoring expansion.
6	Communication port	It is the RS-232/RS-485 communication port, through which the UPM can communicate with the OptiX OSN 1800 equipment to report alarms and perform remote control. The port on the left side is active and the port on the right side is standby. The two ports are not valid at the same time.
7	Indicators on monitoring module	Indicates the running state of the monitoring module.
8	Load port	It can power on the OptiX OSN 1800 through the power cable.

The descriptions of the indicators on the modules are shown in **Table 7-6** and **Table 7-7**.

Table 7-6 Meanings of Indicators on rectifier module

Indicator	Meaning	Color	Normal state	Fault state	Fault cause
RUN	Run indicator	Green	On	Off	Rectifier module failure or non-output over-current protection.
ALM	Alarm indicator	Yellow	Off	On	The indicator is on when the rectifier module occurs recoverable protection, while the indicator blinks when the communication is interrupted.
FAULT	Fault indicator	Red	Off	On	There is non-recoverable fault within the module.

Table 7-7 Meanings of Indicators on monitoring module

Indicator	Meaning	Color	Normal state	Fault state	Fault cause
RUN	Run indicator	Green	Flashing regularly	Off	Monitoring module failure.
				Flashing rapidly	Communication failure.

Indicator	Meaning	Color	Normal state	Fault state	Fault cause
ALM	Alarm indicator	Red	Off	On	Alarm in the power supply system.

7.2.2 Technical Specifications

Specifications include dimensions, weight, current, voltage and so on.

Table 7-8 lists the technical specifications of UPM that used in the OptiX OSN 1800 II chassis.

Table 7-8 Technical specifications of the OptiX OSN 1800 II chassis UPM

Item		Specification
Dimensions		43.6 mm (Height) x 442.0 mm (Width) x 270 mm (Depth) (excluding handle) 43.6 mm (Height) x 482.6 mm (Width) x 270 mm (Depth) (including handle)
Weight		< 10 kg (22.0 lb.)
AC input	Rated input voltage	220 V (90 V to 300 V) AC
	Maximum input current	10 A
	Frequency	50 Hz (45 Hz to 65 Hz)
Battery input	Rated input voltage	48 V
	Capacity	5 Ah to 500 Ah (default: 40 Ah)
DC output	Rated output voltage	-53.5 V (-43.2 V to -57.6 V) DC
	Total output current	● 15 A (the AC input voltage is 90 V to 175 V) ● 30 A (the AC input voltage is 176 V to 300 V)
Efficiency		≥ 89% (rated input, 50% to 100% load)
Power factor		≥ 0.98 (rated input and output)
Operation ambient		-40°C to 65°C
Cooling method		Built-in fan inside the rectifier module: forced air cooling.

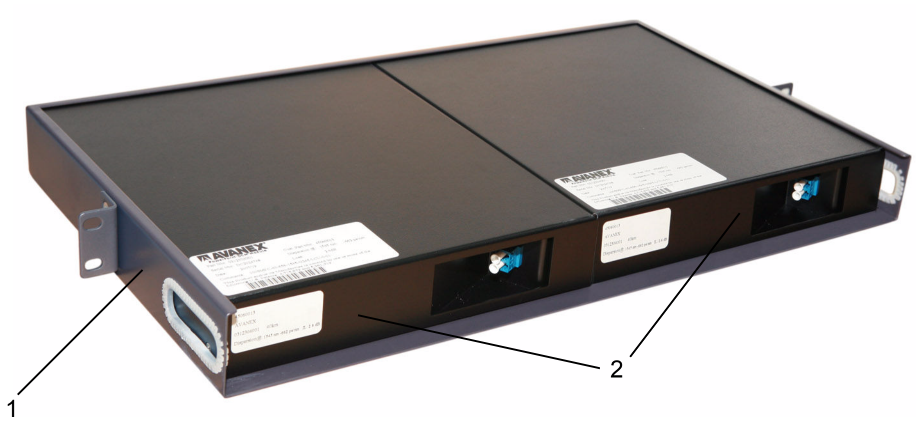
8 DCM Frame and DCM Module

The DCM frame can be used to hold DCM modules which compensate the positive dispersion of transmitting fiber, so as to maintain the original shape of the signal pulse. If your network needs this equipment, contact Huawei.

DCM Frame

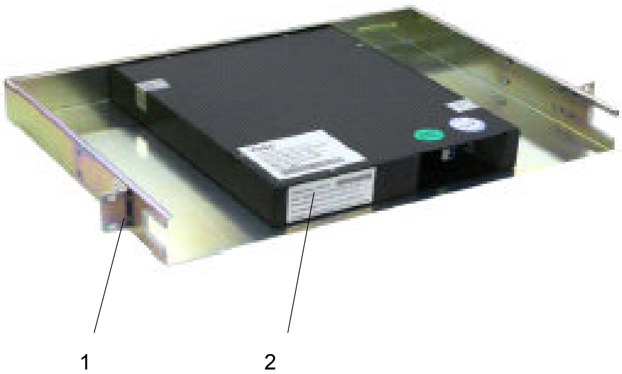
The DCM frame is fixed onto the columns of the cabinet by mounting brackets and screws, as shown in **Figure 8-1** and **Figure 8-2**.

Figure 8-1 Dual-DCM frame in the cabinet



1. DCM frame
2. DCMs

Figure 8-2 Single-DCM frame in the cabinet



1. DCM frame 2. DCM

Table 8-1 DCM frame specifications

Type of a DCM frame	Dimensions (Height x Width x Depth)	Weight	Number of DCMs
Single-DCM frame **NOTE** It applies only to 19-inch cabinets.	48 mm x 436 mm x 280 mm (1.9 in. x 17.2 in. x 11.0 in.)	1.38 Kg (3.04 lb)	1
Dual-DCM frame **NOTE** It applies only to ETSI cabinets.	48 mm x 484 mm x 270.5 mm (1.9 in. x 19.1 in. x 10.6 in.)	1.53 Kg (3.37 lb)	2

DCM Module

After an optical signal is transmitted over certain distance, the optical signal pulse is widened because of the positive dispersion accumulated in the system. This widened shape seriously affects the system transmission performance. The DCM is a passive device that uses a dispersion compensation fiber. Because a DCM has inherent negative dispersion that can offset the positive dispersion of transmission fibers, the signal pulses are compressed.

The OptiX OSN 1800 can provide several types of DCMs of several compensation distance specifications: 5 km (3.1 mi.), 10 km (6.2 mi.), 20 km (12.4 mi.), 40 km (24.8 mi.), 60 km (37.3 mi.), 80 km (49.7 mi.), 100 km (62.1 mi.), 120 km (74.6 mi.).

Table 8-2 and **Table 8-3** provide the performance specifications of the DCM module.

Table 8-2 Performance requirement for C-band dispersion compensation optical fibers (G.652 fibers)

DCM Module	Distance (km)	Max. Insertion Loss (dB)	DSCR	PMD (ps)	PDL (dB)	Max. Allowed Power (dBm)	Operating Wavelength (nm)
DCM(S)	5	2.3	90% to 110%	0.3	0.1	20	1525 to 1568
DCM(T)	10	2.8		0.3	0.1	20	
DCM(A)	20	3.3		0.4	0.1	20	
DCM(B)	40	4.7		0.5	0.1	20	
DCM(C)	60	6.4		0.6	0.1	20	
DCM(D)	80	8		0.7	0.1	20	
DCM(E)	100	9		0.8	0.1	20	
DCM(F)	120	9.8		0.8	0.1	20	

Table 8-3 Performance requirement for C-band dispersion compensation optical fibes (G.655 LEAF fibers)

DCM Module	Distance (km)	Max. Insertion Loss (dB)	DSCR	PMD (ps)	PDL (dB)	Max. Allowed Power (dBm)	Operating Wavelength (nm)
DCM(A)	20	4	90% to 110%	0.4	0.3	24	1528 to 1568
DCM(B)	40	5		0.5	0.3	24	
DCM(C)	60	5.9		0.7	0.3	24	
DCM(D)	80	6.9		0.8	0.3	24	
DCM(E)	100	7.8		0.9	0.3	24	
DCM(F)	120	8.8		1.0	0.3	20	

Table 8-4 provides the mechanical specifications of the DCM module.

Table 8-4 Dimensions of a DCM

Module	Dimensions (Height x Width x Depth)
DCM module	44 mm x 238 mm x 266 mm (1.7 in. x 9.4 in. x 10.5 in.)

9 Overview of Boards

About This Chapter

Describes the classification and appearance of boards, and the pluggable module of the board.

9.1 Appearance and Dimensions of Boards

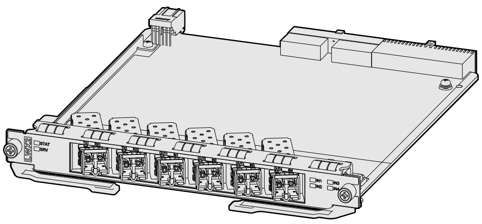
Describes the appearance and dimensions of the boards.

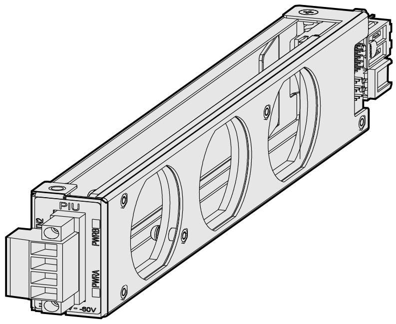
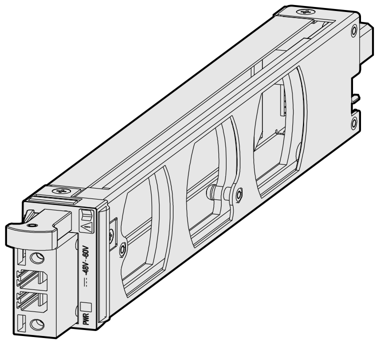
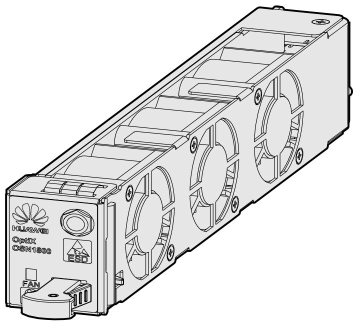
WARNING

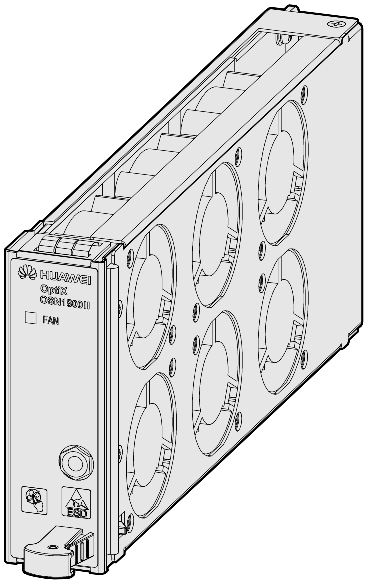
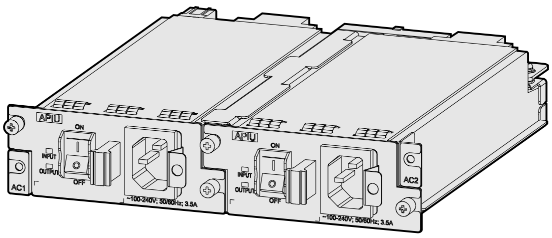
Always wear an ESD wrist strap when holding the board, and make sure the ESD wrist strap is well grounded, to prevent static discharge from damaging the board.

Table 9-1 provides the appearance and dimensions of different board types for the OptiX OSN 1800 series.

Table 9-1 Board appearance and dimensions

Board Type	Board Appearance and Dimension
• System control, supervision and communication board (for example, the SCC) • Optical transponder board (for example, the LDGF) • Optical add/drop multiplexer board (for example, the MR2) • Optical protection board (for example, the OLP) **NOTE** The preceding boards have the same dimensions but differ slightly in appearance. For example, the ejector levers or backplane connectors are different. The boards you receive may appear different from that shown in the figure.	 Dimensions (H x W x D): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)

Board Type	Board Appearance and Dimension
PIU (1 U)	 Dimensions (H x W x D): 41.4 mm x 20.0 mm x 217.1 mm (1.6 in. x 0.8 in. x 8.5 in.)
PIU (2 U)	 Dimensions (H x W x D): 41.8 mm x 20.0 mm x 208.9 mm (1.6 in. x 0.8 in. x 8.2 in.)
FAN (1 U)	 Dimensions (H x W x D): 41.0 mm x 27.5 mm x 214.3 mm (1.6 in. x 1.1 in. x 8.4 in.)

Board Type	Board Appearance and Dimension
FAN (2 U)	 Dimensions (H x W x D): 85.7 mm x 27.5 mm x 207.5 mm (3.4 in. x 1.1 in. x 8.2 in.)
APIU, LEM18, X40 **NOTE** The preceding boards have the same dimensions but differ slightly in appearance. The boards you receive may appear different from that shown in the figure.	 Dimensions (H x W x D): 40.1 mm x 193.8 mm x 208.7 mm (1.6 in. x 7.6 in. x 8.2 in.)

9.2 Laser Hazard Level Label

Lasers are of two hazard levels according to the value of the output power.

WARNING

It is strictly forbidden to stare into the optical interface during the installation and maintenance of the fiber, because the laser beam inside the optical fiber would hurt your eyes.

Table 9-2 shows the laser hazard levels of the unit.

Table 9-2 Hazard levels

Hazard Level	Label	Reference Power Range
HAZARD LEVEL 1	-	<10.00 dBm (<10.00 mW)
HAZARD LEVEL 1M		10.00 dBm - 21.3 dBm (10.00 mW - 136 mW)

9.3 Board Types

The following types of boards are available for the OptiX OSN 1800.

Table 9-3 lists the boards for the OptiX OSN 1800.

Table 9-3 Board types available to the OptiX OSN 1800

Board Category	Board Name	Board Description
Optical Transponder Board	ELOM	Enhanced 8 x Multi-rate Ports Wavelength Conversion Board
	ELQM	Enhanced 4 x Multi-rate Ports Multiplexing Optical Wavelength Conversion Board
	LDE	Double Port EPON/GE Access Wavelength Conversion Board
	LDGF	Double GE Services & Double FE Services Wavelength Conversion Board with FEC
	LDGF2	Double 2 x GE Wavelength Conversion Board
	LDX	2 x 10 Gbit/s Wavelength Conversion Board
	LEM18	16 x GE + 2 x 10GE LAN + 2 x OTU2 Ethernet Switch board
	LOE	8 Port EPON/GE Access Wavelength Conversion Board
	LQG	4 x GE Wavelength Conversion Board
	LQM	4 x Multi-rate Ports Wavelength Conversion Board
	LQM2	Double 4 x Multi-rate Ports Wavelength Conversion Board
	LQPL	OLT Side 4 Port GPON/STM-16/OTU1 Access Wavelength Conversion Board

Board Category	Board Name	Board Description
	LQPU	ONU Side 4 Port GPON/STM-16/OTU1 Access Wavelength Conversion Board
	LSPL	OLT Side Single Port GPON Access Wavelength Conversion Board
	LSPR	Single Port GPON Extension REG Board
	LSPU	ONU Side Single Port GPON Access Wavelength Conversion Board
	LSX	10 Gbit/s Wavelength Conversion Board
	LWX2	Double Arbitrary Bit Rate Wavelength Conversion Board
	TSP	21-channel E1/T1 and 2-channel STM-1 Service Convergence and Wavelength Conversion Board
Optical Multiplexer and Demultiplexer Board	FIU	Fiber Interface Unit
	X40	40-Channel Multiplexing or Demultiplexing Board
Optical Add and Drop Multiplexer Board	DMD1	Bidirectional Single Channel Optical Add/drop Multiplexer Board
	DMD1S	Bidirectional Single Channel Optical Add/drop Multiplexer Board with OSC
	DMD2	Bidirectional Double Channel Optical Add/drop Multiplexer Board
	DMD2S	Bidirectional Double Channel Optical Add/drop Multiplexer Board with OSC
	MD8	8 Channel Multiplexer and Demultiplexer Board
	MD8S	8 Channel Multiplexer and Demultiplexer Board with OSC
	MR1	Single Channel Optical Add/Drop Multiplexer Board
	MR1S	Single Channel Optical Add/drop Multiplexer Board with OSC
	MR2	Double Channel Optical Add/drop Multiplexer Board
	MR2S	Double Channel Optical Add/drop Multiplexer Board with OSC
	MR4	Four Channel Optical Add/drop Multiplexer Board
	MR4S	Four Channel Optical Add/drop Multiplexer Board with OSC
	MR8	Eight Channel Optical Add/drop Multiplexer Board

Board Category	Board Name	Board Description
	SBM1	Single Fiber Bidirectional Single Channel Optical Add/drop Multiplexer Configuration Board
	SBM2	Single Fiber Bidirectional Double Channel Optical Add/drop Multiplexer Configuration Board
	SBM4	Single Fiber Bidirectional Four Channel Optical Add/drop Multiplexer Configuration Board
	SBM8	Single Fiber Bidirectional Eight Channel Optical Add/drop Multiplexer Configuration Board
Optical Amplifying Board	OBU	Optical Booster Board
	OPU	Optical Preamplifier Unit
System Control and Communication Board	CTL	OADM Control Board
	SCC	System Control & Communication Board with OSC
Optical Protection Board	OLP	Optical Line Protection Board
	SCS	Sync Optical Channel Separator Board
Power Supply Access Board	APIU	AC Power Interface Unit
	PIU	DC Power Board
Heat Dissipation Board	FAN	Fan Board

9.4 Bar Code for Boards

The bar code of a board is provided on the front panel of the board and contains the basic information about the board, including the BOM code and delivery time.

The bar code of a board provides the feature information about the board and varies according to boards. **Figure 9-1** shows a bar code and **Table 9-4** provides the description of the bar code.

Figure 9-1 Bar code of a board

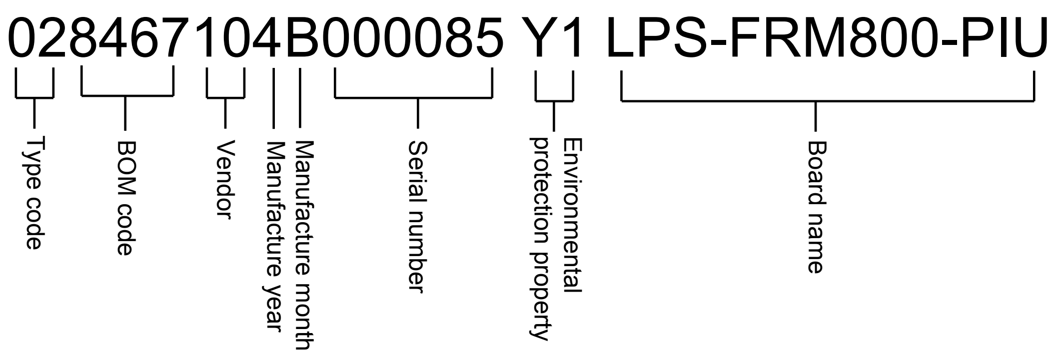


Table 9-4 Description of the bar code of a board

Item	Description
Type Code	Indicates whether a board is a manufactured or finished board. "02" indicates a manufactured board and "03" indicates a finished board.
BOM Code	Indicates the last four digits of the BOM code of a board.
Vendor	Indicates the vendor of a board. "10" indicates Huawei.
Manufacture Year	Indicates the last digit of the year when a board is manufactured. For example, "4" indicates 2004. From 2010 onwards, a letter is used to indicate the manufacture year. For example, the letter A indicates 2010, the letter B indicates 2011, and so on.
Manufacture Month	Indicates the month when a board is manufactured. The value is expressed in hexadecimal format. For example, the letter B indicates November.
Serial Number	Indicates the production serial number of a board. The value ranges from 000001 to 999999.
Environmental Protection Property	Indicates the environmental protection property of a board.
Board Name	Indicates the name and associated information about a board.

10 Optical Transponder Unit

About This Chapter

Describes the functions and the working principle of optical transponder boards.

10.1 ELOM

ELOM: Enhanced 8 x Multi-rate Ports Wavelength Conversion Board

10.1.1 Version Description

The available hardware version of the ELOM board is TNF2.

Version

Table 10-1 describes the version mapping of the ELOM board.

Table 10-1 Version description of the ELOM board

Item	Description
Board hardware version	TNF2: The mapping version of the equipment is V100R003C00 or later.
Logical board name	The logical board name of the ELOM can be ELOM (COMP) or ELOM(STND) based on the functions and application scenarios. ELOM(COMP) has the functions of the ELOM board in V100R003C00. **NOTE** On the NMS, ELOM(COMP) and ELOM(STND) are ELOM and ELOM(STND) respectively, but ELOM (COMP) and ELOM(STND) are used in board description.

10.1.2 Application Overview

The ELOM(COMP) board can work in five different modes: 1*AP8 ODU1 mode, 1*AP4 ODU1 mode, 1*AP1 ODU2 mode, 1*AP2 ODU2 mode, 1*AP8 ODU0&ODU1 mode. The ELOM (STND) board can work in three different modes: 1*AP8 general mode, 1*AP1 ODU2 mode, 1*AP1 ODUflex mode.

Table 10-2 and **Table 10-3** describe the principle for configuring the interfaces of the ELOM board.

Table 10-2 Principle for configuring the interfaces of the ELOM(COMP) board

<table>
<tr><th>Board Working Mode</th><th>Port Working Mode</th><th>Available Interfaces</th><th>Service Access</th><th>Remarks</th></tr>
<tr><td>1*AP8 ODU1 mode</td><td>-</td><td>TX1/RX1 to TX8/RX8</td><td>FE, STM-1, ESCON, STM-4, FC100, FICON, FICON Express, CPRI option2, GE (GFP_T), GE (TTT-GMP), FC200, CPRI option3, Infiniband 2.5G, STM-16</td><td>● The overall bandwidth of the entire services for TX1/RX1 to TX8/RX8 should not be more than 10.3 Gbit/s.
● The total timeslots allocated for services converged into an ODU1 container cannot exceed 16.</td></tr>
<tr><td>1*AP4 ODU1 mode</td><td>-</td><td>TX1/RX1, TX3/RX3, TX5/RX5, TX7/RX7</td><td>FC200, FICON Express, CPRI option3, STM-16, OTU1</td><td>-</td></tr>
<tr><td>1*AP1 ODU2 mode</td><td>-</td><td>TX1/RX1</td><td>10GE LAN, FC800, FICON 8G</td><td>-</td></tr>
<tr><td>1*AP2 ODU2 mode</td><td>-</td><td>TX1/RX1, TX5/RX5</td><td>FC400, FICON 4G, InfiniBand5G</td><td>-</td></tr>
<tr><td rowspan="2">1*AP8 ODU0&ODU1 mode</td><td>ODU1 non-convergence mode</td><td rowspan="2">TX1/RX1 to TX8/RX8</td><td rowspan="2">FE, STM-1, ESCON, STM-4, FC100, FICON, FICON EXPRESS, CPRI option2, GE, FC200, CPRI option3, STM-16, OTU1</td><td rowspan="2">● The overall bandwidth of the entire services for TX1/RX1 to TX8/RX8 should not be more than 10.3 Gbit/s.
● OTU1 services can only be received at the TX1/RX1, TX3/RX3, TX5/RX5, and TX7/RX7 ports.</td></tr>
<tr><td>ODU0 non-convergence mode</td></tr>
</table>

NOTE

On the WDM side, only the IN1/OUT1 optical ports can be used if no protection is configured for the ELOM(COMP) board.

Table 10-3 Principle for configuring the interfaces of the ELOM(STND) board

Board Working Mode	Port Working Mode	Available Interfaces	Service Access	Remarks
1*AP8 general mode	ODU0 non-convergence mode	TX1/RX1 to TX8/RX8	125 Mbit/s – 1.25 Gbit/s	GE(GFP_F) services cannot be received.
	ODU1 convergence mode	TX1/RX1 to TX8/RX8	125 Mbit/s – 2.46 Gbit/s	The total timeslots allocated for services converged into an ODU1 container cannot exceed 16.
	ODU1 non-convergence mode	TX1/RX1 to TX8/RX8	1.5 Gbit/s – 2.67 Gbit/s	OTU1 services can only be received at the TX1/RX1, TX3/RX3, TX5/RX5, and TX7/RX7 ports.
	ODUflex non-convergence mode	TX1/RX1 to TX8/RX8	2.5 Gbit/s – 4.25 Gbit/s	When 3G-SDI, FC400 or FICON 4G services are received, the 3 x 1.25 Gbit/s, 4 x 1.25 Gbit/s or 4 x 1.25 Gbit/s bandwidth is occupied. **NOTE** When intra-board 1+1 protection or ODUk SNCP protection is configured for the board, only TX1/RX1 and TX3/RX3 are available.
1*AP1 ODU2 mode	-	TX1/RX1	4.9 Gbit/s – 10.5 Gbit/s	-
1*AP1 ODUflex mode	-	TX1/RX1	CPRI option6, FC800, FICON 8G	-

Board Working Mode	Port Working Mode	Available Interfaces	Service Access	Remarks
NOTE ● In 1*AP8 general mode, port working modes can be set for ports 201-208 and various services can be received at the ports. ● In 1*AP8 general mode, the total bandwidth for services received at ports 201(LP1/LP1)-208(LP8/LP8) cannot exceed 10 Gbit/s if intra-board 1+1 protection or ODUk SNCP protection is configured. If intra-board 1+1 protection or ODUk SNCP protection is not configured, the total bandwidth can reach 20 Gbit/s. ● In 1*AP8 general mode, intra-board 1+1 protection is not recommended because of service configuration restrictions but ODUk SNCP protection is recommended if both ODU1 convergence mode and ODU0/ODUflex non-convergence mode are configured.				

10.1.3 Functions and Features

The main functions and features supported by the ELOM board are wavelength conversion, service convergence, and ALS.

For detailed functions and features, see **Table 10-4**.

Table 10-4 Functions and features of the ELOM board

Function and Feature	Description
Basic Function	The ELOM(COMP) board supports the following working modes: ● 1*AP8 ODU1 mode – 8 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 1 x OTU2 – Supports ODU1-level mapping. – The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP4 ODU1 mode – 4 x Any (2.12 Gbit/s – 2.67 Gbit/s) <-> 1 x OTU2 – The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP1 ODU2 mode – 1 x Any (5 Gbit/s – 10.3 Gbit/s) <-> 1 x OTU2/OTU2e – The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP2 ODU2 mode – 2 x FC400/FICON 4G <-> 1xOTU2 – The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP8 ODU0&ODU1 mode – 8 x Any (125 Mbit/s – 2.67 Gbit/s) <-> 1 x OTU2 – The optical ports on the WDM side provide the dual fed and selective receiving function. The ELOM(STND) board supports the following working modes: ● 1*AP8 general mode – ODU0 non-convergence mode (Any->ODU0): 8 x Any (125 Mbit/s – 1.25 Gbit/s) <-> 2xOTU2 – ODU1 convergence mode (n*Any->ODU1): 8 x Any (125 Mbit/s – 2.67 Gbit/s) <-> 2xOTU2 – ODU1 non-convergence mode (OTU1/Any->ODU1): 8 x Any (1.5 Gbit/s – 2.67 Gbit/s) <-> 2xOTU2 – ODUflex non-convergence mode (Any->ODUflex): 8 x Any (2.5 Gbit/s – 4.25 Gbit/s) <-> 2xOTU2 **NOTE** If intra-board 1+1 protection or ODUk SNCP is configured, the client-side signals are converged into one channel of OTU2 optical signals, WDM-side ports support the dual fed and selective receiving function. ● 1*AP1 ODU2 mode – 1 x Any (4.9 Gbit/s – 10.5 Gbit/s) <-> 1xOTU2/OTU2e

Function and Feature	Description
	– The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP1 ODUflex mode – 1 x CPRI option6/FC800/FICON 8G<-> 1xOTU2 – The optical ports on the WDM side provide the dual fed and selective receiving function.

Function and Feature	Description
Service type	• OTU1: OTN services with the rate being 2.67 Gbit/s. • 10GE LAN: Ethernet services with the rate being 10.31 Gbit/s. The 10GE LAN services can be mapped in two modes: Bit Transparent Mapping (11.1 G) and MAC Transparent Mapping (10.7 G). • 10GE WAN: Ethernet services with the rate being 9.95 Gbit/s. (supported only by ELOM(STND)) • STM-1: SDH services, the rate is 155.52 Mbit/s. • STM-4: SDH services, the rate is 622.08 Mbit/s. • STM-16: SDH services, the rate is 2.488 Gbit/s. • STM-64: SDH services, the rate is 9.95 Gbit/s. • OC-3: SONET services, the rate is 155.52 Mbit/s. (supported only by ELOM (STND)) • OC-12: SONET services, the rate is 622.08 Mbit/s. (supported only by ELOM (STND)) • OC-48: SONET services, the rate is 2.488 Gbit/s. (supported only by ELOM (STND)) • OC-192: SONET services, the rate is 9.95 Gbit/s. (supported only by ELOM (STND)) • FE: Fast Ethernet services with the rate being 125 Mbit/s. Supports FE optical signals and FE electrical signals. • GE: Gigabit Ethernet services with the rate being 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. • ESCON: Enterprise system connection services with the rate being 200 Mbit/s. • FC100: Fiber channel services with the rate being 1.06 Gbit/s. • FC200: Fiber channel services with the rate being 2.12 Gbit/s. • FC400: Fiber channel services with the rate being 4.25 Gbit/s. • FC800: Fiber channel services with the rate being 8.5 Gbit/s. • FC1200: Fiber channel services with the rate being 10.51 Gbit/s. (supported only by ELOM(STND)) • FICON: Fiber channel services with the rate being 1.06 Gbit/s. • FICON 4G: Fiber channel services with the rate being 4.25 Gbit/s. (supported only by ELOM(STND)) • FICON 8G: Fiber channel services with the rate being 8.5 Gbit/s. (supported only by ELOM(STND)) • FICON 10G: Fiber channel services with the rate being 10.51 Gbit/s. (supported only by ELOM(STND)) • FICON EXPRESS: Fiber channel services with the rate being 2.12 Gbit/s. • InfiniBand 2.5G: SAN services with the rate being 2.5 Gbit/s. (supported only by ELOM(COMP))

Function and Feature	Description
	• InfiniBand 5G: SAN services with the rate being 5 Gbit/s. (supported only by ELOM(COMP)) • DVB-ASI (Digital Video Broadcasting -Asynchronous Serial Interface): Digital TV services with the rate being 270 Mbit/s. (supported only by ELOM (STND)) • SDI (Digital Video Broadcasting - Serial Digital Interface): Digital TV services with the rate being 270 Mbit/s. (supported only by ELOM(STND)) • HD-SDI: High-definition digital TV services with the rate being 1.485 Gbit/s or 1.4835 Gbit/s. (supported only by ELOM(STND)) • 3G-SDI: High-definition digital TV services with the rate being 2.97 Gbit/s. (supported only by ELOM(STND)) • CPRI option2: the rate is 1.2288 Gbit/s. • CPRI option3: the rate is 2.4576 Gbit/s. • CPRI option6: the rate is 6.144 Gbit/s. (supported only by ELOM(STND)) • CPRI option7: the rate is 9.83 Gbit/s. (supported only by ELOM(STND)) **NOTE** "SDI" is also called "SD-SDI" according to SMPTE 259M standard.
FEC function	• Supports forward error correction (FEC) that complies with ITU-T G.709. • Supports AFEC-2 that complies with ITU-T G.975.1. **NOTE** Boards that use different FEC modes cannot interoperate with each other.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes.
Alarms and performance events monitoring	Monitors B1, SM_BIP8, PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of GE, FE and 10GE LAN services.

Function and Feature	Description
OTN function	• Provides the OTU2 and OTU2e interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports the mapping of client-side 10GE LAN services into OTU2/OTU2e signals, FC1200/FICON 10G services into OTU2e signals, and the mapping of other services into OTU2 signals. • Supports PM functions for ODU2, ODUflex, ODU1 and ODU0. • Supports SM functions for OTU2 and OTU1. • ELOM(COMP) supports PM functions for ODU2/ODU1/ODU0, and SM functions for OTU2/OTU1. ELOM(STND) supports PM functions for ODU2/ODUflex/ODU1/ODU0, and SM functions for OTU2/OTU1.
Tunable wavelength function	Supports the tunable wavelength optical module. Equipped with this module, the board can tune the optical signal output on the WDM side within the range of 40 wavelengths in C-band with the channel spacing of 100 GHz.
Regeneration board	The WDM-side signals of the ELOM board can be regenerated by the TNF1LSX board.
Synchronous Ethernet services	Supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
Protection schemes	ELOM(COMP): • Supports intra-board 1+1 protection • Supports client 1+1 protection ELOM(STND): • Supports intra-board 1+1 protection • Supports client 1+1 protection • Supports ODUk (k = 0, 1, 2, flex) SNCP protection
Loopback	• Supports WDM side inloop • Supports WDM side outloop • Supports client side inloop • Supports client side outloop
ALS function	Supports the ALS function on the client side.
ESC function	Supported

Function and Feature	Description
Cross-connect function	ELOM(COMP): ● Intra-board cross-connect: - When the board works in 1*AP8 ODU1 mode, it achieves the intra-board cross-connect function of Any optical services at a rate of 125 Mbit/s to 2.5 Gbit/s. - When the board works in 1*AP8 ODU0&ODU1 mode, it achieves the intra-board cross-connect function of ODU0 and ODU1 optical services. ● Inter-board cross-connect: not supported. ELOM(STND): ● Intra-board cross-connect: - When the board works in 1*AP8 general mode, it achieves intra-board ODU0, ODU1, and ODUflex cross-connections. When the ports on the board work in ODU1 convergence mode, the board also achieves the intra-board cross-connect function of optical services at any rate in the range from 125 Mbit/s to 2.46 Gbit/s. ● Inter-board cross-connect: not supported.
LPT function	The board supports the LPT function only when the client-side service type is FE, GE or 10GE LAN.
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is OTU1/STM-1/STM-4/STM-16/GE(GFP-T)/10GE LAN.
Ethernet port working mode	● 10GE optical port: 10G full-duplex ● GE optical port: 1000M full-duplex ● FE optical port: 100M full-duplex
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.

Function and Feature	Description	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.3u IEEE 802.3z ITU-T G.707 ITU-T G.782 ITU-T G.783 NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI) NCITS FIBRE CHANNEL LINK SERVICES (FC-LS) NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2) NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3) NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3) NCITS FIBRE CHANNEL - PHYSICAL AND SIGNALING INTERFACE (FC-PH) NCITS FIBRE CHANNEL SINGLE-BYTE COMMAND CODE SETS-2 MAPPING PROTOCOL (FC-SB-2) SMPTE 292M Bit-Serial Digital Interface for High-Definition Television Systems SMPTE 297-2006 Serial Digital Fiber Transmission System for SMPTE 259M, SMPTE 344M, SMPTE 292 and SMPTE 424M Signals ETSI TR 101 891 Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI) SMPTE 259M 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals - Serial Digital Interface NCITS SBCON Single-Byte Command Code Sets CONnection architecture (SBCON) CPRI Specification V4.1 InfiniBandTM Architecture Release 1.2.1 IEEE 802.3ae

Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.873.1 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

NOTE

The ELOM(STND) board can work at room temperature below 50°C (122°F) at a long term or below 55°C (131°F) at a short term. A short term refers to a maximum of 72 consecutive hours or fewer than 15 days in a year in total.

10.1.4 Physical Ports Displayed on NMS

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-5 lists the sequence number displayed on an NMS of the optical port on the ELOM board front panel.

Table 10-5 Display of the ELOM optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX1/TX1	3
RX2/TX2	4

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
RX3/TX3	5
RX4/TX4	6
RX5/TX5	7
RX6/TX6	8
RX7/TX7	9
RX8/TX8	10

NOTE

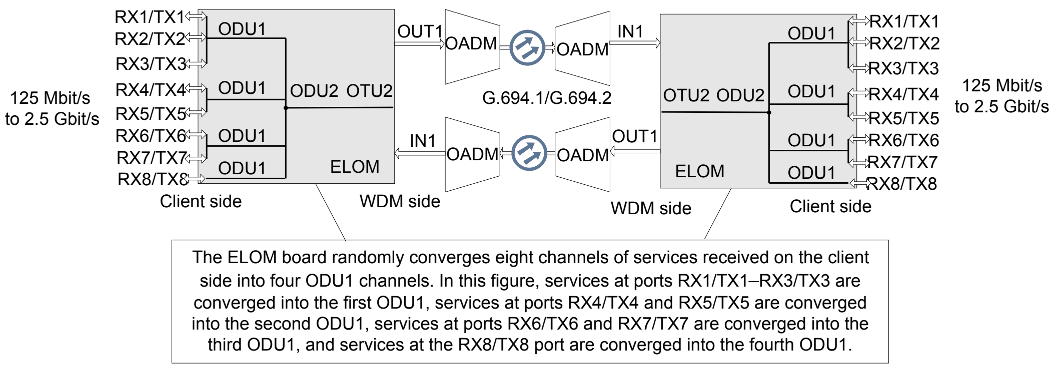
An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.1.5 ELOM(COMP) Scenario 1: 1*AP8 ODU1 Mode

10.1.5.1 Application

The ELOM board converges a maximum of eight channels of Any service signals at a rate in the range of 125 Mbit/s to 2.5 Gbit/s into any of the four ODU1 channels, and then converges the signals into one channel of OTU2 optical signals. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-1**.

Figure 10-1 Application of the ELOM(COMP) board working in 1*AP8 ODU1 mode



NOTE

- In this scenario, the ELOM board supports the following types of services on the client side: FE, STM–1, ESCON, STM–4, FC100, FICON, FICON Express, CPRI option2, GE (GFP_T), FC200, CPRI option3, InfiniBand 2.5G, and STM-16.
- CPRI option3, InfiniBand 2.5G , and STM-16 services can only be received at the TX1/RX1, TX3/RX3, TX5/RX5, and TX7/RX7 ports.
- Each ODU1 container has 16 timeslots. Therefore, the total timeslots allocated for services converged into an ODU1 container cannot exceed 16. In **Figure 10-1**, the total timeslots allocated for services received at ports TX1/RX1 to TX3/RX3, ports TX4/RX4 to TX5/RX5, or ports TX6/RX6 to TX7/RX7 each cannot exceed 16.

Background Information

Timeslots can be set for services when the ELOM(COMP) board works in 1*AP8 ODU1 mode. The number of timeslots that are occupied by services varies according to service types. Each ODU1 service requires 16 timeslots; therefore, the total number of timeslots occupied by all client-side services that are converged into an ODU1 service must be 16 or smaller.

Table 10-6 lists the number of timeslots required by common services.

Table 10-6 Number of timeslots required by common services

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
GE(GFP_T)	7	FICON	6
STM-1	1	FICON EXPRESS	12
STM-4	4	ESCON	2
STM-16	16	DVB-ASI	2
FC200	12	SDI	3
FC100	6	HDSDI	12
FE	1	HDSDI14835	12
OTU1	16	-	-

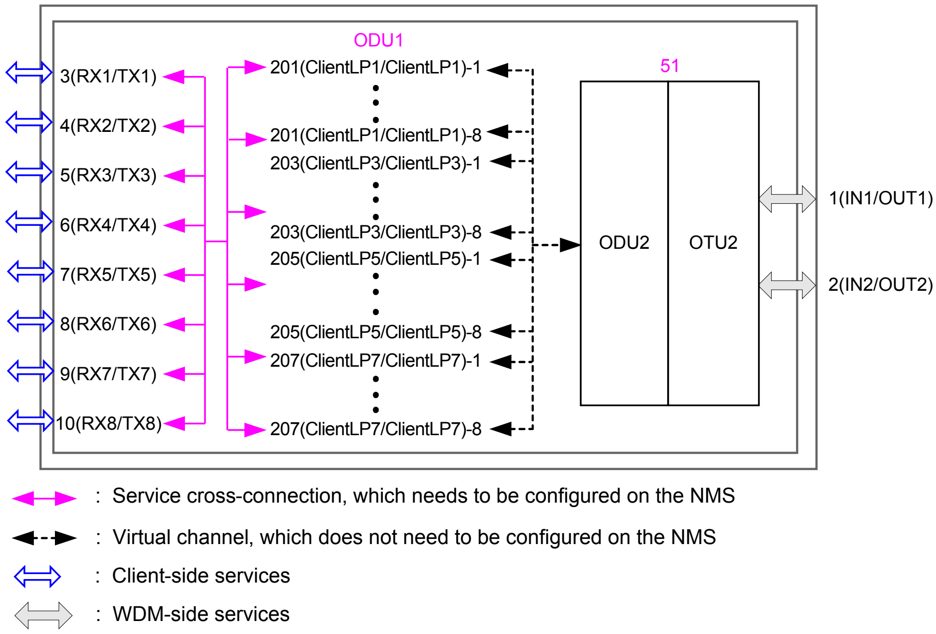
NOTE

In 1*AP8 ODU1 mode, multiple client-side services can be encapsulated into one ODU1 service, but one client-side service cannot be encapsulated into multiple ODU1 services. For example, one FC200 service occupies 12 timeslots. If four FC400 services are received on the client side, the four FC200 services can be encapsulated into only four ODU1 services but cannot be encapsulated into three ODU1 services.

10.1.5.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-2 Port model for the ELOM(COMP) board working in 1*AP8 ODU1 mode



NOTE

The client-side signals received at client-side optical ports 3–10 (RX1/TX1 to RX8/TX8) can be cross-connected to any 8 channels among 32 channels of logical ports 201–207.

- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3–10 (RX1/TX1 to RX8/TX8).
- Alarms and performance events related to ODU1 electrical-layer overheads are reported through channel 1 of logical ports 201, 203, 205, and 207.
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channels 1 and 2 of logical port 51.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

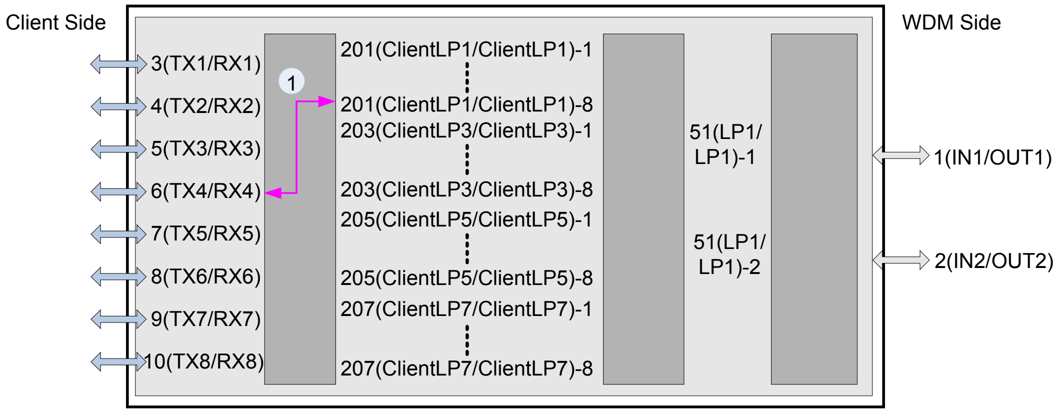
10.1.5.3 Configuration of Cross-connection

This section describes the cross-connections and provides the configuration steps for this board on the NMS.

Cross-Connections of ELOM(COMP)

When working in 1*AP8 ODU1 mode, the ELOM board supports intra-board cross-connections of the received Any services. The board provides intra-board cross-connections of the services after required timeslots are configured. **Figure 10-3** shows an example in which intra-board cross-connections are configured on the ELOM board.

Figure 10-3 Cross-connections on the ELOM board (1*AP8 ODU1 mode)



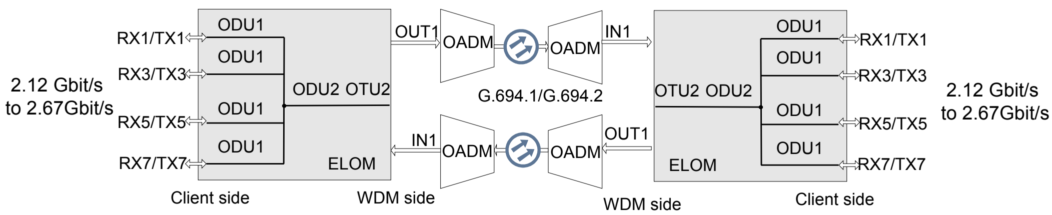
- Intra-board cross-connections
  - In 1*AP8 ODU1 mode, client signals are cross-connected to channels 1-8 of logical ports 201, 203, 205, 207. An example is shown as 1 in **Figure 10-3**.

10.1.6 ELOM(COMP) Scenario 2: 1*AP4 ODU1 Mode

10.1.6.1 Application

The ELOM board maps a maximum of four channels of Any service signals at a rate in the range of 2.12 Gbit/s to 2.67 Gbit/s into four ODU1 channels, and then converges the signals into one channel of OTU2 optical signal. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-4**.

Figure 10-4 Application of the ELOM(COMP) board working in 1*AP4 ODU1 mode



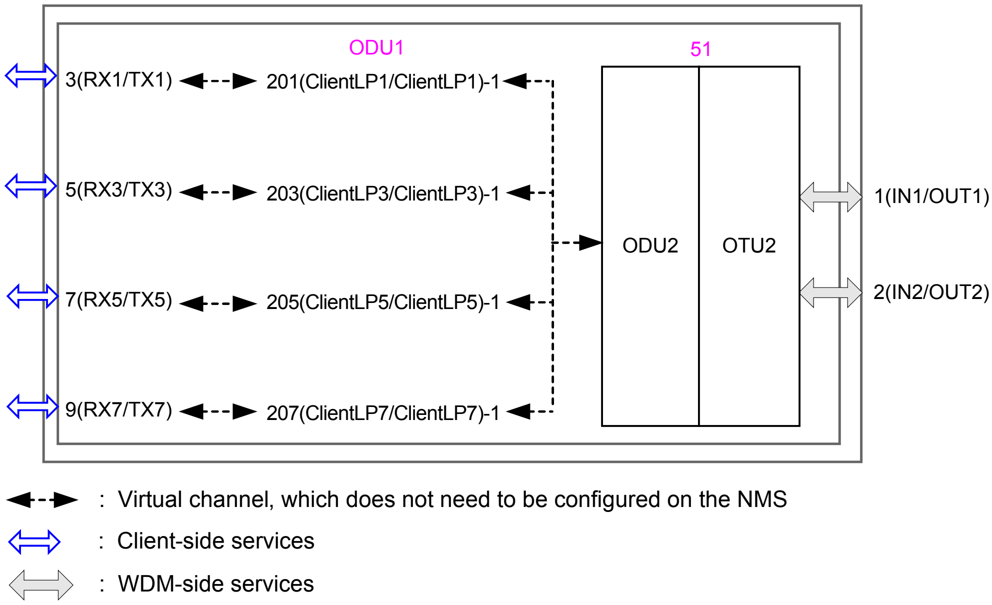
NOTE

In this scenario, the ELOM board supports the following types of services on the client side: FC200, FICON Express, CPRI option3, STM–16, and OTU1.

10.1.6.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-5 Port model for the ELOM(COMP) board working in 1*AP4 ODU1 mode



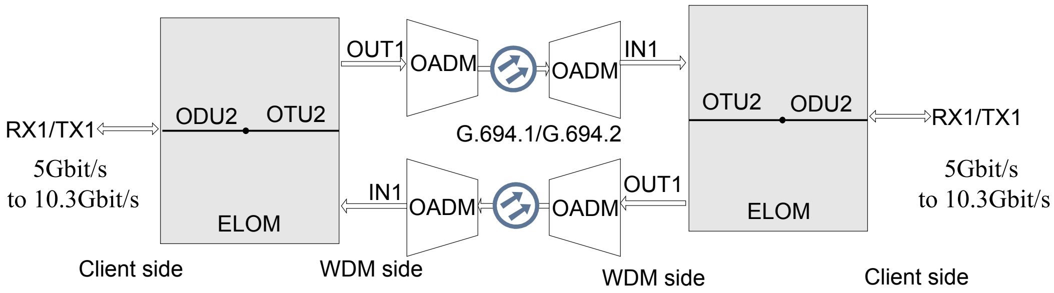
- The default services for optical ports 3 (RX1/TX1), 5 (RX3/TX3), 7 (RX5/TX5), and 9 (RX7/TX7) are **OTU1**.
- When the client services are not OTU1:
  - Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3, 5, 7, and 9 (RX1/TX1, RX3/TX3, RX5/TX5 and RX7/TX7).
  - The downstream ODU1 alarms and performance events are reported through channel 1 of logical ports 201, 203, 205, and 207.
- When the client services are OTU1:
  - The upstream OTU1 and ODU1 alarms and performance events are reported through channel 1 of client-side optical ports 3, 5, 7, and 9 (RX1/TX1, RX3/TX3, RX5/TX5 and RX7/TX7).
  - The downstream ODU1 alarms and performance events are reported through channel 1 of logical ports 201, 203, 205, and 207.
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channels 1 and 2 of logical port 51.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

10.1.7 ELOM(COMP) Scenario 3: 1*AP1 ODU2 Mode

10.1.7.1 Application

The ELOM board maps a maximum of one channel of Any service signals at a rate in the range of 5 Gbit/s to 10.3 Gbit/s into one ODU2 channel, and then converges the signals into one channel of OTU2 optical signal. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-6**.

Figure 10-6 Application of the ELOM(COMP) board working in 1*AP1 ODU2 mode



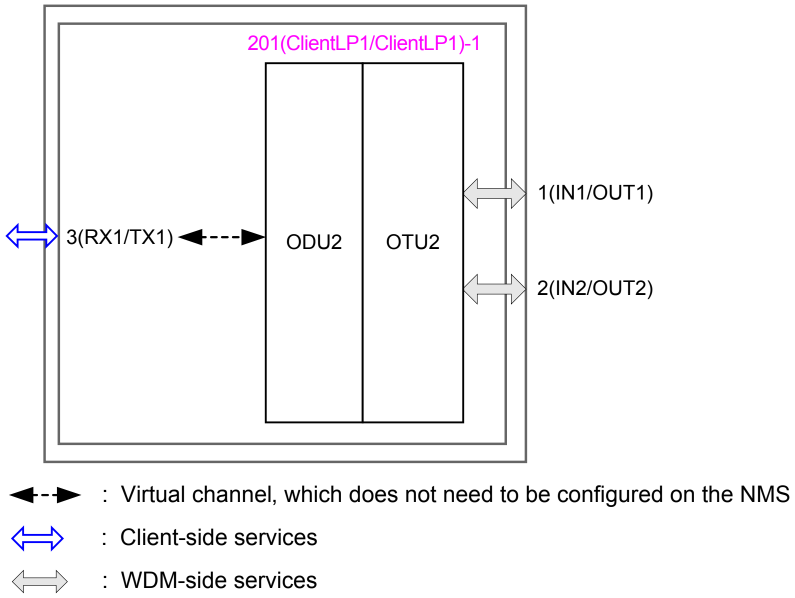
NOTE

In this scenario, the ELOM board supports the following types of services on the client side: 10GE LAN and FC800.

10.1.7.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-7 Port model for the ELOM(COMP) board working in 1*AP1 ODU2 mode



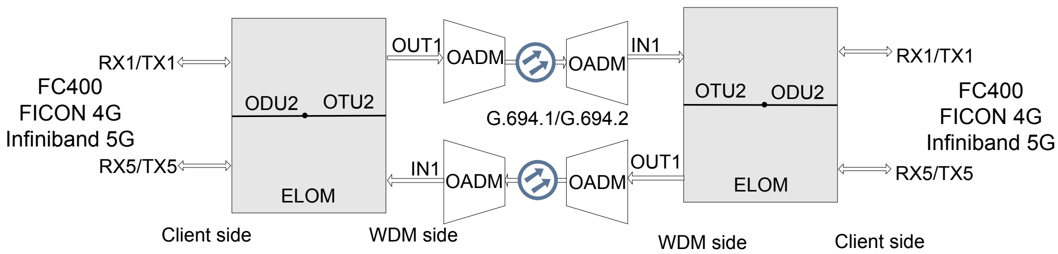
- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical port 3 (RX1/TX1).
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through logical port 201.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

10.1.8 ELOM(COMP) Scenario 4: 1*AP2 ODU2 Mode

10.1.8.1 Application

The ELOM board converges two channels of FC400 service signals into one ODU2 channel, and then converges signals into one channel of OTU2 optical signals. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-8**.

Figure 10-8 Application of the ELOM(COMP) board working in 1*AP2 ODU2 mode



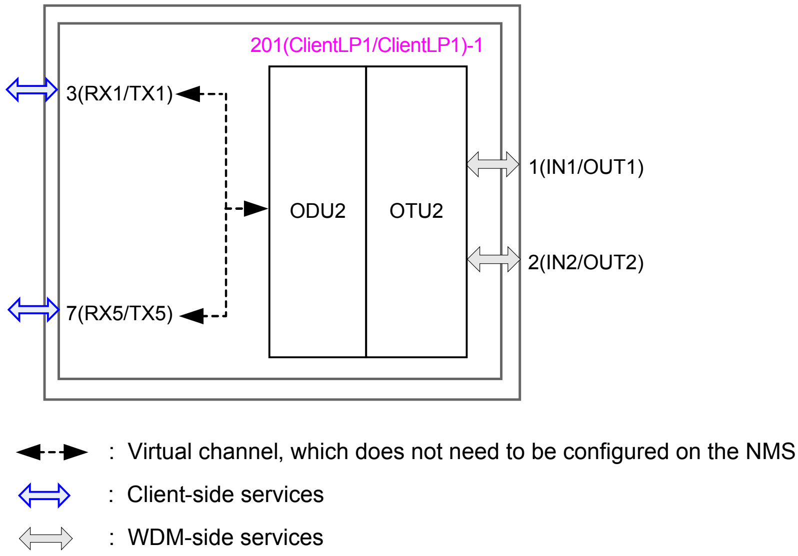
NOTE

In this scenario, the ELOM board supports the following types of services on the client side: FC400, FICON 4G, and Infiniband 5G.

10.1.8.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-9 Port model for the ELOM(COMP) board working in 1*AP2 ODU2 mode



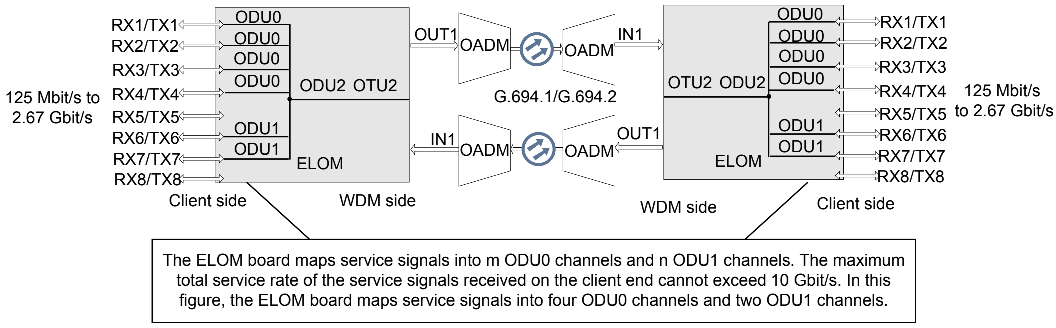
- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3 and 7 (RX1/TX1 and RX5/TX5).
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through logical port 201.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

10.1.9 ELOM(COMP) Scenario 5: 1*AP8 ODU0&ODU1 Mode

10.1.9.1 Application

The ELOM board maps a maximum of eight channels of Any service signals at a rate in the range of 125 Mbit/s to 2.67 Gbit/s into a mixture of ODU0 and ODU1 signals (or a maximum of eight ODU0 or four ODU1 channels), and then converges the signals into one channel of OTU2 optical signal. Then, the ELOM board converts the OTU2 optical signals into the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-10**.

Figure 10-10 Application of the ELOM(COMP) board working in 1*AP8 ODU0&ODU1 mode



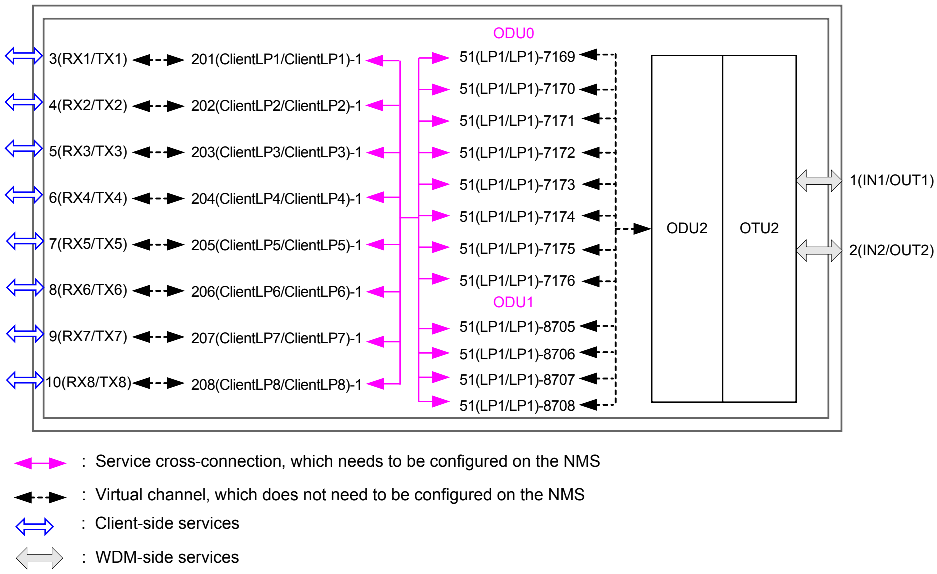
NOTE

- In this scenario, the ELOM board supports the following types of services on the client side: FE, STM–1, ESCON, STM–4, FC100, FICON, FICON EXPRESS, CPRI option2, GE, FC200, CPRI option3, STM–16, and OTU1.
- OTU1 services can only be received at the TX1/RX1, TX3/RX3, TX5/RX5, and TX7/RX7 ports.

10.1.9.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-11 Port model for the ELOM(COMP) board working in 1*AP8 ODU0&ODU1 mode



NOTE

The signals received at logical ports 201–208 can be cross-connected to any 8 channels among the 12 channels at optical port 52, but the total bandwidth cannot exceed 10.3 Gbit/s.

- Ports 201 to 208 can be set to ODU0 non-convergence mode, ODU1 non-convergence mode, or None. The default mode of ports 201, 203, 205, and 207 is ODU1 non-convergence mode. The default mode of ports 202, 204, 206, and 208 is None.

- The default services for optical ports 3 (RX1/TX1), 5 (RX3/TX3), 7 (RX5/TX5), and 9 (RX7/TX7) are **OTU1** and the default services for other ports are **None**. By default, the services at ports 201, 203, 205, and 207 are cross-connected to channels 8705 to 8708 of ODU1.
- When the client services are not OTU1:
  - Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3–10 (RX1/TX1 to RX8/TX8).
  - The downstream ODU0/ODU1 alarms and performance events are reported through channel 1 of logical ports 201 to 208.
- When the client services are OTU1:
  - The upstream OTU1 and ODU1 alarms and performance events are reported through channel 1 of client-side optical ports 3 (RX1/TX1), 5 (RX3/TX3), 7 (RX5/TX5) and 9 (RX7/TX7).
  - The downstream ODU1 alarms and performance events are reported through channel 1 of logical ports 201, 203, 205, and 207.
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channels 1 and 2 of logical port 51.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).

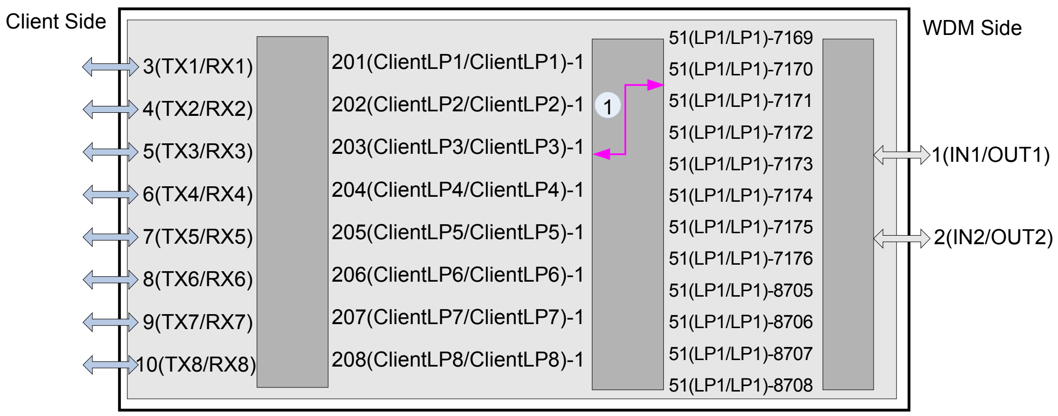
10.1.9.3 Configuration of Cross-connection

This section describes the cross-connections and provides the configuration steps for this board on the NMS.

Cross-Connections of ELOM(COMP)

When working in 1*AP8 ODU0&ODU1 mode, the ELOM board supports intra-board cross-connections of the ODU0 and ODU1 services. The board provides intra-board cross-connections of the services after required timeslots are configured. **Figure 10-12** shows an example in which intra-board cross-connections are configured on the ELOM board.

Figure 10-12 Cross-connections on the ELOM board (1*AP8 ODU0&ODU1 mode)



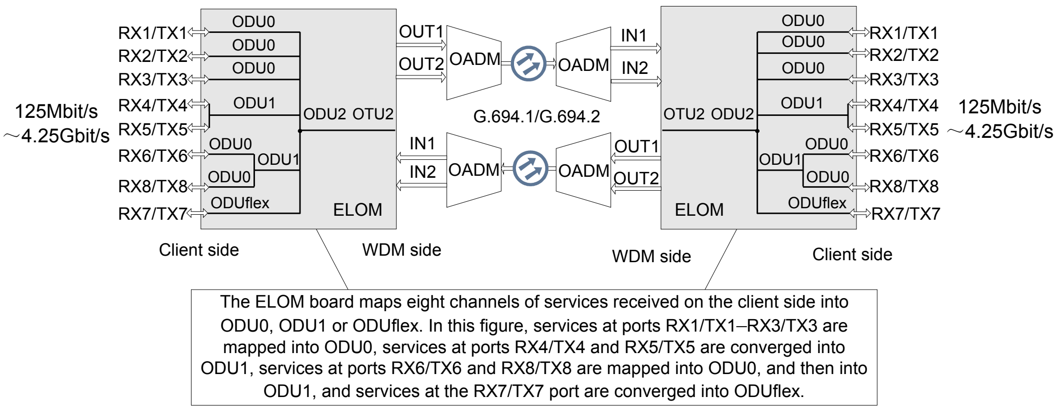
- Intra-board cross-connections
  - In 1*AP8 ODU0&ODU1 mode, ODU0 signals of logical ports 201-208 are cross-connected to channels 7169-7176 of logical ports 51, ODU1 signals of logical ports 201-208 are cross-connected to channels 8705-8708 of logical ports 51. An example is shown as 1 in **Figure 10-12**.

10.1.10 ELOM(STND) Scenario 1: 1*AP8 General Mode

10.1.10.1 Application

The ELOM board converges a maximum of eight channels of Any service signals at a rate in the range of 125 Mbit/s to 4.25 Gbit/s into the ODU0, ODU1 or ODUflex channels, and then converges the signals into one channel or two channels of OTU2 optical signals. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. See **Figure 10-13**.

Figure 10-13 Application of the ELOM(STND) board working in 1*AP8 general mode



NOTE

In this scenario, the board can work in five port modes to support various services on the client side:

- ODU0 non-convergence mode (Any->ODU0): STM–1, STM–4, FE, GE(GFP_T), GE(TTT_GMP), ESCON, FC100, FICON, DVB-ASI, CPRI option2, HD-SDI.
- ODU1 convergence mode (n*Any->ODU1): STM–1, STM–4, GE(GFP_T), FE, ESCON, FC100, FC200, FICON, FICON EXPRESS, DVB-ASI, HD-SDI, CPRI option2, CPRI option3. The total timeslots allocated for services converged into an ODU1 container cannot exceed 16.
- ODU1 non-convergence mode (OTU1/Any->ODU1): OTU1, STM–16, FC200, FICON EXPRESS, CPRI option3. OTU1 services can only be received at the TX1/RX1, TX3/RX3, TX5/RX5, and TX7/RX7 ports.
- ODUflex non-convergence mode (Any->ODUflex): FC400, FICON 4G, 3G-SDI
- None (not for ports): No service can be received.
- Ports RX1/TX1–RX8/TX8 support EVOA SFP modules.

Table 10-7 lists the mapping between the port working modes and available mapping paths when the ELOM(STND) board works in 1*AP8 general mode.

Table 10-7 Mapping between the port working modes and available mapping paths

Port Working Mode	Available Mapping Path
ODU0 non-convergence mode (Any->ODU0)	ODU0->ODU1->ODU2 ODU0->ODU2
ODU1 convergence mode (n*Any->ODU1)	ODU1->ODU2
ODU1 non-convergence mode (OTU1/Any->ODU1)	ODU1->ODU2
ODUflex non-convergence mode (Any->ODUflex)	ODUflex->ODU2

NOTE

- When intra-board 1+1 protection or ODUk SNCP protection is not configured, the client-side signals can be converged into two channels of OTU2 optical signals, WDM-side ports do not support the dual fed and selective receiving function, and the total bandwidth of services received at ports 201 (LP1/LP1) to 208 (LP8/LP8) cannot exceed 20 Gbit/s.
- When intra-board 1+1 protection or ODUk SNCP protection is configured, the client-side signals are converged into one channel of OTU2 optical signals, WDM-side ports support the dual fed and selective receiving function, and the total bandwidth of services received at ports 201 (LP1/LP1) to 208 (LP8/LP8) cannot exceed 10 Gbit/s.
- In 1*AP8 general mode, intra-board 1+1 protection is not recommended because of service configuration restrictions but ODUk SNCP protection is recommended if both ODU1 convergence mode and ODU0/ODUflex non-convergence mode are configured.

NOTE

Ports RX1/TX1-RX8/TX8 support EVOA SFP modules when the board works in 1*AP8 general mode.

Background Information

Timeslots can be set for services when the TNF2ELOM board works in 1*AP8 general mode and the ports on the board work in ODU1 convergence mode. The number of timeslots that are occupied by services varies according to service types. Each ODU1 service requires 16 timeslots; therefore, the total number of timeslots occupied by all client-side services that are converged into an ODU1 service must be 16 or smaller.

Table 10-8 lists the number of timeslots required by common services.

Table 10-8 Number of timeslots required by common services

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
GE(GFP_T)/GE (TTT-GMP)	7	FICON	6
STM-1	1	FICON EXPRESS	12

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
STM-4	4	ESCON	2
STM-16	16	DVB-ASI	2
FC200	12	SDI	3
FC100	6	HDSDI	12
FE	1	HDSDI14835	12
OTU1	16	-	-

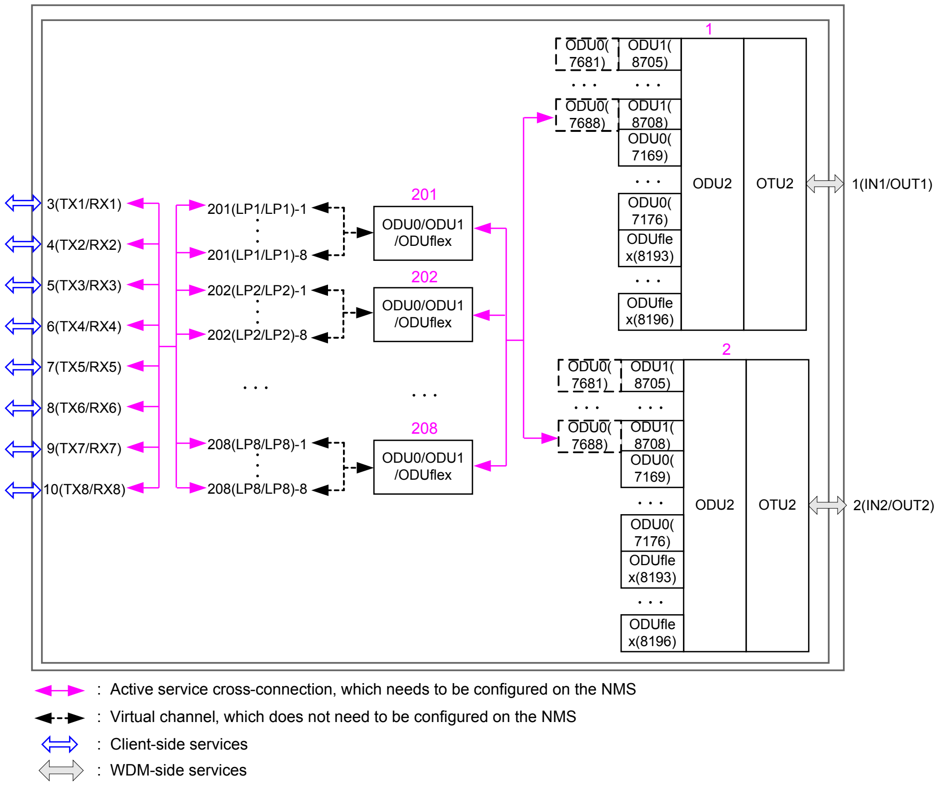
NOTE

In 1*AP8 general mode, multiple client-side services can be encapsulated into one ODU1 service, but one client-side service cannot be encapsulated into multiple ODU1 services. For example, one FC200 service occupies 12 timeslots. If four FC400 services are received on the client side, the four FC200 services can be encapsulated into only four ODU1 services but cannot be encapsulated into three ODU1 services.

10.1.10.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-14 Port model for the ELOM(STND) board working in 1*AP8 general mode



- Ports 201 to 208 can be set to ODU0 non-convergence mode, ODU1 convergence mode, ODU1 non-convergence mode, ODUflex non-convergence mode, or None. The default mode of ports 201, 203, 205, and 207 is ODU1 non-convergence mode. The default mode of ports 202, 204, 206, and 208 is None.
- After power is supplied to the board, straight-through cross-connections are configured from channel 1 at ports 3(TX1/RX1)-10(TX8/RX8) to channel 1 at ports 201-208 by default. When a port works in ODU1 convergence mode (n*Any->ODU1) mode, you can configure cross-connections from channel 1 at any port among ports 3(TX1/RX1)-10(TX8/RX8) to any of the eight channels at the port.
- OTU1 services can be received only through ports 3(TX1/RX1), 5(TX3/RX3), 7(TX5/RX5), and 9(TX7/RX7) on the client side.
  - The upstream OTU1 and ODU1 alarms and performance events are reported through channel 1 of corresponding client-side optical ports.
  - The downstream ODU1 alarms and performance events are reported through channels 8705-8708 at optical ports 1 and 2.
- When the client services are not OTU1:
  - Alarms and performance events related to client signal overheads are reported through channel 1 of corresponding client-side optical ports.
  - ODU0 alarms and performance events are reported through channels 7169-7176 or channels 7681-7688 at optical ports 1 and 2. ODU1 alarms and performance events are reported through channels 8705-8708 at optical ports 1 and 2. ODUflex alarms and performance events are reported through channels 8193-8196 at optical ports 1 and 2.
- When ODUk cross-connections are configured, the channel IDs vary according to ODUk mapping paths. The following table lists the mapping between channel IDs and mapping paths.

Mapping Path	Channel ID
ODU0->ODU1->ODU2[a]	7681-7688
ODU0->ODU2	7169-7176
ODU1->ODU2	8705-8708
ODUflex->ODU2	8193-8196
a: Eight ODU0 channels are encapsulated into four ODU1 channels in sequence with each ODU1 channel containing two ODU0 channels. For example, ODU0 channels 7681 and 7682 are encapsulated into ODU1 channel 8705 and ODU0 channels 7683 and 7684 are encapsulated into ODU1 channel 8706.	

- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).

NOTE

- When intra-board 1+1 protection or ODUk SNCP protection is not configured, the client-side signals can be converged into two channels of OTU2 optical signals, WDM-side ports do not support the dual fed and selective receiving function, and the total bandwidth of services received at ports 201 (LP1/LP1) to 208 (LP8/LP8) cannot exceed 20 Gbit/s.
- When intra-board 1+1 protection or ODUk SNCP protection is configured, the client-side signals are converged into one channel of OTU2 optical signals, WDM-side ports support the dual fed and selective receiving function, and the total bandwidth of services received at ports 201 (LP1/LP1) to 208 (LP8/LP8) cannot exceed 10 Gbit/s.

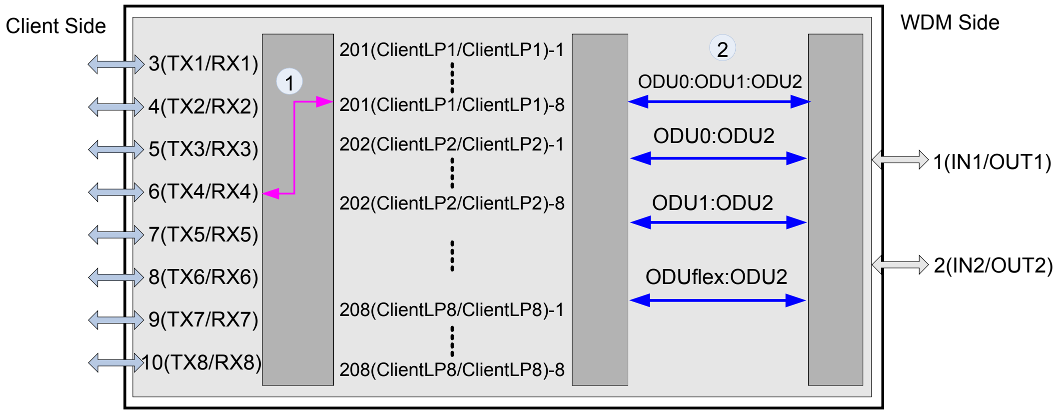
10.1.10.3 Configuration of Cross-connection

This section describes the cross-connections and provides the configuration steps for this board on the NMS.

Cross-Connections of ELOM(STND)

When working in 1*AP8 general mode, the ELOM(STND) board supports intra-board cross-connections of the received Any services, and intra-board cross-connections of the ODU0, ODU1 and ODUflex services. **Figure 10-15** show an example in which intra-board cross-connections are configured on the ELOM board.

Figure 10-15 Cross-connections on the ELOM board (1*AP8 general mode)



- Intra-board cross-connections
  - When the **Port Working Mode** is **ODU1 convergence mode**, client signals received from the port are cross-connected to channels 1-8 of logical ports 201-208. An example is shown as 1 in **Figure 10-15**.
  - ODU0, ODU1 and ODUflex services of logical ports 201-208 are cross-connected to optical ports 1 and 2. An example is shown as 2 in **Figure 10-15**.

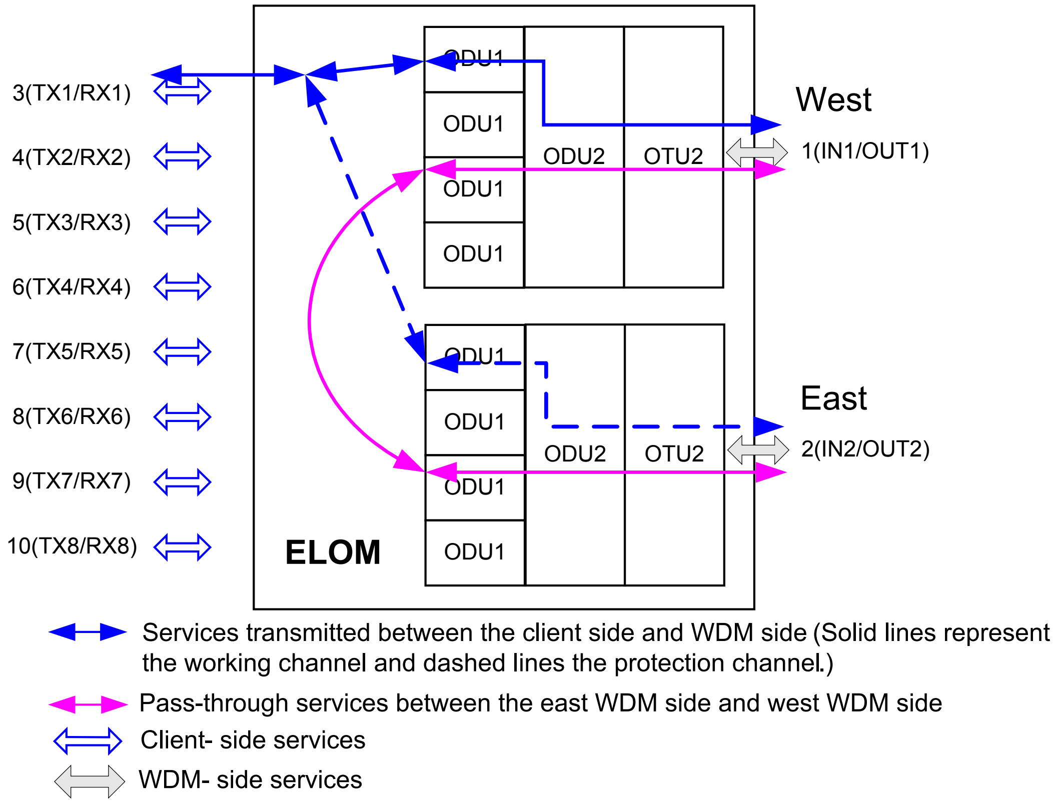
10.1.10.4 Function Overview of ODUk ADM

The ELOM board can enable ODUk services to pass through between the east WDM side and west WDM side.

In normal cases, services are transmitted between the client side and WDM side on the ELOM board, as represented by blue lines with arrows in **Figure 10-16**. The ODUk ADM function enables ODUk services to pass through between the east WDM side and west WDM side, as represented by purple lines with arrows in **Figure 10-16**.

The ELOM board supports a 10 Gbit/s pass-through capability and a 20 Gbit/s service grooming capability. The board supports pass-through of ODU0, ODU1, and ODUflex services. The following figure shows the pass-through of ODU1 services.

Figure 10-16 Schematic diagram of the ODUk ADM function



10.1.10.5 Application Scenarios of ODUk ADM

The ODUk ADM function of ELOM(STND) board can be used in two different application scenarios.

Application Scenario 1

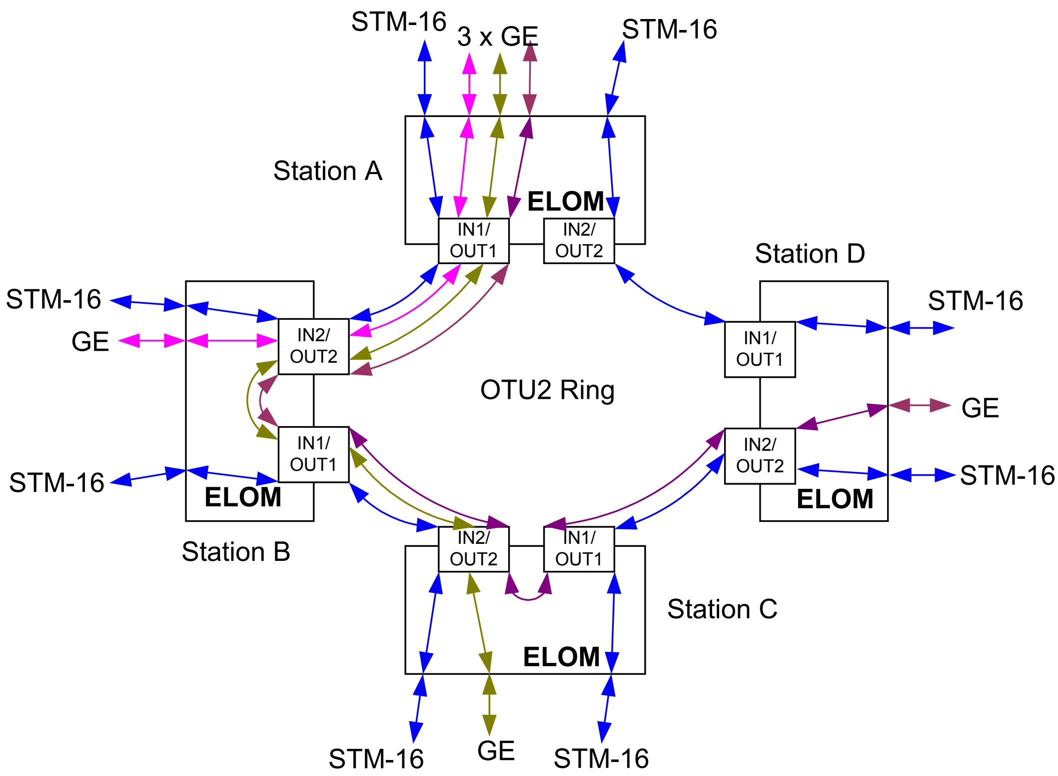
As shown in **Figure 10-17**, OptiX OSN 1800 OADM stations A, B, C, and D form a ring network. An ELOM board is configured at each station. The following services are configured:

- One STM-16 service is transmitted between stations A and B, between stations B and C, between stations C and D, and between stations D and A each.
- Three GE services are transmitted from station A to stations B, C, and D each (the signal transmission paths are respectively represented by red, yellow, and purple lines in the following figure). The GE service to station C passes through the ELOM board at station B (the signal transmission path is represented by yellow lines). The GE service to station

D passes through the ELOM boards at stations B and C (the service transmission path is represented by purple lines).

The ODUk ADM function enables ODUk services to be added, be dropped, and pass through on the ring.

Figure 10-17 Networking for application scenario 1



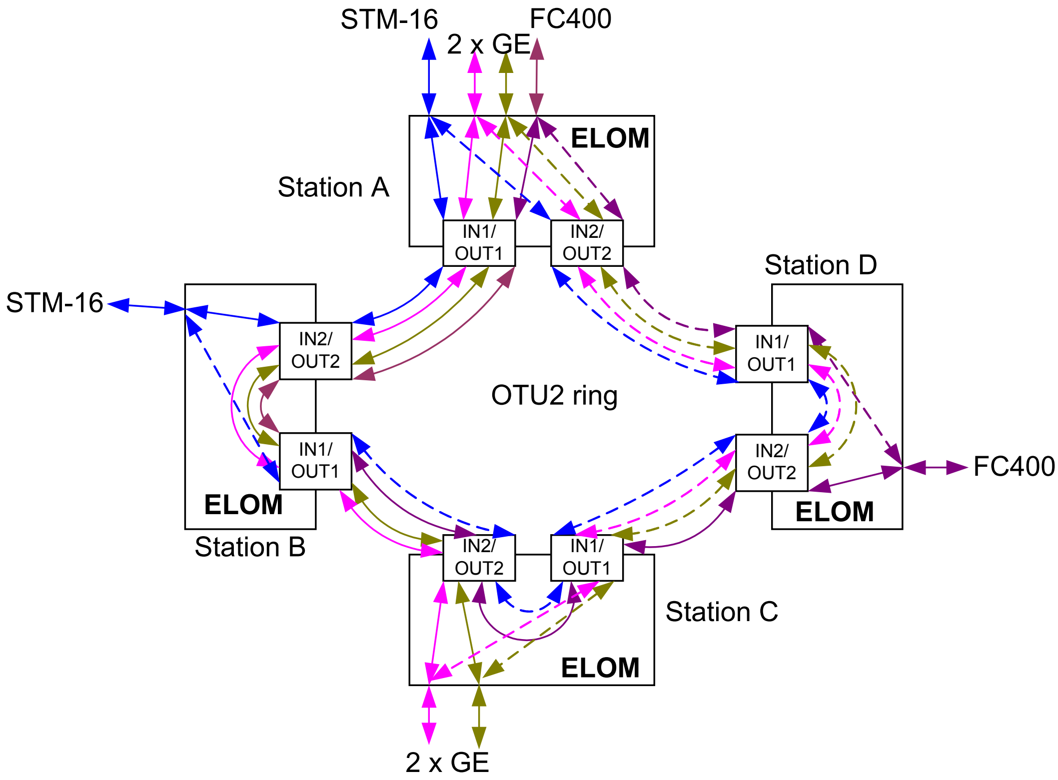
Application Scenario 2

OptiX OSN 1800 OADM stations A, B, C, and D form a ring network. An ELOM board is configured at each station. The following services are configured:

- One STM-16 service is transmitted between stations A and B, and one ODU1 SNCP protection group is configured for the service.
- Two GE services are transmitted between stations A and C, and two ODU0 SNCP protection groups are configured for the services.
- One FC400 service is transmitted between stations A and D, and one ODUflex SNCP protection group is configured for the service.

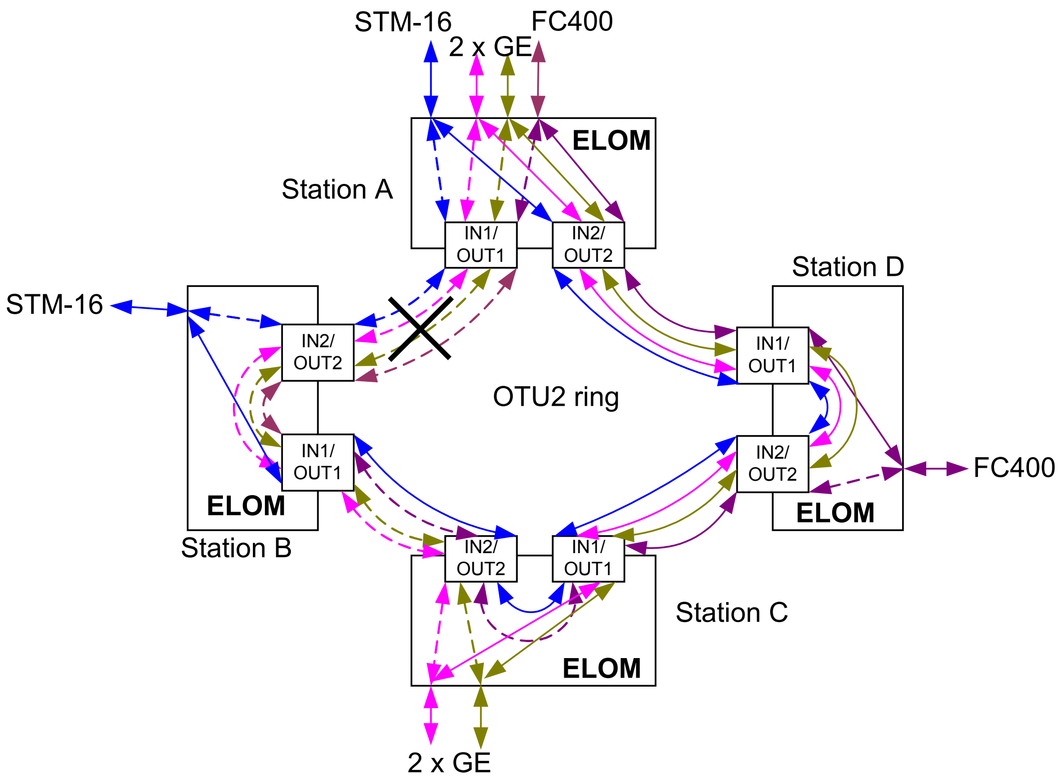
In normal cases, services between stations A, B, C, and D are carried on the working channel. In **Figure 10-18**, the solid lines indicate the working channel and the dashed lines indicate the protection channel.

Figure 10-18 Networking for application scenario 2 (normal)



When a line fault occurs between stations A and B, services at each station are switched to the protection channel, as shown in the solid lines in **Figure 10-19**.

Figure 10-19 Networking for application scenario 2 (switching)



10.1.10.6 Function Implementation of ODUk ADM

A maximum of eight ODU0 services, four ODU1 services, two ODUflex services, or a combination of these services can pass through between the east WDM side and west WDM side of the ELOM board.

This section describes how the ODUk ADM function is implemented for ODU0 services, ODU1 services, ODUflex services, or a combination of these services on an ELOM board.

ODUk ADM (ODU0 Services)

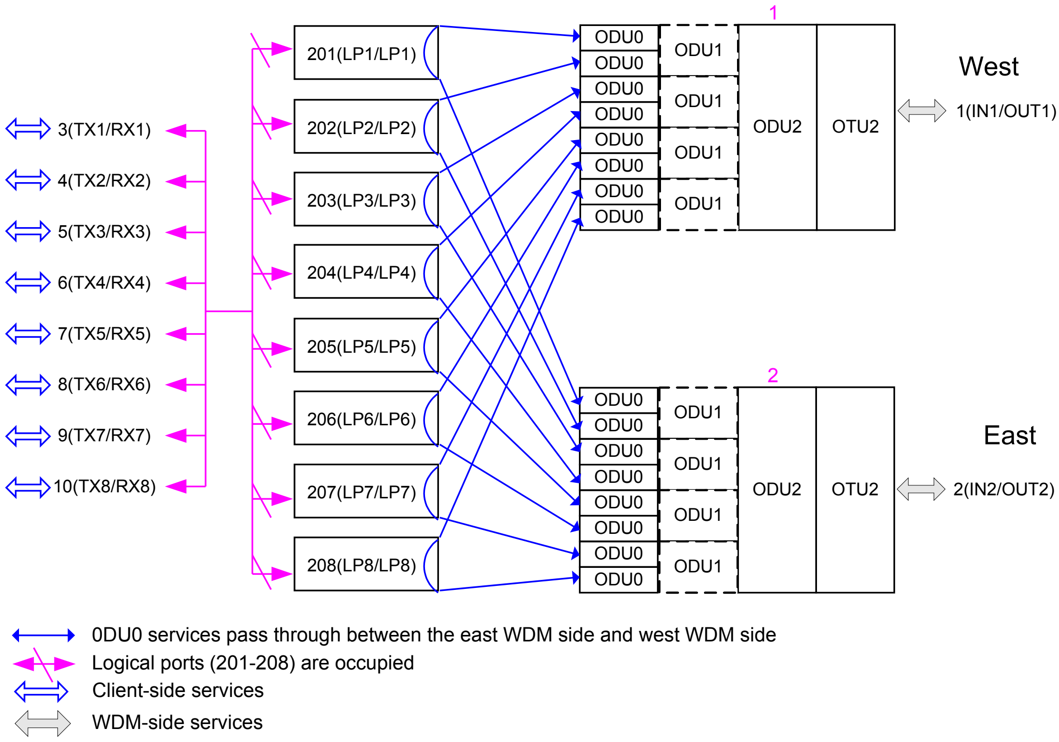
As shown in **Figure 10-20**, the first ODU0 service in the west can pass through to any ODU0 channel (the first ODU0 channel in this example) in the east using the 201 port. The reverse process (from east to west) is also supported. Similarly, the eighth ODU0 service in the west can pass through to any vacant ODU0 channel (the eighth ODU0 channel in this example) in the east using the 208 port. The reverse process (from east to west) is also supported.

Ports that have used to pass through ODU0 services cannot be used again. If fewer than eight ODU0 services need to pass through the board, vacant logical ports (201-208) can be used to transmit services between the client side and WDM side.

NOTE

The east WDM-side and west WDM-side mapping paths for a pass-through service must be the same.

Figure 10-20 ODU0 service pass-through



The eight ODU0 channels on the west WDM side correspond to logical ports (201-208). **Table 10-9** and **Table 10-10** list the mapping between the ODU0 channels and the logical ports (201-208).

Table 10-9 Mapping between ODU0 services and the required logical ports (ODU0->ODU1->ODU2)

ODU0 Channel	Logical Ports (201-208)
ODU0(7681)	201
ODU0(7682)	202
ODU0(7683)	203
ODU0(7684)	204
ODU0(7685)	205
ODU0(7686)	206
ODU0(7687)	207
ODU0(7688)	208

Table 10-10 Mapping between ODU0 services and the required logical ports (ODU0->ODU2)

ODU0 Channel	Logical Ports (201-208)
ODU0(7169)	201
ODU0(7170)	202
ODU0(7171)	203
ODU0(7172)	204
ODU0(7173)	205
ODU0(7174)	206
ODU0(7175)	207
ODU0(7176)	208

ODUk ADM (ODU1 Services)

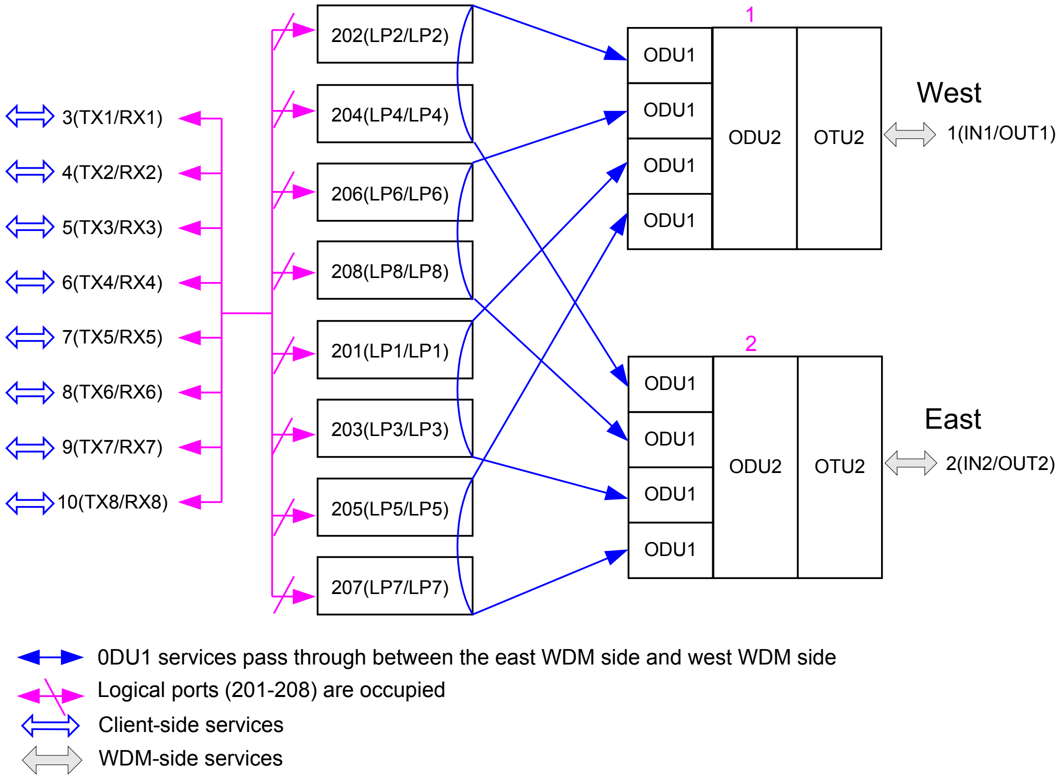
As shown in **Figure 10-21**, the first ODU1 service in the west can pass through to any ODU1 channel (the first ODU1 channel in this example) in the east using the 202 and 204 ports. The reverse process (from east to west) is also supported. Similarly, the fourth ODU1 service in the west can pass through to any vacant ODU1 channel (the fourth ODU1 channel in this example) in the east using the 205 and 207 ports. The reverse process (from east to west) is also supported.

Ports that have used to pass through ODU1 services cannot be used again. If fewer than four ODU1 services need to pass through the board, vacant logical ports (201-208) can be used to transmit services between the client side and WDM side.

NOTE

The east WDM-side and west WDM-side mapping paths for a pass-through service must be the same.

Figure 10-21 ODU1 service pass-through



The ODU1 services that pass through from the west WDM side use fixed logical ports (201-208). **Table 10-11** lists the mapping between ODU1 services and the required logical ports (201-208).

Table 10-11 Mapping between ODU1 services and the required logical ports

ODU1 Channel	Logical ports (201-208)
ODU1(8705)	202 and 204
ODU1(8706)	206 and 208
ODU1(8707)	201 and 203
ODU1(8708)	205 and 207

ODUk ADM (ODUflex Services)

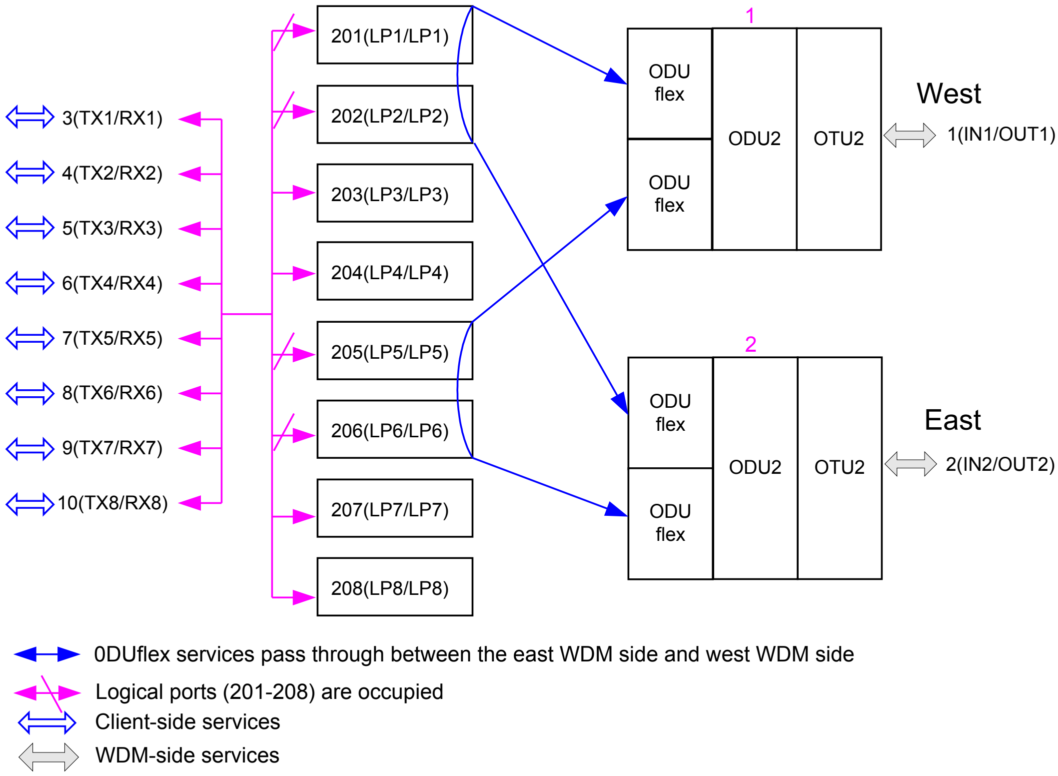
As shown in **Figure 10-22**, the first ODUflex service in the west can pass through to any ODUflex channel (the first ODUflex channel in this example) in the east using the 201 and 202 ports. The reverse process (from east to west) is also supported. Similarly, the second ODUflex service in the west can pass through to any vacant ODUflex channel (the second ODUflex channel in this example) in the east using the 203 and 204 ports. The reverse process (from east to west) is also supported.

If fewer than two ODUflex services need to pass through the board, vacant logical ports (201-208) can be used to transmit services between the client side and WDM side.

NOTE

The east WDM-side and west WDM-side mapping paths for a pass-through service must be the same.

Figure 10-22 ODUflex service pass-through



The ODUflex services that pass through from the west WDM side use fixed logical ports (201-208). **Table 10-12** lists the mapping between ODUflex services and the required logical ports (201-208).

Table 10-12 Mapping between ODUflex services and the required logical ports

ODUflex Channel	Logical ports (201-208)
ODUflex(8193)	201 and 202
ODUflex(8194)	205 and 206

ODUk ADM (ODU0&ODU1&ODUflex Services)

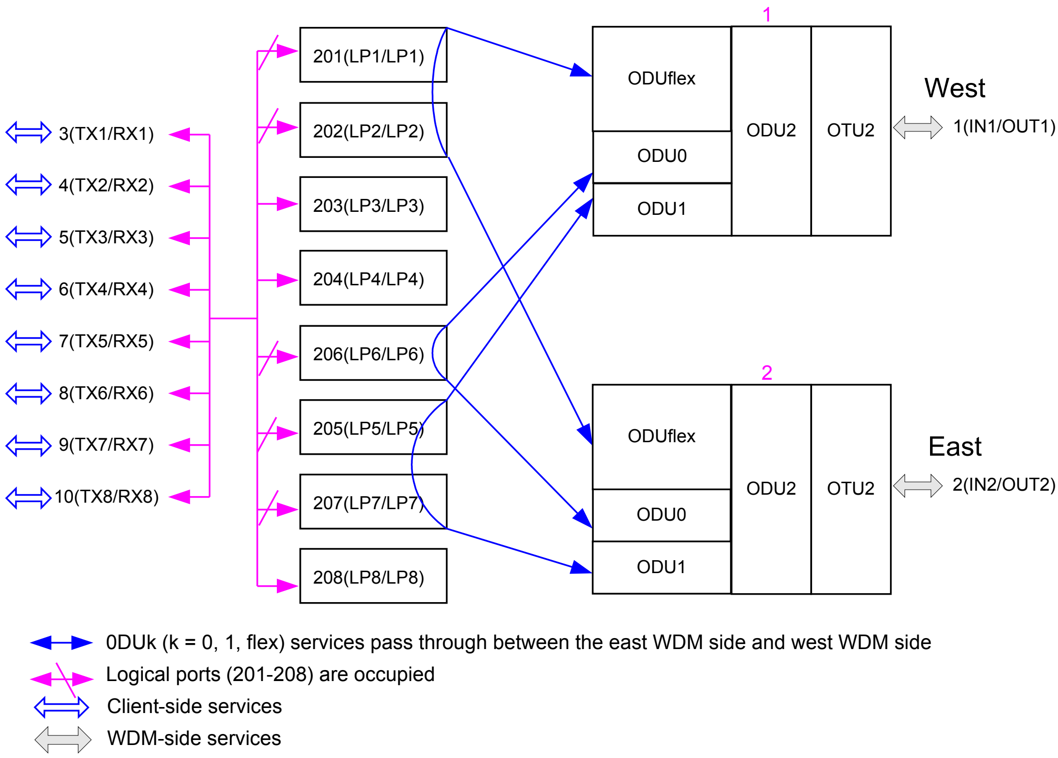
As shown in **Figure 10-23**, one ODU0 service, one ODU1 service, and one ODUflex service in the west pass through to the east WDM side in hybrid mode using the 201, 202, and 205–207 ports respectively.

In hybrid pass-through, the total ODUk capacity is smaller than 10 Gbit/s and logical ports (201-208) cannot be repeatedly used. See **Table 10-9**, **Table 10-11**, and **Table 10-12** for the mappings between the required logical ports (201-208) and ODU0 services, ODU1 services, and ODUflex services respectively.

NOTE

The east WDM-side and west WDM-side mapping paths for a pass-through service must be the same.

Figure 10-23 Hybrid pass-through of ODU0, ODU1, and ODUflex services

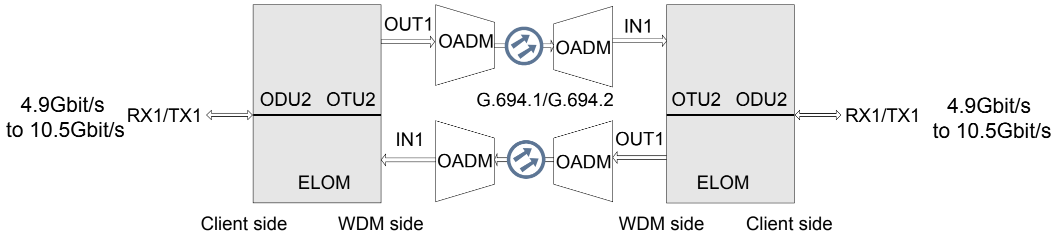


10.1.11 ELOM(STND) Scenario 2: 1*AP1 ODU2 Mode

10.1.11.1 Application

The ELOM board maps one channel of Any service signals at a rate in the range of 4.9 Gbit/s to 10.5 Gbit/s into the ODU2 channels, and then converges the signals into one channel of OTU2 optical signals. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-24**.

Figure 10-24 Application of the ELOM(STND) board working in 1*AP1 ODU2 mode



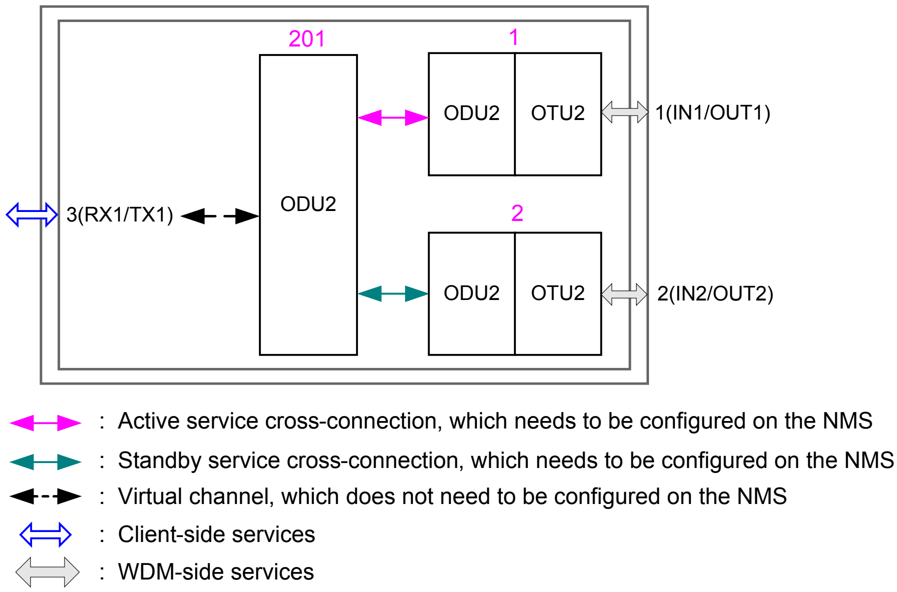
NOTE

- In this scenario, the ELOM board supports the following types of services on the client side: 10GE LAN, 10GE WAN, STM–64, FC800, FICON 8G, FC1200, FICON 10G, CPRI option6, and CPRI option7.
- The services can only be received at the TX1/RX1 ports.
- Ports RX7/TX7 and RX8/TX8 support EVOA SFP modules.

10.1.11.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-25 Port model for the ELOM(STND) board working in 1*AP1 ODU2 mode



- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3 (RX1/TX1).
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).

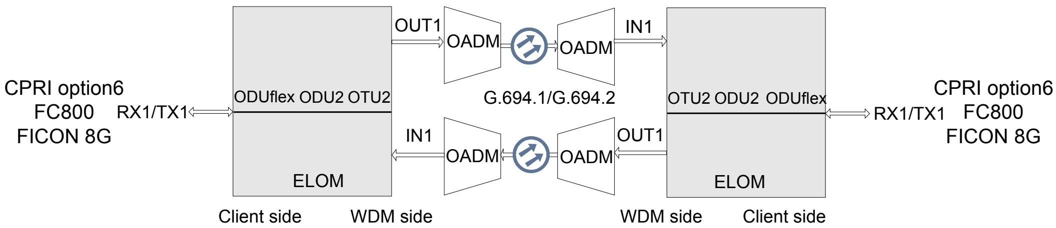
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Intra-board 1+1 protection or ODU2 SNCP protection can be configured on the WDM side.

10.1.12 ELOM(STND) Scenario 3: 1*AP1 ODUflex Mode

10.1.12.1 Application

The ELOM board maps one channel of CPRI option6, FC800 or FICON 8G service signals into the ODUflex channels, and then converges the signals into one channel of OTU2 optical signals. Then, the ELOM board converts the OTU2 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELOM board also performs the reverse process. The WDM-side port of the ELOM board supports the dual feeding and selective receiving function. See **Figure 10-26**.

Figure 10-26 Application of the ELOM(STND) board working in 1*AP1 ODUflex mode



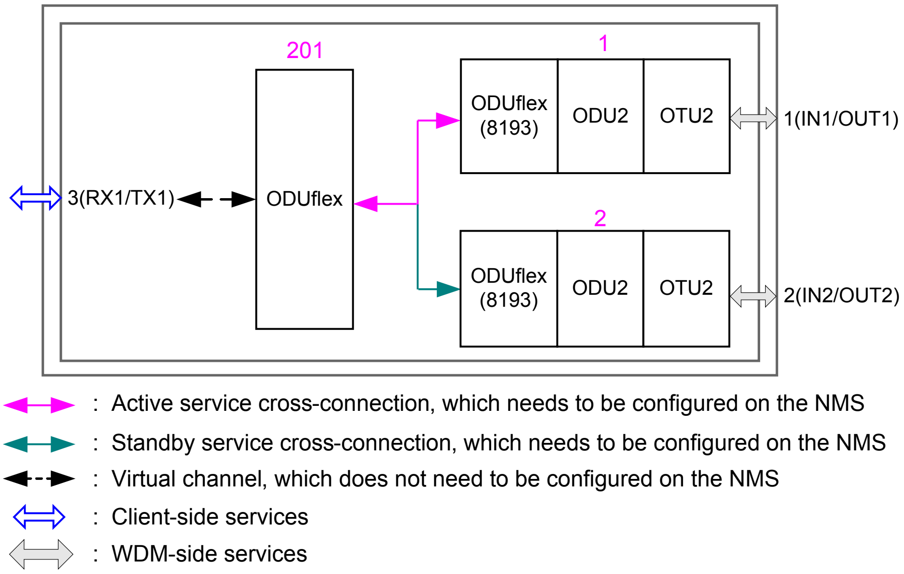
NOTE

- In this scenario, the ELOM board supports the following types of services on the client side: FC800, FICON 8G, and CPRI option6.
- The services can only be received at the TX1/RX1 ports.
- Ports RX7/TX7 and RX8/TX8 support EVOA SFP modules.

10.1.12.2 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Figure 10-27 Port model for the ELOM(STND) board working in 1*AP1 ODUflex mode



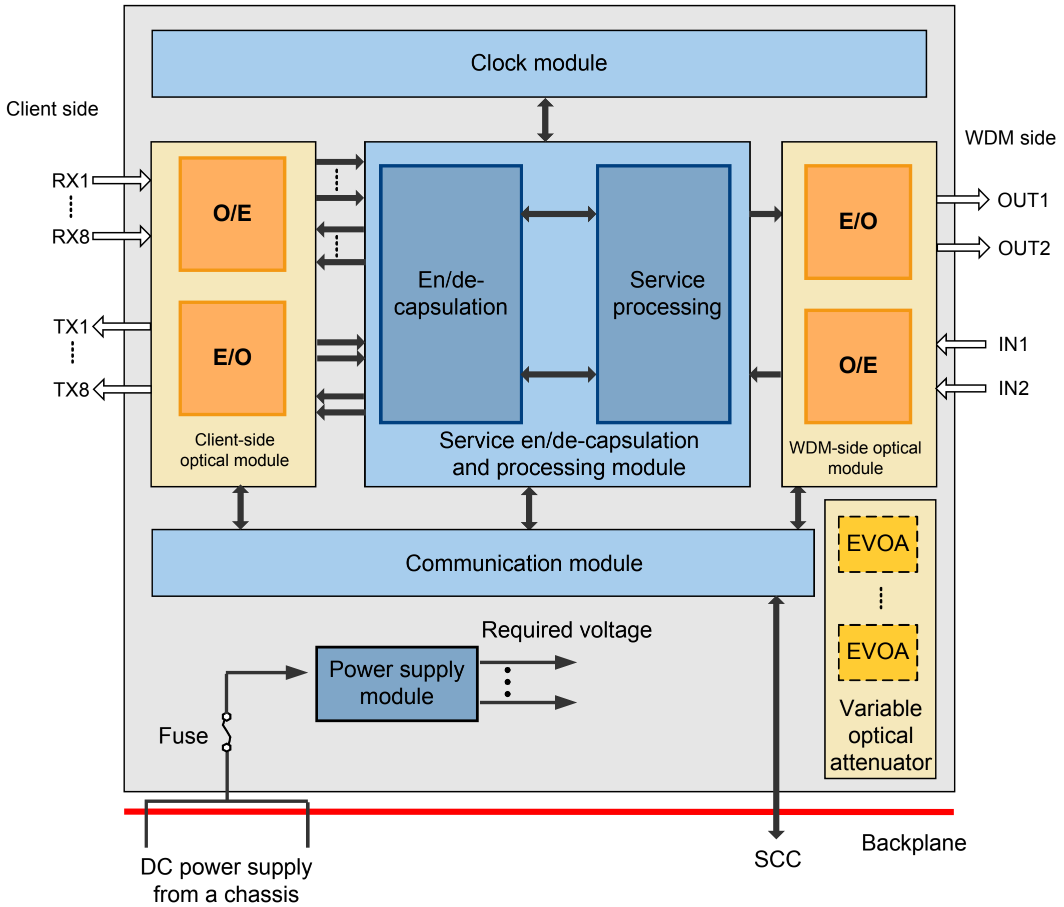
- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3 (RX1/TX1).
- Alarms and performance events related to OTU2/ODU2 electrical-layer overheads are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Alarms and performance events related to ODUflex electrical-layer overheads are reported through channel 8193 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Intra-board 1+1 protection or ODUflex SNCP protection can be configured on the WDM side.

10.1.13 Working Principle and Signal Flow

The ELOM board consists of the client-side optical module, the WDM-side optical module, the service en/de-capsulation and processing module, the clock module, the variable optical attenuator, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Figure 10-28 is the functional block diagram of the ELOM board that realize the convergence of eight channels of signals at any rate.

Figure 10-28 Functional block diagram of the ELOM board



NOTE

The variable optical attenuators are only supported by the ELOM(STND).

In the signal flow of the ELOM board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the ELOM to the WDM side of the ELOM, and the receive direction is defined as the reverse direction.

- Transmit direction

  The client-side optical module receives optical signals from client side equipment through the RX1 - RX8 optical ports, and performs O/E conversion.

  After conversion, the eight channels of electrical signals are sent to the service en/decapsulation and processing module. The module performs processes such as multiplexing, clock generating and frame processing. Then, the module outputs one channel of OTU2 or OTU2e electrical signals.

  The OTU2 or OTU2e electrical signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths OTU2/OTU2e optical signals. The optical signals are output through the OUT1 and OUT2 optical ports.

- Receive direction

The WDM-side optical module receives the G.694.1-compliant or G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as decapsulation, clock recovery and demultiplexing. Then, the module outputs eight channels of electrical signals at any rate.

The client-side optical module performs E/O conversion and the client-side electrical module performs level conversion of the eight channels of electrical signals, and then outputs eight channels of client-side optical signals and electrical signals through the TX1 - TX8 optical ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical ports.
  - Reports the working state of the client-side laser.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs the O/E conversion of OTU2/OTU2e optical signals.
  - WDM-side transmitter: Performs the E/O conversion from the internal electrical signals to OTU2/OTU2e optical signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module

  The module consists of the service en/de-capsulation module and the service processing module. It realizes the en/de-capsulation of signals in any format and service convergence.

  - Service en/de-capsulation module: Processes the overheads of signals in any format, and reports the performance monitoring state of service signals.
  - Service processing module: Achieves the multiplexing from signals in any format to signals in OTU2 format and the demultiplexing from signals in OTU2 format to signals in any format, and performs processes such as encapsulation/decapsulation of FEC, encoding/decoding and scrambling/descrambling.
- Clock module
  - Provides a clock for the board and realizes clock transparent transmission.
- Variable optical attenuator (can be selected)
  - Adjust the transmission optical power or receive optical power.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.

- Power supply module
  - Converts the DC power into the power required by each module of the unit.

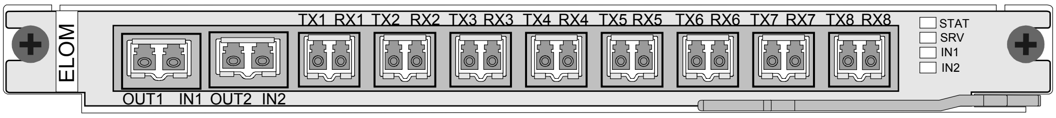
10.1.14 Front Panel

There are indicators and interfaces on the ELOM front panel.

Appearance of the Front Panel

Figure 10-29 shows the front panel of the ELOM.

Figure 10-29 Front panel of the ELOM



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Interfaces

Table 10-13 lists the type and function of each interface.

Table 10-13 Types and functions of the ELOM interfaces

Interface	Interface Type	Function
IN1/OUT1 to IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
TX1/RX1 to TX8/RX8	LC	Transmits/receives service signals to client-side equipment.
NOTE When the ELOM(STND) board works in 1*AP8 general mode, the EVOA SFP modules can be used in RX1/TX1 - RX8/TX8 ports, when the ELOM(STND) board works in 1*AP1 ODU2 mode and 1*AP1 ODUflex mode, the EVOA SFP modules can be used in RX7/TX7 and RX8/TX8 ports.		

NOTE

- FE electrical ports can use only crossover cables.

NOTE

The RX1/TX1-RX8/TX8 interfaces on the client side support the optical interface SFP module, electrical interface SFP module, and single-fiber bidirectional GE SFP module. The preceding SFP modules can be used on the client side at the same time. The interfaces on the client side can access Any optical signals, GE/FE electrical signals, or GE optical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.1.15 Valid Slots

The ELOM occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT 1, SLOT 3, and SLOT 4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT 1 to SLOT 6. To ensure board performance, it is recommended that the ELOM board be inserted into SLOT1, SLOT3 or SLOT5.

NOTE

A DC-powered OptiX OSN 1800 II chassis can accommodate at most five ELOM boards when it is equipped with ODUk SNCP protection. It can accommodate up to six ELOM boards when it is unequipped with ODUk SNCP protection.

An AC-powered OptiX OSN 1800 II chassis can accommodate at most three ELOM boards.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.1.16 ELOM Parameters on the NMS

Precautions

CAUTION

If you delete a logical ELOM board and configure it again on the NMS, the original configuration of the board is deleted and the default configuration is restored.

Parameter Description

Field	Value	Description
Board Working Mode	ELOM(COMP): - 1*AP8 ODU1 mode, 1*AP4 ODU1 mode, 1*AP1 ODU2 mode, 1*AP2 ODU2 mode, 1*AP8 ODU0&ODU1 mode - Default: 1*AP4 ODU1 mode ELOM(STND): - 1*AP8 general mode, 1*AP1 ODU2 mode, 1*AP1 ODUflex mode - Default: 1*AP8 general mode	ELOM(COMP): - **1*AP8 ODU1 mode**: The ELOM board supports ODU1 service encapsulation and the received client services can be mapped into one ODU1 service. - **1*AP4 ODU1 mode**: The ELOM board supports ODU1 service encapsulation but the received client services must be mapped into different ODU1 services. - **1*AP1 ODU2 mode**: The ELOM board supports access of one client service and maps the client service into one ODU2 service. - **1*AP2 ODU2 mode**: The ELOM board supports access of two client services and maps the two client services into one ODU2 service. - **1*AP8 ODU0&ODU1 mode**: The ELOM board supports access of eight client services and maps the eight client services into ODU0 and ODU1 service. ELOM(STND): - **1*AP8 general mode**: The ELOM board supports ODU0, ODU1 and ODUflex service encapsulation. - **1*AP1 ODU2 mode**: The ELOM board supports ODU2 service encapsulation. - **1*AP1 ODUflex mode**: The ELOM board supports ODUflex service encapsulation.

Field	Value	Description
		NOTE Before changing the **Board Working Mode**, ensure that no cross-connection is configured on the board. If a cross-connection is configured on the board, delete the cross-connection before you change the working mode of the board. **CAUTION** The signal flow and functions of the ELOM board vary according to the working modes. Switching between different working modes will interrupt services that are running in the current working mode.

Field	Value	Description
Port Working Mode	ELOM(COMP): ● ODU1 non-convergence mode (OTU1/Any->ODU1), ODU0 non-convergence mode (Any->ODU0), None (Not for Ports) ● The default mode of ports 201, 203, 205, and 207 is ODU1 non-convergence mode (OTU1/Any->ODU1). The default mode of ports 202, 204, 206, and 208 is None (not for ports). ELOM(STND): ● ODU0 non-convergence mode (Any->ODU0), ODU1 convergence mode (n*Any->ODU1), ODU1 non-convergence mode (OTU1/ Any->ODU1), ODUflex non-convergence mode (Any->ODUflex), None (Not for Ports) ● The default mode of ports 201, 203, 205, and 207 is ODU1 non-convergence mode (OTU1/Any->ODU1). The default mode of ports 202, 204, 206, and 208 is None (not for ports).	For ELOM(COMP), this parameter is valid when **Board Working Mode** is set to **1*AP8 ODU0&ODU1 mode**. ● ODU1 non-convergence mode (OTU1/Any->ODU1): client services are mapped into ODU1 services. ● ODU0 non-convergence mode (Any->ODU0): client services are mapped into ODU0 services. ● None (Not for Ports): reserved mode. For ELOM(STND), this parameter is valid when **Board Working Mode** is set to **1*AP8 general mode**. ● ODU0 non-convergence mode (Any->ODU0): client services are mapped into different ODU0 services. ● ODU1 convergence mode (n*Any->ODU1): client services are mapped into one ODU1 services. ● ODU1 non-convergence mode (OTU1/Any->ODU1): client services are mapped into different ODU1 services. ● ODUflex non-convergence mode (Any->ODUflex): client services are mapped into different ODUflex services. ● None (Not for Ports): reserved mode. **NOTE** Before changing the **Port Working Mode**, ensure that no cross-connection is configured on the board. If a cross-connection is configured on the board, delete the cross-connection before you change the working mode of the port.

Field	Value	Description
Cross-Connection Configuration Mode	• Automatic, Manual • Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection or no protection is configured for the board, set this parameter to **Manual**. **NOTE** This parameter is only supported by the ELOM(STND). **CAUTION** When the **ODU Timeslot Configuration Mode** is set to **Assign consecutive**, the **Cross-Connection Configuration Mode** must be set to **Manual**.

Field	Value	Description
Service Type	ELOM(COMP): ● None, FE, GE(TTT-GMP), GE (GFP-T), 10GE_LAN, FC-100, FC-200, FC-400, FC-800, Infiniband 2.5G, Infiniband 5G, CPRI2, CPRI3, STM-1, STM-4, STM-16, FICON, FICON EXPRESS, ESCON, OTU-1 ● Default: – When the board works in **1*AP4 ODU1 mode** or **1*AP8 ODU0&ODU1 mode**, the default service type for optical ports 3 (RX1/TX1), 5 (RX3/TX3), 7 (RX5/TX5) and 9 (RX7/TX7) is **OTU-1**, the default service type for other optical ports is **None**. – When the board works in **1*AP8 ODU1 mode**, **1*AP1 ODU2 mode** or **1*AP2 ODU2 mode**, the default service type for all the optical ports is **None**. ELOM(STND): ● None, FE, GE(TTT-GMP), GE (GFP-T), 10GE_LAN, FC-100, FC-200, FC-400, FICON 4G, FC-800, FICON 8G, CPRI2, CPRI3, 10GE WAN, STM-64, OC-192, DVB-ASI, HD-SDI, 3G-SDI, CPRI6, CPRI7, FC1200, FICON 10G, STM-1, OC-3, STM-4, OC-12, STM-16, OC-48, FICON, FICON EXPRESS, ESCON, OTU-1 ● Default: – When the board works in **1*AP8 general mode**, the default service type for optical ports 3 (RX1/TX1), 5 (RX3/TX3), 7 (RX5/TX5) and 9 (RX7/TX7) is **OTU-1**, the default service type for other optical ports is **None**. – When the board works in **1*AP1 ODU2 mode** or **1*AP1 ODUflex mode**, the default	The **Service Type** parameter sets the type of the service accessed at the optical interface on the client side. In case of GE services, select a proper service type according to the source of the GE services. ● When a board is used to transmit synchronous Ethernet services, this parameter must be set to **GE(TTT-GMP)**. ● When a board is used to transmit ordinary Ethernet services, this parameter must be set to **GE(GFP_T)**. NOTE ● After you configure a cross-connection for the board, setting the **Service Type** field fails if the service type selected during cross-connection configuration is different from the value you set for **Service Type**. In this case, you need to delete the cross-connection and set the **Service Type** field again. ● The service type supported by the ELOM board varies according to the value of Working Mode. ● Only the ELOM(COMP) board supports Infiniband 2.5G and Infiniband 5G services and only the ELOM(STND) board supports 10GE WAN, STM-64, FC1200, FICON 10G, FICON 8G, FICON 4G, DVB-ASI, HD-SDI, 3G-SDI, CPRI6 and CPRI7 services. NOTE ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.

Field	Value	Description
	service type for all the optical ports is **None**.	
Port Mapping	Bit Transparent Mapping (11.1 G), MAC Transparent Mapping (10.7 G) Default: Bit Transparent Mapping (11.1 G)	This parameter is valid when **Service Type** is set to **10GE LAN**. - When a board is used to transparently transmit synchronous Ethernet services, this parameter must be set to **Bit Transparent Mapping (11.1 G)**. - Select **Bit Transparent Mapping (11.1 G)** when there are OTU2e signals on the WDM side. - Select **MAC Transparent Mapping (10.7 G)** when there are OTU2 signals on the WDM side. **NOTE** - Port mapping of the two boards that are interconnected with each other must be consistent.
Channel Use Status	Used, Unused Default: Used	- Set this parameter to **Unused** when a channel that is not used. - Set this parameter to **Used** when a channel that is used. For example, if the ELOM board works in 1*AP2 ODU2 mode, set the status of the TX1/RX1 optical port to **Used** and the status of the TX5/RX5 optical port to **Unused** when only the TX1/RX1 optical port receives services.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled	- The default value is recommended. - On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.

Field	Value	Description
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect. **NOTE** This parameter is only supported by the ELOM(STND).
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	The default value is recommended. In practical application, set this parameter according to the scenario where the board is used. **CAUTION** When NEs communicate with each other through the electric supervisory channel (ESC) of ELOM, the NEs will be unreachable if all the lasers at ports IN1/OUT1 and IN2/OUT2 on the WDM side of the ELOM board are disabled.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
FEC Mode	FEC, AFEC Default: FEC	This parameter is available only when you set **FEC Working State** to **Enabled**. ● The default value is recommended. To improve the error correction capability, set this parameter to **AFEC**. ● **FEC Mode** of the two boards that are interconnected on the WDM side must be consistent. Otherwise, services are interrupted. **NOTE** The actual value is **AFEC-2**, but **AFEC** is displayed on the NMS.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.

Field	Value	Description
Optical Interface Attenuation Ratio (dB)	0 to 20 Default: 20	parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range. **NOTE** This parameter is only supported by the ELOM(STND).
Max. Attenuation Ratio (dB)	20 Default: 20	parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board. **NOTE** This parameter is only supported by the ELOM(STND).
Min. Attenuation Ratio (dB)	0 Default: 0	parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board. **NOTE** This parameter is only supported by the ELOM(STND).
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid only when **Service Type** is set to **10GE LAN**, and when **Port Mapping** is set to **MAC Transparent Mapping (10.7 G)**. It is recommended that you use the default value.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.

Field	Value	Description
LPT Enabled	Enabled, Disabled Default: Disabled	The board supports the LPT function only when **Service Type** is set to **FE**, **GE(TTT-GMP)**, **GE(GFP-T)** or **10GE LAN**. ● The LPT function can work only with intra-board 1+1 protection or ODUk SNCP protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
ODU Timeslot Configuration Mode	Assign random, Assign consecutive Default: Assign random	● In **Assign consecutive** mode, the service mapping path can be as follows: ODU0 –> ODU1 –> ODU2 or ODU1–>ODU2. ● In **Assign random** mode, the service mapping path can be as follows: ODU0–>ODU2 or ODUflex–>ODU2. **NOTE** This parameter is supported only when the ELOM(STND) board works in **1*AP8 general mode**. **CAUTION** When the **Cross-Connection Configuration Mode** is set to **Automatic**, the **ODU Timeslot Configuration Mode** must be set to **Assign random**.

Field	Value	Description
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **NOTE** This parameter is only supported by the ELOM(STND). **CAUTION** The settings of **GCC Receive/ Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./optical port wavelength/frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./optical port wavelength/frequency, for example, C/ 11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.

Field	Value	Description
Optical Interface/ Channel	-	-

10.1.17 ELOM Specifications

Specifications include optical specifications, mechanical specifications, and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
ELOM(COMP)	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1400ps/nm-fixed-APD-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2 10G BASE-SR 10G BASE-LR FC400 Multi-mode FC400 Single-mode Multi-rate-10km-SFP+ Multi-rate-40km-SFP+ CPRI option6-2km CPRI option6-10km 3G-SDI EVOA	GE electrical module FE electrical module	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 1400ps/nm-fixed-APD-XFP

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
ELOM(STND)	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2 10G BASE-SR 10G BASE-LR FC400 Multi-mode FC400 Single-mode Multi-rate-10km-SFP+ Multi-rate-40km-SFP+ CPRI option6-2km CPRI option6-10km 3G-SDI EVOA	GE electrical module FE electrical module	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 1400ps/nm-fixed-APD-XFP

NOTE

The ports on the WDM side support gray optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-14 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-15 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	**1600ps/nm-fixed-APD-XFP**
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-16 Specifications of 1400ps/nm-fixed-APD-XFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	4 (1471 nm to 1571 nm) 3 (1591 nm to 1611 nm)
Minimum mean launched power	dBm	0
Minimum extinction ratio	dB	8.2
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	±6.5
Maximum -20 dB spectral width	nm	1
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	Compliant with Telcordia GR-253/ IEEE802.3ae/G.959
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1460 to 1620
Receiver sensitivity	dBm	-23 (1471 nm to 1551 nm) -22 (1571 nm) -21 (1591 nm to 1611 nm)
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-17 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-18 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	**800ps/nm-fixed-PIN-eSFP**
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-19 Specifications of 1400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-eSFP
Maximum wavelength count	-	8
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	8
Minimum mean launched power	dBm	3
Minimum extinction ratio	dB	5
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	≤±6.5
Maximum -20 dB spectral width	nm	1

Item	Unit	Value
		1400ps/nm-fixed-APD-eSFP
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	G.959.1-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1450 to 1620
Receiver sensitivity (with FEC)	dBm	-25.5
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-20 Specifications of 10G BASE-SR/10G BASE-LR optical modules

Item	Unit	Value	
Supported optical interface type	-	10G BASE-SR	10G BASE-LR
Line code format	-	NRZ	NRZ
Light source type	-	Multi-mode	SLM
Target distance	km	0.3	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	840 to 860	1290 to 1330
Maximum mean launched power	dBm	-1	0.5
Minimum mean launched power	dBm	-7.3	-8.2
Minimum extinction ratio	dB	3	3.5
Eye pattern mask	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN

Item	Unit	Value	
Operating wavelength range	nm	840 to 860	1290 to 1330
Receiver sensitivity	dBm	-11.1	-14.4
Minimum receiver overload	dBm	-1	0.5
Maximum reflectance	dB	-12	-12

Table 10-21 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-22 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-23 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-24 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-25 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	**L-4.1**	**L-4.2**
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-26 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	**S-1.1**	**L-1.1**	**L-1.2**
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Table 10-27 Specifications of FC400 Multi-mode and FC400 Single-mode optical modules

Item	Unit	Value	
		FC400 Multi-mode	FC400 Single-mode
Line code format	-	8B/10B	8B/10B
Target distance	km	0.3	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	830 to 860	1270 to 1355
Maximum mean launched power	dBm	-1.1	-1
Minimum mean launched power	dBm	-9	-8.4
Maximum -20 dB spectral width	nm	NA	NA
Minimum side mode suppression ratio	dB	NA	NA
Eye pattern mask	-	FC-PI-2-compliant	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	770 to 860	1260 to 1600
Receiver sensitivity	dBm	-15	-18
Minimum receiver overload	dBm	0	0
Maximum reflectance	dB	-12	-12

Table 10-28 Specifications of Multi-Rate-SFP+ (with CDR) optical module

Item	Unit	Value	
		Multi-Rate-10km-SFP+	Multi-Rate-40km-SFP+
Rate	Gbit/s	9.95 to 11.1	9.95 to 11.1
Line code format	-	NRZ	NRZ
Optical source type	-	SLM	SLM
Target distance	km	10	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		Multi-Rate-10km-SFP+	**Multi-Rate-40km-SFP+**
Operating wavelength range	nm	1260 to 1355	1530 to 1565
Maximum mean launched power	dBm	-1	2
Minimum mean launched power	dBm	-6	-1
Minimum extinction ratio	dB	6	8.2
Maximum -20 dB spectral width	nm	NA	0.5
Minimum side mode suppression ratio	dB	NA	30
Eye pattern mask	-	Compliant with IEEE802.3/G.959.1/G.691	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	1260 to 1600	1260 to 1605
Receiver sensitivity	dBm	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	-16 (9.95Gbit/s) -15.8(10.3Gbit/s)
Minimum receiver overload	dBm	0.5	-1
Maximum reflectance	dB	-14	-27

Table 10-29 Specifications of optical module for CPRI option6 services at client side

Item	Unit	Value	
		CPRI option6-2km	**CPRI option6-10km**
Line code format	-	NRZ	NRZ
Light source type	-	SLM	SLM
Target distance	km	2	10

Item	Unit	Value	
		CPRI option6-2km	CPRI option6-10km
Transmitter parameter specifications at point S			
Operating wavelength range	nm	1260 to 1350	1260 to 1360
Maximum mean launched power	dBm	0.5	0.5
Minimum mean launched power	dBm	-8.2	-8.4
Minimum extinction ratio	dB	3.5	3.5
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	1260 to 1360	1260 to 1360
Receiver sensitivity	dBm	-11	-13.8
Minimum receiver overload	dBm	0.5	0.5
Maximum reflectance	dB	-12	-12

Table 10-30 Specifications of 3G-SDI optical module

Item	Unit	Value
		3G-SDI
Line code format	-	NRZ
Light source type	-	SLM
Target distance	km	10
Transmitter parameter specifications at point S		
Operating wavelength range	nm	1290 to 1330
Maximum mean launched power	dBm	0
Minimum mean launched power	dBm	-7
Minimum extinction ratio	dB	5

Item	Unit	Value
		3G-SDI
Eye pattern mask	-	Compliant with G.694.2
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1260 to 1620
Receiver sensitivity	dBm	-17
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-31 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Specifications for Client-Side Electrical Modules

Table 10-32 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-33 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

NOTE

The GE electrical ports support 100/1000 Mbit/s self-adapting and 1000 Mbit/s.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.77 kg (1.69 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 27.1 W
- Maximum Power Consumption at 55°C (131°F): 35.1 W

10.2 ELQM

ELQM: Enhanced 4 x Multi-rate Ports Multiplexing Optical Wavelength Conversion Board

10.2.1 Version Description

The available hardware version of the ELQM is TNF1.

Version

Table 10-34 describes the version mapping of the ELQM board.

Table 10-34 Version description of the ELQM

Item	Description
Board hardware version	TNF1: The mapping version of the equipment is V100R003C01 or later.

10.2.2 Application

The ELQM board can work in two different modes: 1*AP4 ODU1 mode, 1*AP2 ODU0 mode.

Service Access Description

Table 10-35 describes the principle for configuring the interfaces of the ELQM board.

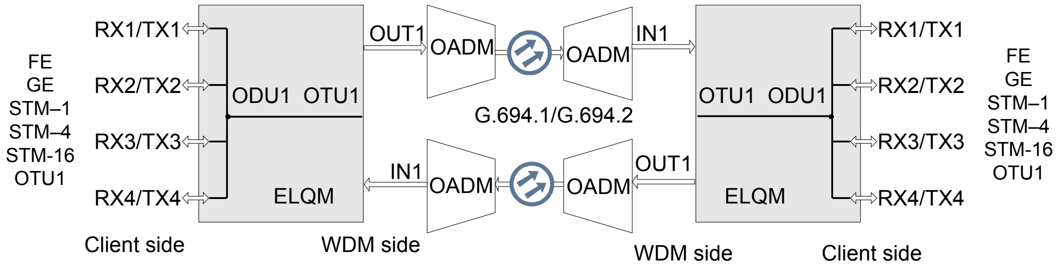
Table 10-35 Principle for configuring the interfaces of the ELQM board

Board Working Mode	Available Interfaces	Service Access	Remarks
1*AP4 ODU1 mode	TX1/RX1 to TX4/RX4	STM-1, STM-4, STM-16, GE, FE, OTU1	● The overall bandwidth of the entire services for TX1/RX1 to TX4/RX4 should not be more than 2.5 Gbit/s. ● STM-16 and OTU1 services can only be received at the TX1/RX1 ports. ● The total number of timeslots occupied by all client-side services that are converged into an ODU1 service must be 16 or smaller.
1*AP2 ODU0 mode	TX1/RX1, TX2/RX2	STM-1, STM-4, GE, FE	The overall bandwidth of the entire services for TX1/RX1 to TX4/RX4 should not be more than 2.5 Gbit/s.

Application Scenario 1: 1*AP4 ODU1 Mode

The ELQM board converges a maximum of four channels of Any (at a rate in the range of 125 Mbit/s to 2.67 Gbit/s) signals into one channel of ODU1 signals, and then converges the signals into one channel of OTU1 optical signals. Then, the ELQM board converts the OTU1 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELQM board also performs the reverse process. The WDM-side port of the ELQM board supports the dual feeding and selective receiving function. See **Figure 10-30**.

Figure 10-30 Application of the ELQM board working in 1*AP4 ODU1 mode



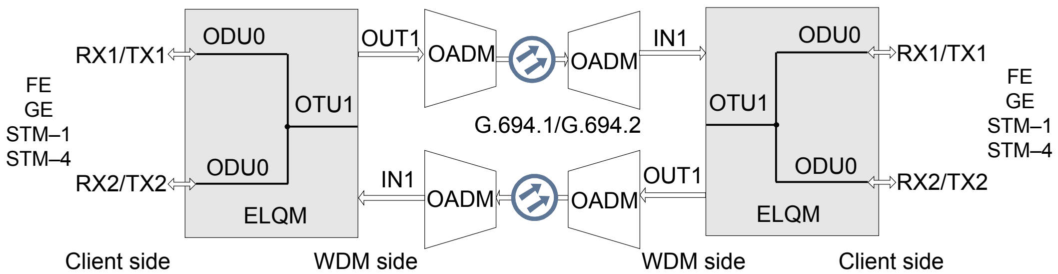
NOTE

- In this scenario, the ELQM board supports the following types of services on the client side: FE, STM–1, STM–4, STM–16, GE (GFP_T) and OTU1.
- STM–16 and OTU1 services can only be received at the TX1/RX1 ports.
- When OTU1 services are received on the client side of the ELOM board, the board regenerates OTU1 signals.

Application Scenario 2: 1*AP2 ODU0 Mode

The ELQM board maps a maximum of two channels of Any (at a rate in the range of 125 Mbit/s to 1.25 Gbit/s) signals into two ODU0 channels, and then converges the signals into one channel of OTU1 optical signal. Then, the ELQM board converts the OTU1 optical signals into standard DWDM wavelengths that comply with ITU-T G.694.1 or CWDM wavelengths that comply with ITU-T G.694.2. The ELQM board also performs the reverse process. The WDM-side port of the ELQM board supports the dual feeding and selective receiving function. See **Figure 10-31**.

Figure 10-31 Application of the ELQM board working in 1*AP2 ODU0 mode



NOTE

In this scenario, the ELQM board supports the following types of services on the client side: FE, STM–1, STM–4, GE (GFP_T), GE (TTT-GMP) and OTU1.

Background Information

The service processing chip of the ELQM board provides 16 timeslots for receiving services. Different types of services require different number of timeslots. The total number of timeslots for the services received at the ELQM board must be smaller than the maximum number of timeslots that the service processing chip can provide. In addition, the total number of timeslots for the services configured at the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports must be not greater than 16.

Table 10-36 lists the number of timeslots required by common services.

Table 10-36 Number of timeslots required by common services

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
GE(GFP_T)/GE (TTT-GMP)	7	FE	1
STM-1	1	OTU1	16
STM-4	4	STM-16	16

10.2.3 Functions and Features

The main functions and features supported by the ELQM are wavelength conversion, service convergence, and ALS.

For detailed functions and features, see **Table 10-37**.

Table 10-37 Functions and features of the ELQM

Function and Feature	Description
Basic Function	The ELQM board supports the following working modes: ● 1*AP4 ODU1 mode – 4 x Any (125 Mbit/s – 2.67 Gbit/s) <-> 1 x OTU1 – Supports ODU1-level mapping. – The optical ports on the WDM side provide the dual fed and selective receiving function. ● 1*AP2 ODU0 mode – 2 x Any (125 Mbit/s – 1.25 Gbit/s) <-> 1 x OTU1 – Supports ODU0-level mapping. – The optical ports on the WDM side provide the dual fed and selective receiving function.

Function and Feature	Description
Service type	- OTU1: OTN services, the rate is 2.67 Gbit/s. - STM-1: SDH services, the rate is 155.52 Mbit/s. - STM-4: SDH services, the rate is 622.08 Mbit/s. - STM-16: SDH services, the rate is 2.488 Gbit/s. - FE: Fast Ethernet services, the rate is 125 Mbit/s. Supports FE optical signals and FE electrical signals. - GE: Gigabit Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes.
Alarms and performance events monitoring	Monitors B1, SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of GE and FE services.
OTN function	- Provides the OTU1 interface on WDM-side. - Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. - Supports PM functions for ODU1. - Supports PM functions for ODU0. - Supports SM functions for OTU1.
Regeneration board	The WDM-side signals of the ELQM board can be regenerated by the LWX2, LQM, TNF1LQM2 board.
Synchronous Ethernet services	Supports the transparent transmission and processing of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
Protection schemes	- Supports intra-board 1+1 protection - Supports client 1+1 protection (includes inter-shelf 1+1 optical channel protection). - Supports ODUk (k = 0, 1) SNCP protection.

<table>
<tr><th>Function and Feature</th><th colspan="2">Description</th></tr>
<tr><td>Loopback</td><td colspan="2">● Supports WDM side inloop
● Supports WDM side outloop
● Supports client side inloop
● Supports client side outloop</td></tr>
<tr><td>IEEE 1588v2</td><td colspan="2">The client side supports the IEEE 1588v2 function when the GE(GFP_T) service is received and transmitted on the client side.
The WDM side supports the IEEE 1588v2 function when a service except OTU1 is received and transmitted on the client side.</td></tr>
<tr><td>ALS function</td><td colspan="2">Supports the ALS function on the client side.</td></tr>
<tr><td>ESC function</td><td colspan="2">Supported</td></tr>
<tr><td>Cross-connect function</td><td colspan="2">Not supported.</td></tr>
<tr><td>LPT function</td><td colspan="2">The board supports the LPT function only when the client-side service type is GE optical services, GE electrical services, or FE optical services when the services are encapsulated in GFP_T.</td></tr>
<tr><td>PRBS test</td><td colspan="2">Supports the PRBS function on the client side.
NOTE
The PRBS function on the client side is supported only when the client-side service type is OTU1/STM-1/STM-4/STM-16/GE(GFP-T).</td></tr>
<tr><td>Ethernet port working mode</td><td colspan="2">● GE optical port: 1000M full-duplex
● FE optical port: 100M full-duplex</td></tr>
<tr><td>WDM specifications</td><td colspan="2">Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.</td></tr>
<tr><td>Protocol or standard compliance</td><td>Protocols or standards (non-performance monitoring) with which transparently transmitted services comply</td><td>IEEE 802.3u
IEEE 802.3z
ITU-T G.707
ITU-T G.782
ITU-T G.783</td></tr>
</table>

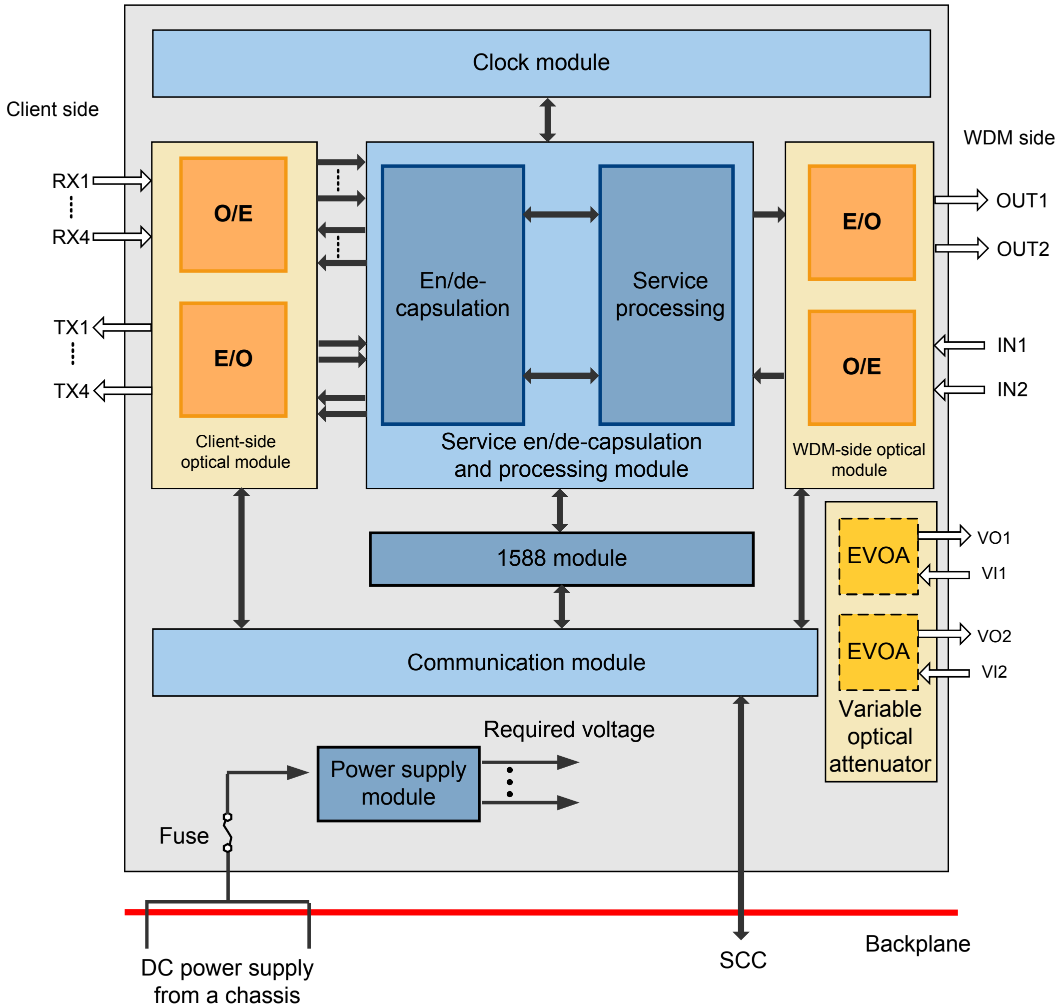
Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.8262 ITU-T G.694.1 ITU-T G.694.2 IEEE_1588v2

10.2.4 Working Principle and Signal Flow

The ELQM board consists of the client-side optical module, the WDM-side optical module, the service en/de-capsulation and processing module, the clock module, the variable optical attenuator, the 1588 module, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Figure 10-32 is the functional block diagram of the ELQM board that realizes the convergence of four channels of signals at any rate.

Figure 10-32 Functional block diagram of the ELQM board



In the signal flow of the ELQM board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the ELQM to the WDM side of the ELQM, and the receive direction is defined as the reverse direction.

- Transmit direction

  The client-side optical module receives optical signals from client side equipment through the RX1 - RX4 optical ports, and performs O/E conversion.

  After conversion, the four channels of electrical signals are sent to the service en/decapsulation and processing module. The module performs processes such as multiplexing, clock generating and frame processing. Then, the module outputs one channel of OTU1 electrical signals.

  The OTU1 electrical signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths OTU1 optical signals. The optical signals are output through the OUT1 and OUT2 optical ports.

- Receive direction

The WDM-side optical module receives the G.694.1-compliant or G.694.2-compliant at WDM standard wavelengths OTU1 optical signals from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as decapsulation, clock recovery and demultiplexing. Then, the module outputs four channels of electrical signals at any rate.

The client-side optical module performs E/O conversion and the client-side electrical module performs level conversion of the four channels of electrical signals, and then outputs four channels of client-side optical signals and electrical signals through the TX1 - TX4 optical ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical ports.
  - Reports the working state of the client-side laser.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs the O/E conversion of OTU1 optical signals.
  - WDM-side transmitter: Performs the E/O conversion from the internal electrical signals to OTU1 optical signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module

  The module consists of the service en/de-capsulation module and the service processing module. It realizes the en/de-capsulation of signals in any format and service convergence.

  - Service en/de-capsulation module: Processes the overheads of signals in any format, and reports the performance monitoring state of service signals.
  - Service processing module: Achieves the multiplexing from signals in any format to signals in OTU1 format and the demultiplexing from signals in OTU1 format to signals in any format, and performs processes such as encapsulation/decapsulation of FEC, encoding/decoding and scrambling/descrambling.
- Clock module
  - Provides a clock for the board, selects a clock source, and transparently transmits clock signals.
- 1588 module

  Extracts clock signals based on the IEEE 1588 protocol and transmits clock signals to the clock module.
- Variable optical attenuator (can be selected)
  - Adjust the transmission optical power or receive optical power.

- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

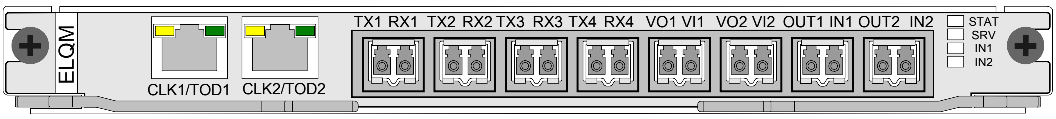
10.2.5 Front Panel

There are indicators and interfaces on the ELQM front panel.

Appearance of the Front Panel

Figure 10-33 shows the front panel of the ELQM.

Figure 10-33 Front panel of the ELQM



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Interfaces

Table 10-38 lists the type and function of each interface.

Table 10-38 Types and functions of the ELQM interfaces

Interface	Interface Type	Function
IN1/OUT1 to IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
TX1/RX1 to TX4/RX4	LC	Transmits/receives service signals to client-side equipment.
VI1 to VI2	LC	Receive the signal to be attenuated.
VO1 to VO2	LC	Transmit the attenuated signal.

Interface	Interface Type	Function
CLK1/TOD1 to CLK2/TOD2	RJ-45	Transmit clock signals or time signals. CLK1/CLK2 interface can input or output clock signals. CLK1/CLK2 interface is bidirectional. That is, they input and output signals at the same time. TOD1/TOD2 interface can input or output time signals. At any time, a TOD1/TOD2 interface can either input or output time signals.

NOTE

- The RX1/TX1-RX4/TX4 interfaces on the client side support the optical interface SFP module, electrical interface SFP module, and single-fiber bidirectional GE SFP module. The preceding SFP modules can be used on the client side at the same time. The interfaces on the client side can access Any optical signals, GE/FE electrical signals, or GE optical signals through the replacement of the SFP modules.
- FE electrical ports can use only crossover cables.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.2.6 Valid Slots

The ELQM occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT 1, SLOT 3, and SLOT 4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT 1 to SLOT 6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.2.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the port models and the configuration steps for this board.

Display of Optical Ports

Table 10-39 lists the sequence number displayed on an NMS of the optical port on the ELQM board front panel.

Table 10-39 Display of the ELQM optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX1/TX1	3
RX2/TX2	4
RX3/TX3	5
RX4/TX4	6
VO1/VI1	7
VO2/VI2	8

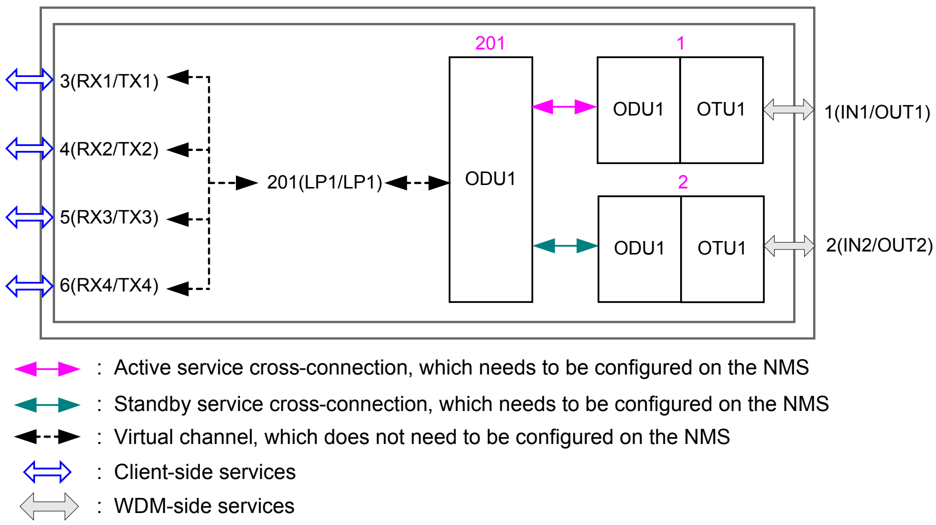
NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port Models

- 1*AP4 ODU1 mode

Figure 10-34 Port model for the board working in 1*AP4 ODU1 mode



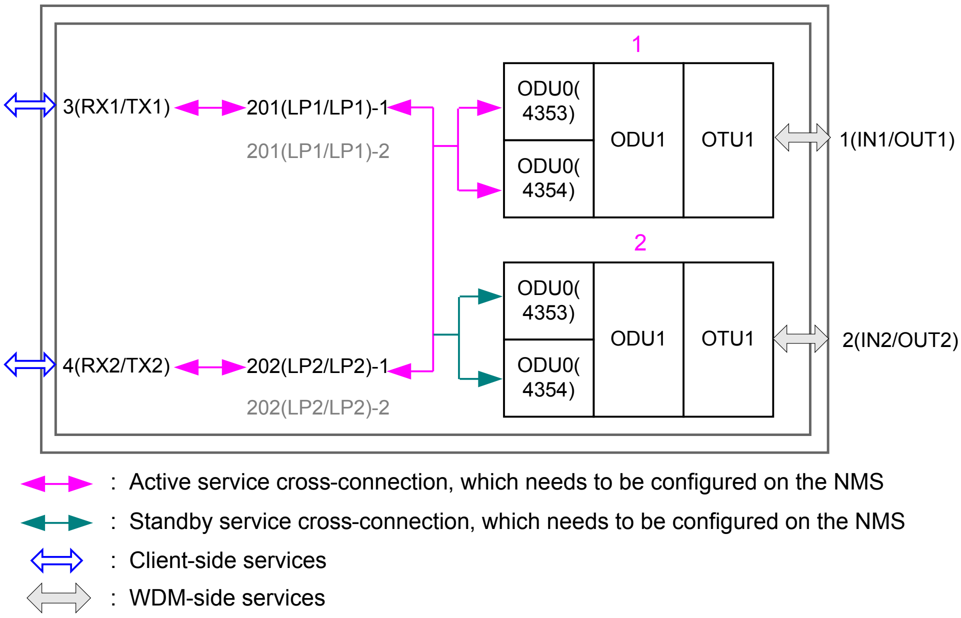
– Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-6 (RX1/TX1 to RX4/TX4).

– Alarms, performance events, and configurations related to OTU1/ODU1 overheads are reported on channel 1 of optical ports 1 and 2.

- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 1) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2. When ODUk SNCP (k = 1) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 1*AP2 ODU0 mode

Figure 10-35 Port model for the board working in 1*AP2 ODU0 mode



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3 (RX1/TX1) and 4 (RX2/TX2).
- Alarms, performance events, and configurations related to ODU0 signal overheads are reported on channels 4353 and 4354 of WDM-side optical ports 1 and 2.
- Alarms, performance events, and configurations related to ODU1/OTU1 overheads are reported on channel 1 of optical ports 1 and 2.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Cross-connections from optical ports 3 (RX1/TX1) and 4 (RX2/TX2) to channel 1 of ports 201 and 202 need to be configured. When the board is interconnected with a TN52TOM board for NG WDM products, you can configure the cross-connections from optical ports 3 (RX1/TX1) and 4 (RX2/TX2) to channel 2 of optical ports 201 and 202 to ensure channel ID consistency for the TN52TOM board.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 0) protection. However, the two types of protection cannot be configured simultaneously. When intra-

board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to channel 4353 of optical port 1 and unidirectional cross-connections from port 201 to channel 4353 of optical port 2; bidirectional cross-connections from port 202 to channel 4354 of optical port 1 and unidirectional cross-connections from port 202 to channel 4354 of optical port 2. When ODUk SNCP (k = 0) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

10.2.8 ELQM Parameters on the NMS

Precautions

CAUTION

If you delete a logical ELQM board and configure it again on the NMS, the original configuration of the board is deleted and the default configuration is restored.

Parameter Description

Field	Value	Description
Board Working Mode	• 1*AP4 ODU1 mode, 1*AP2 ODU0 mode • Default: 1*AP4 ODU1 mode	• **1*AP4 ODU1 mode**: The ELQM board supports ODU1 service encapsulation. • **1*AP2 ODU0 mode**: The ELQM board supports ODU0 service encapsulation. **CAUTION** The signal flow and functions of the ELQM board vary according to the working modes. Switching between different working modes will interrupt services that are running in the current working mode.
Cross-Connection Configuration Mode	• Automatic, Manual • Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**.

Field	Value	Description
Service Type	• Default: None, FE, GE(GFP-T), GE (TTT-GMP), STM-1, OC-3, STM-4, OC-12, STM-16, OC-48, OTU-1 – When the board works in **1*AP4 ODU1 mode**, the default service type for optical ports 3 (RX1/TX1) is **OTU-1**, the default service type for other optical ports is **None**. – When the board works in **1*AP2 ODU0 mode**, the default service type for all the optical ports is **None**.	The **Service Type** parameter sets the type of the service accessed at the optical interface on the client side. **NOTE** • After you configure a cross-connection for the board, setting the **Service Type** field fails if the service type selected during cross-connection configuration is different from the value you set for **Service Type**. In this case, you need to delete the cross-connection and set the **Service Type** field again. • The service type supported by the ELQM board varies according to the value of Working Mode. **CAUTION** • Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used. For example, if the ELQM board works in 1*AP2 ODU0 mode, set the status of the TX1/RX1 optical port to **Used** and the status of the TX2/RX2 optical port to **Unused** when only the TX1/RX1 optical port receives services.
Automatic Laser Shutdown	Enabled, Disabled Default: • When the board works in **1*AP4 ODU1 mode**, the default value for optical ports 3 (RX1/TX1) is **Disabled**, the default value for other optical ports is **Enabled**. • When the board works in **1*AP2 ODU0 mode**, the default service type for all the optical ports is **Enabled**.	• The default value is recommended. • On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.

Field	Value	Description
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	The default value is recommended. In practical application, set this parameter according to the scenario where the board is used. **CAUTION** When NEs communicate with each other through the electric supervisory channel (ESC) of ELQM, the NEs will be unreachable if all the lasers at ports IN1/OUT1 and IN2/OUT2 on the WDM side of the ELQM board are disabled.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Optical Interface Attenuation Ratio (dB)	0 to 20 Default: 20	parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range.
Max. Attenuation Ratio (dB)	20 Default: 20	parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board.
Min. Attenuation Ratio (dB)	0 Default: 0	parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board.

Field	Value	Description
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
PRBS Test Status	Enabled, Disabled Default: /	• Retain the default value when a network works normally. • Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	• Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. • Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **CAUTION** The settings of **GCC Receive/ Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.
Synchronous Clock Enabled	Enabled, Disabled	If this parameter is set to **Enabled** at a client-side optical port, Ethernet services at this optical port can function as clock sources and S1 bytes can be transmitted and received.

Field	Value	Description
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./optical port wavelength/frequency, for example, C/ 11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.2.9 ELQM Specifications

Specifications include optical specifications, mechanical specifications, and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1ELQM	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2 EVOA	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support gray optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-40 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-41 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	**800ps/nm-fixed-PIN-eSFP**
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-42 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-43 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	**1000BASE-BX-10km (SM1490)**
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-44 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-45 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-46 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-47 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Table 10-48 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Specifications for Client-Side Electrical Modules

Table 10-49 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100

Item	Unit	Value
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-50 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

NOTE

The GE electrical ports support 100/1000 Mbit/s self-adapting and 1000 Mbit/s.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.62 kg (1.37 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 14.1 W
- Maximum Power Consumption at 55°C (131°F): 17.8 W

10.3 LDE

LDE: Double Port EPON/GE Access Wavelength Conversion Board

10.3.1 Version Description

The available hardware version of the LDE is TNF1.

Version

Table 10-51 describes the version mapping of the LDE board. The mapping version of the equipment is V100R002C00 or later.

Table 10-51 Version description of the LDE

Item	Description
Board hardware version	TNF1

10.3.2 Application

The LDE can be used in three different application scenarios: convergence of two channels of EPON optical signals, convergence of two channels of GE optical signals, and hybrid transmission of EPON and GE services.

Service Access Description

Table 10-52 describes the principle for configuring the ports of the LDE board.

Table 10-52 Principle for configuring the ports of the LDE board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Convergence of eight channels of EPON optical signals	EPON service: The service rate is 1.25 Gbit/s in both the uplink and downlink.	2	TX1/RX1 to TX2/RX2
Convergence of eight channels of GE optical signals	GE optical signal or GE electrical signal	2	TX1/RX1 to TX2/RX2

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Hybrid transmission of EPON and GE services	● EPON service ● GE optical signal or GE electrical signal	2	TX1/RX1 to TX2/RX2

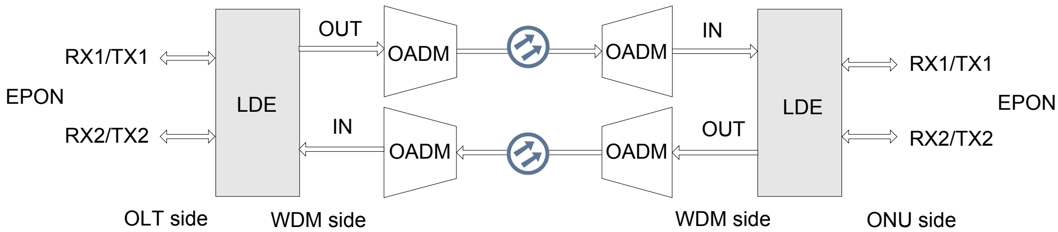
Application Scenario 1: Implements the Convergence of Two Channels of EPON Optical Signals

RX1/TX1-RX2/TX2 ports of the LDE board can house the ONU optical module, the OLT optical module, and the client-side SFP module. When housing the ONU optical module and the OLT optical module, the ports are interconnected with the OLT equipment and the ONU equipment respectively to access EPON services. When housing the client-side SFP modules, the ports are interconnected with the client-side equipment to access GE services.

The LDE board can be connected to the ONU equipment and the OLT equipment to access two channels of EPON service, which is converged into one OTU1 signal. The OTU1 signal is then converted into standard WDM wavelength for further transmission.

For the application of the board to access two channels of EPON services, see **Figure 10-36**.

Figure 10-36 Application of the LDE to access two channels of EPON services

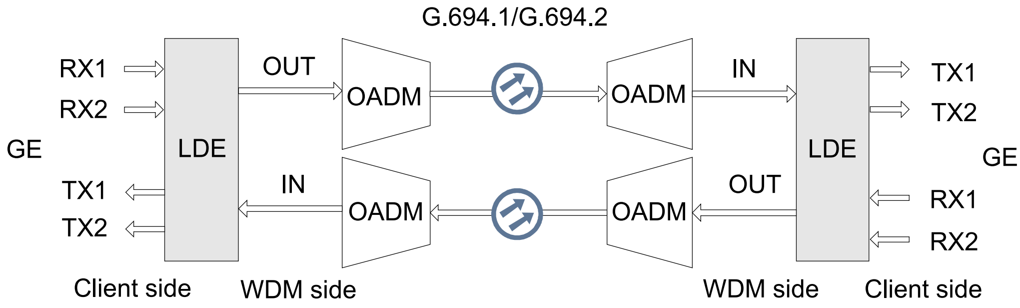


Application Scenario 2: Implements the Convergence of Two Channels of GE Optical Signals

The LDE board can access two channels of GE service, which is converged into one OTU1 signal. The OTU1 signal is then converted into standard WDM wavelength for further transmission.

For the application of the board to access two channels of GE services, see **Figure 10-37**. The diagram shows that the optical SFP module is used in every port on the client side.

Figure 10-37 Application of the LDE to access two channels of GE services



NOTE

The LDE implements the convergence of two channels of GE services in the following two modes:

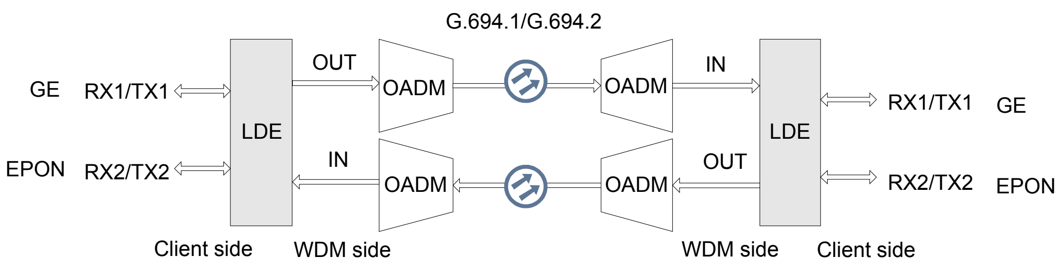
- ODU0 mode: GE->ODU0->ODU1->OTU1
- Non-ODU0 mode: GE->OTU1

Application Scenario 3: Hybrid Transmission of EPON and GE Services

The LDE board can access EPON and GE services at the same time. The services are converged into OTU1 signals, which are then converted into standard WDM wavelengths for transmission.

Figure 10-38 shows the hybrid transmission of EPON and GE services.

Figure 10-38 Hybrid transmission of EPON and GE services



NOTE

In this scenario, RX1/TX1-RX2/TX2 ports can house the ONU optical module and client-side SFP module, or OLT optical module and client-side SFP module at the same time.

NOTE

- The maximum distance between the LDE board on the ONU-side and an ONU is 20 km; the maximum distance between the LDE board on the OLT-side and an OLT is 20 km; the maximum distance between an ONU and an OLT is 35 km.
- LDE boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

10.3.3 Functions and Features

The LDE board supports distance extension of two EPON services, convergence of two GE services, hybrid transmission of EPON and GE services, and convergence of EPON and GE services into OTU1 services.

For detailed functions and features, see **Table 10-53**.

Table 10-53 Functions and features of the LDE board

Functions and Features	Description
Basic Function	● 2xEPON <-> 1xOTU1 ● 2xGE <-> 1xOTU1 ● 2xEPON/GE <-> 1xOTU1 ● The optical ports on the WDM side provide the dual fed and selective receiving function.
Service type	● Convergence services: – GE: As the Gigabit Ethernet service, the rate is 1.25 Gbit/s and the GE service type includes GE optical signals and GE electrical signals. – EPON: The service rate is 1.25 Gbit/s in both the uplink and downlink.
Encoding scheme	Supports the non return to zero (NRZ) encoding.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes.
Alarms and performance events monitoring	Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.
OTN function	● Provides the OTU1 interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM functions for ODU1 in Non-ODU0 mode. ● Supports PM functions for ODU0 in ODU0 mode. ● Supports SM functions for OTU2. ● Supports SM functions for OTU1.
RMON function	Monitors the RMON performance of GE and EPON services.

Functions and Features	Description
Regeneration board	When the LDE board accesses GE signals on the client side, the WDM-side signals of the LDE board can be regenerated by the LWX2, LQM, or TNF1LQM2 board.
Synchronous Ethernet services	Supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
Protection schemes	When the LDE board accesses GE services: ● Supports client 1+1 protection ● Supports intra-board 1+1 protection When the LDE board accesses EPON services: ● Supports client 1+1 protection ● Supports intra-board 1+1 protection **NOTE** ● In the case of client 1+1 protection, if a fiber on the ONU side of the LDE board is broken, the protection switching cannot be performed.
Loopback	When the LDE board accesses only GE services: ● Supports WDM side inloop ● Supports WDM side outloop ● Supports client side inloop ● Supports client side outloop When the LDE board accesses both GE and EPON services at the same time, the ports for receiving GE services are as follows: ● Supports client side inloop ● Supports client side outloop
ALS function	Supports the ALS function on the client side.
ESC function	Supported
Cross-connect function	Not supported
LPT function	The board supports the LPT function only when the client-side service type is GE services.

Functions and Features	Description	
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is GE (GFP-T).	
Port working mode	● GE optical port: 1000M full-duplex or auto-negotiation ● GE electrical port: auto-negotiation	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.3z IEEE802.3ah
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.3.4 Working Principle and Signal Flow

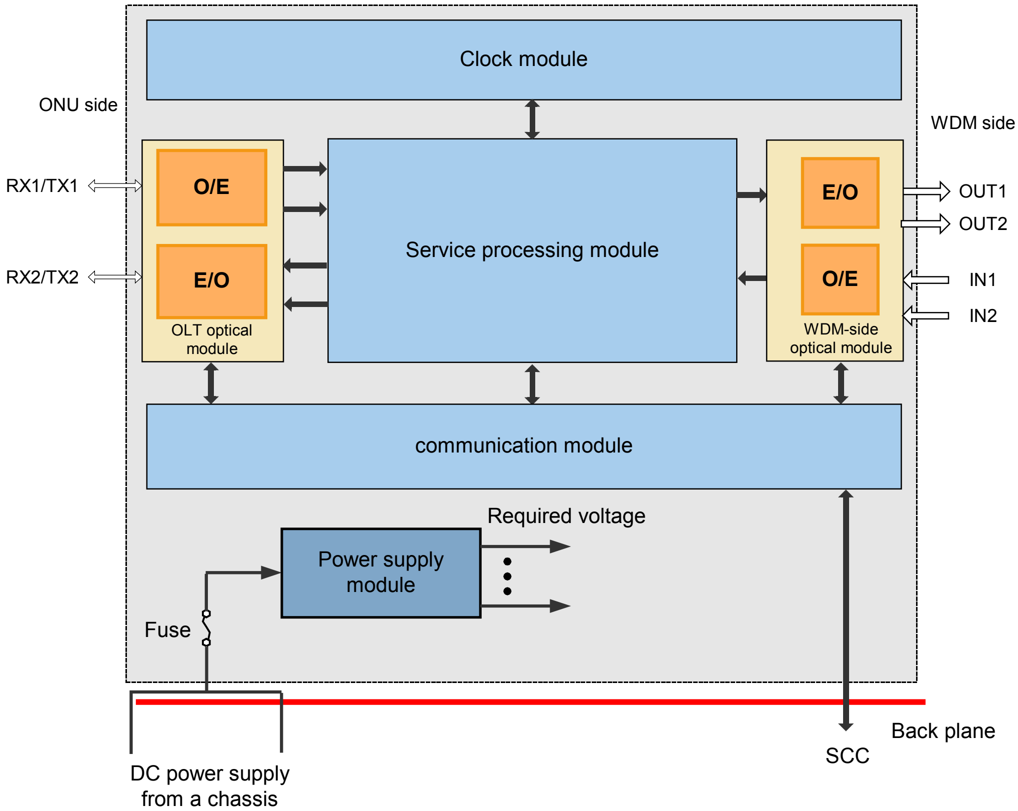
The LDE board consists of the ONU optical module (or OLT optical module/client-side optical module/client-side electrical module), WDM-side module, service processing module, clock module, communication module, detection module and power supply module.

Signal Flow of Convergence of two Channels of EPON Signals

When the LDE board aggregates two channels of EPON services, the LDE boards must be used in pairs with one on the ONU side and the other on the OLT side. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

Figure 10-39 and **Figure 10-40** show the functional block diagram of the LDE to access two channels of EPON signals.

Figure 10-39 Functional block diagram of the LDE (on the ONU side to access two channels of EPON services)



- In the uplink direction

  The OLT optical module receives two channels of EPON signals through the RX1/TX1 to RX2/TX2 ports, and then performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

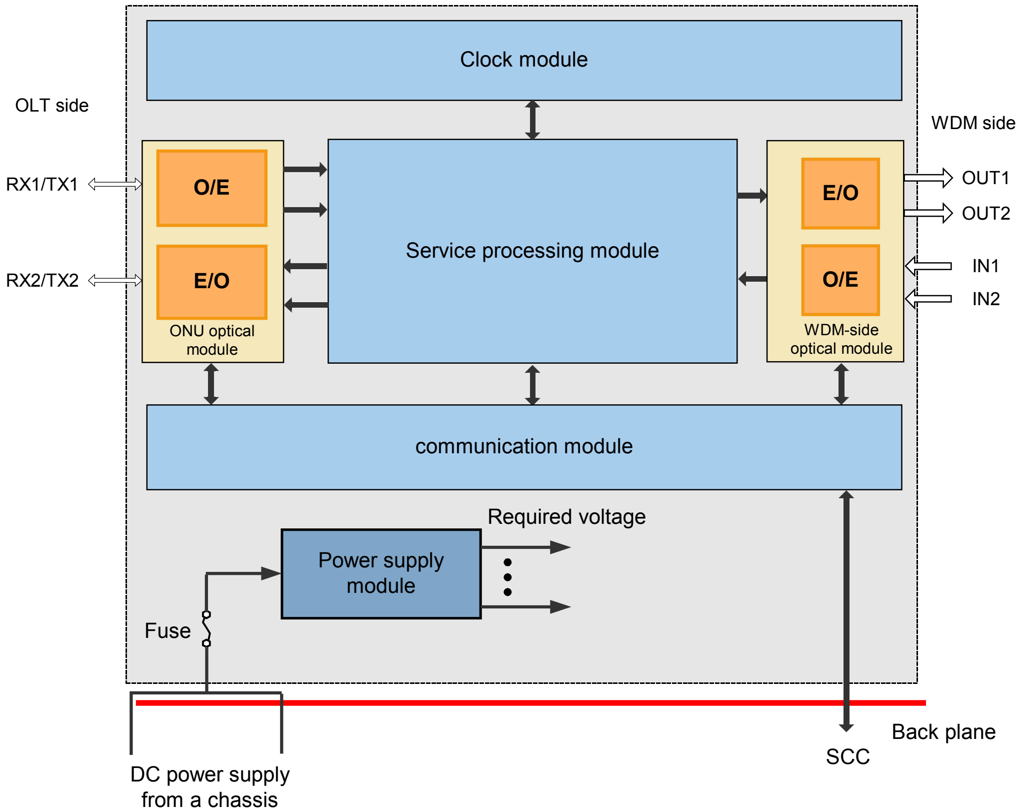
- In the downlink direction

  The WDM-side optical module receives one channel of OTU1 signals through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs two channels of EPON signals.

  The EPON signals are sent to the OLT optical module and are then output through the RX1/TX1 to RX2/TX2 ports after the E/O conversion.

Figure 10-40 Functional block diagram of the LDE (on the OLT side to access two channels of EPON services)



- In the uplink direction

  The WDM-side optical module receives one channel of OTU1 signal through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs two channels of EPON signals.

  The EPON signals are sent to the ONU optical module and are then output through the RX1/TX1 to RX2/TX2 ports after the E/O conversion.

- In the downlink direction

The ONU optical module receives two channels of EPON signals from the OLT equipment through the RX1/TX1 to RX2/TX2 ports, and then performs the O/E conversion.

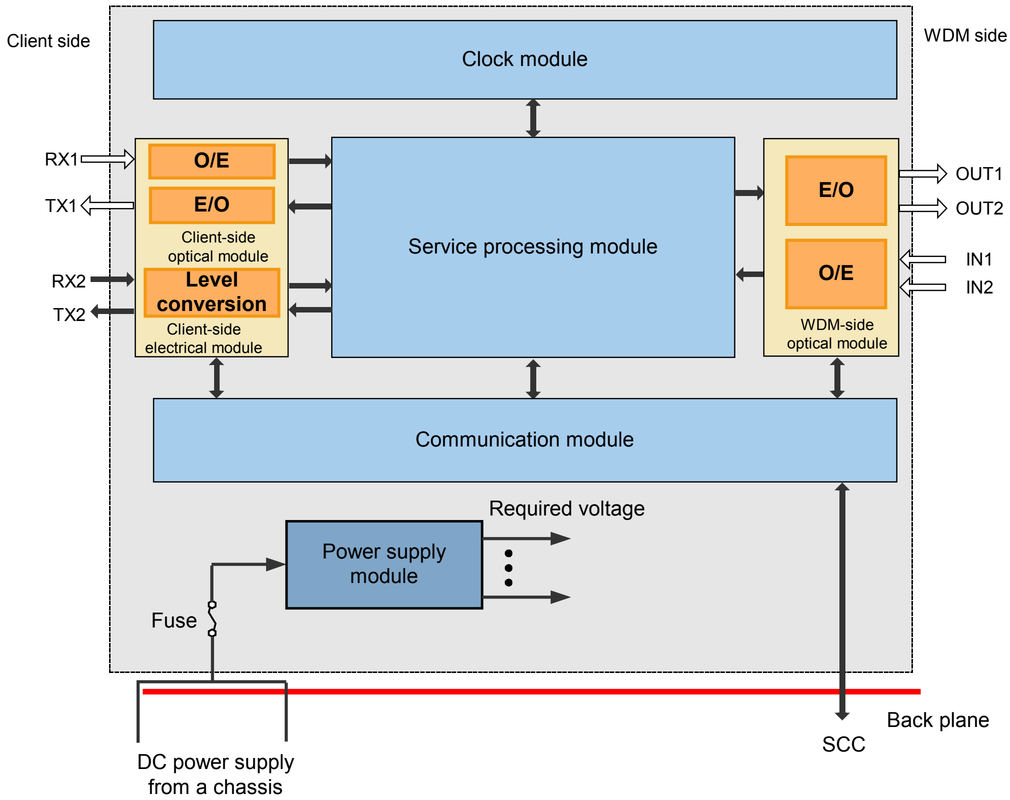
After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

Signal Flow of Convergence of two Channels of GE Signals

Figure 10-41 shows the functional block diagram of the LDE to access two channels of GE signals. The diagram shows that the optical SFP module is used in the RX1/TX1 ports and the electrical SFP module is used in the RX2/TX2 ports.

Figure 10-41 Functional block diagram of the LDE (access two channels of GE signals)



When the LDE board is used to access two channels of GE services, in the signal flow of the board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LDE to the WDM side of the LDE, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives GE optical signals through the RX1 to RX2 ports, and then performs O/E conversion.

  - The client-side optical module receives GE electrical signals through the RX1 to RX2 ports, and then performs level conversion.

  After the conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

- Receive direction

  The WDM-side optical module receives one channel of OTU1 signals through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs two channels of GE signals.

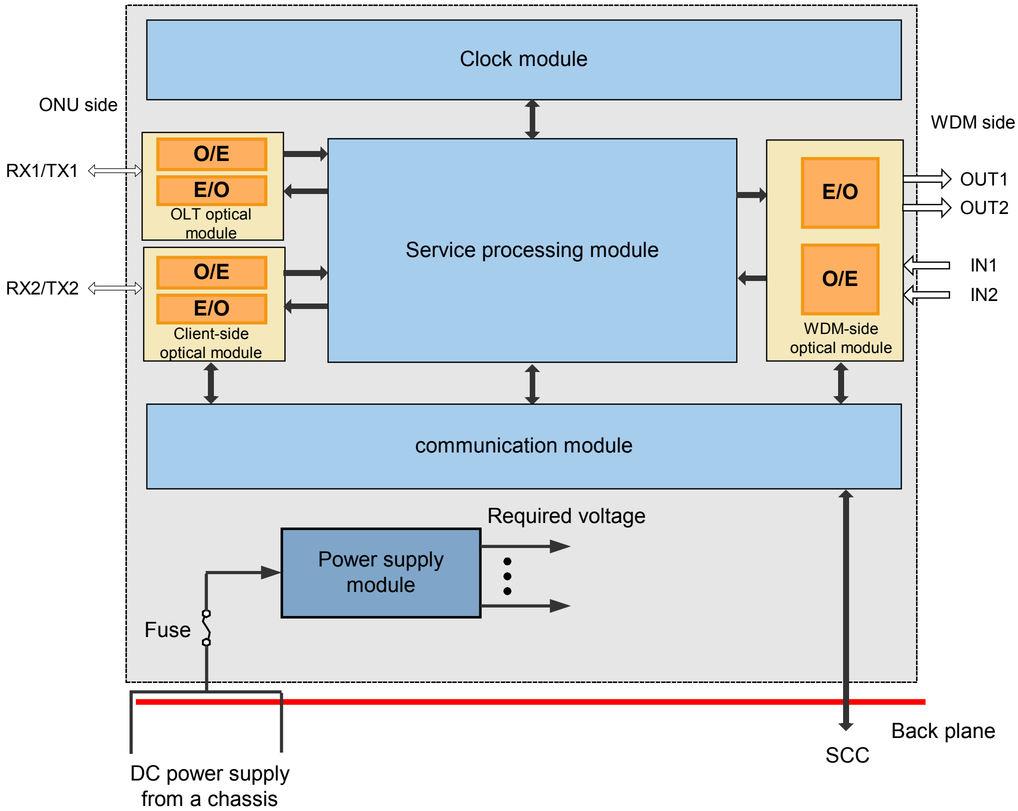
  The GE signals are sent to the client-side optical module and the client-side electrical module, and then output through the TX1 to TX2 ports after the E/O conversion and level conversion.

Signal Flow of Hybrid Transmission of EPON and GE Services

When the LDE is used to converge both the EPON and GE services, two LDE boards are required. One LDE is used on the ONU side and the other OLE is used on the OLT side. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

Figure 10-42 and **Figure 10-43** show the functional block diagram of the LDE to access EPON signals and GE signals. **Figure 10-42** shows that the OLT optical module is used in the RX1/TX1 ports and the single-fiber bidirectional GE SFP module is used in the RX2/TX2 ports. **Figure 10-43** shows that the ONU optical module is used in the RX1/TX1 ports and the single-fiber bidirectional GE SFP module is used in the RX2/TX2 ports.

Figure 10-42 Functional block diagram of the LDE (hybrid transmission of GE services and ONU-side EPON services)



- In the uplink direction
  - The OLT optical module receives EPON signals from ONU equipment through the RX1/TX1 to RX2/TX2 ports, and then performs the O/E conversion.
  - The client-side optical module receives GE signals through the RX1/TX1 to RX2/TX2 ports, and then performs O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

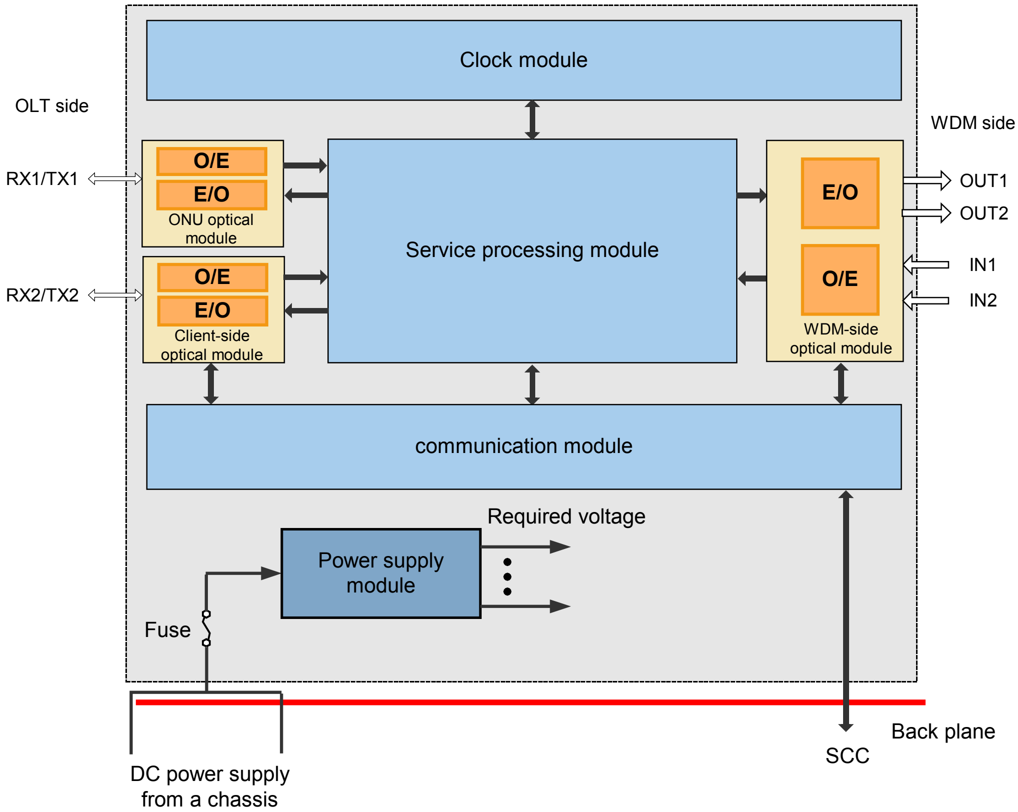
  The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.
- In the downlink direction

  The WDM-side optical module receives one channel of OTU1 signals through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs two channels of electrical signals.

  The OLT optical power and client-side optical module perform O/E conversion for the two channels of electrical signals. Then, RX1/TX1-RX2/TX2 ports output EPON signals and GE optical signals.

Figure 10-43 Functional block diagram of the LDE (hybrid transmission of GE services and OLT-side EPON services)



- In the uplink direction

  The WDM-side optical module receives one channel of OTU1 signal through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs two channels of electrical signals.

  The ONU optical power and client-side optical module perform O/E conversion for the two channels of electrical signals. Then, RX1/TX1-RX2/TX2 ports output EPON signals and GE signals.

- In the downlink direction
  - The ONU optical module receives EPON signals from the OLT equipment through the RX1/TX1 to RX2/TX2 optical ports, and then performs the O/E conversion.
  - The client-side optical module receives GE signals through the RX1/TX1 to RX2/TX2 ports, and then performs O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

Module Function

- ONU optical module
  - OLT-side receiver: Receives EPON optical signals from the OLT devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - OLT-side transmitter: Performs E/O conversion from internal electrical signals to EPON optical signals, and transmits the optical signals to OLT devices.
  - Reports the performance of the OLT-side optical port.
  - Reports the working state of the OLT-side laser.
- OLT optical module
  - ONU-side receiver: Receives EPON optical signals from the ONU devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - ONU-side transmitter: Performs E/O conversion from internal electrical signals to EPON optical signals, and transmits the optical signals to ONU devices.
  - Reports the performance of the ONU-side optical port.
  - Reports the working state of the ONU-side laser.
- Client-side optical module
  - Client-side receiver: Receives GE optical signals from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE optical signals, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- Client-side electrical module
  - Client-side receiver: Receives GE electrical signals from the client side devices and performs level conversion of the signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE electrical signals, and transmits the signals to client side devices.
- WDM-side optical module
  - WDM-side receiver: Performs the O/E conversion of the OTU1 signals.
  - WDM-side transmitter: Performs the E/O conversion from internal electrical signals to OTU1 optical signals.
  - Reports performance events of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service processing module
  - Performs a series of operations for the signals, such as mapping/demapping, and clock transparent transmission.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.

- Power supply module
  - Converts the DC power into the power required by each module of the unit.

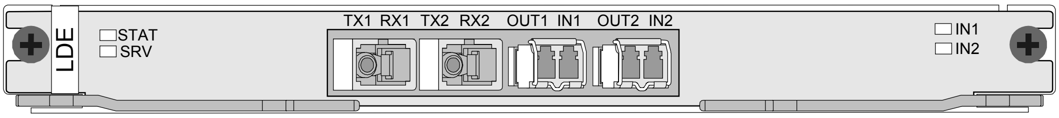
10.3.5 Front Panel

There are indicators and ports on the LDE front panel.

Appearance of the Front Panel

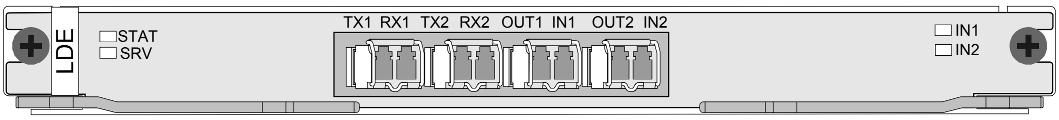
When the LDE board is used to access two channels of EPON signals, the front panel of the board is shown in **Figure 10-44**.

Figure 10-44 Front panel of the LDE (used to access two channels of EPON signals)



When the LDE board is used to access two channels of GE signals, the front panel of the board is shown in **Figure 10-45**.

Figure 10-45 Front panel of the LDE (used to access two channels of GE signals)



NOTE

Figure 10-45 shows the situation that the ports are inserted with optical SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-54 lists the type and function of each port.

Table 10-54 Types and functions of the LDE ports

Optical Port	Port Type	Function
IN1/OUT1 to IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals.
RX1/TX1 to RX2/TX2	SC	Transmits/receives EPON service signals to ONU equipment.
	LC	Transmits/receives EPON service signals to OLT equipment.
	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives GE service signals to client-side equipment.

NOTE

- RX1/TX1-RX2/TX2 ports can house the ONU SFP optical module, OLT SFP optical module, and client-side SFP module. In addition, RX1/TX1-RX2/TX2 ports can house the ONU SFP optical module and client-side SFP module, or OLT SFP optical module and client-side SFP module at the same time. The port interconnecting with the ONU-side equipment must correspond to the port interconnecting with the OLT-side equipment one by one.
- The RX1/TX1-RX2/TX2 ports on the client side support the optical SFP module, electrical SFP module, and single-fiber bidirectional GE SFP module. The preceding SFP modules can be used on the client side at the same time. The ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.
- The ONU SFP optical module also can be used to access GE single-fiber bidirectional optical signals, and the ONU SFP optical modules, client-side optical SFP modules and client-side electrical SFP modules can be used on the client side at the same time. The ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.3.6 Valid Slots

The LDE occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.3.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-55 lists the sequence number displayed on an NMS system of the optical port on the LDE board front panel.

Table 10-55 Display of the LDE optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX1/TX1	3
RX2/TX2	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.3.8 LDE Parameters on the NMS

Parameter Description

Field	Value	Description
Board Mode	ODU0 Mode, Non-ODU0 Mode Default: Non-ODU0 Mode	● In **Non-ODU0 Mode**, services are encapsulated directly into ODU1 signals rather than into ODU0 signals first. ● In the case of the boards that are interconnected on the WDM side and require encapsulation at ODU0 level, set this parameter to **ODU0 Mode**. In this mode, services are encapsulated into ODU0 signals first and then into ODU1 signals. **CAUTION** Switching between different working modes on a board interrupts the services.

Field	Value	Description

Service Type	• When **Board Mode** is set to **Non-ODU0 Mode**, the following services are supported: GE (GFP_T), EPON_OLT, EPON_ONU, and None.
	• When **Board Mode** is set to **ODU0 Mode**, the following services are supported: GE (GFP_T), GE (TTT-GMP), and NONE.
	Default: GE(GFP_T)
		In case of GE services, select a proper service type according to the source of the GE services.
		• When **Board Mode** is set to **Non-ODU0 Mode**, this parameter should be set to **GE (GFP_T)**.
		• When **Board Mode** is set to **ODU0 Mode**,
		  - When a board is used to transparently transmit synchronous Ethernet services, this parameter must be set to **GE(TTT-GMP)**.
		  - When a board is used in asynchronous mode, this parameter must be set to **GE(GFP_T)**.
		In case of EPON services, select a proper service type according to the optical module type.
		• When the board is configured with an OLT optical module (to interconnect with the ONU side of PON equipment), set this parameter to **EPON_ONU**.
		• When the board is configured with an ONU optical module (to interconnect with the OLT side of PON equipment), set this parameter to **EPON_OLT**.
		NOTE
		When the service type changes between **EPON_ONU** and **EPON_OLT**, the service type of a channel carrying EPON services must be set to **GE(GFP_T)** or **NONE** first. For example, when the board receives four EPON services, the service type must be changed from **EPON_ONU** to **EPON_OLT**. In this case, you must set the service types of the four channels to **GE(GFP_T)** or **None** before you change the service type to **EPON_OLT**.
		If no services are received at the board, you can set this parameter to **None**. In this case, the board does not report electrical-layer alarms on the channel.
		NOTE
		• Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.

Field	Value	Description
Synchronous/Asynchronous Mode	Synchronous Mode, Asynchronous Mode Default: Asynchronous Mode	This parameter is valid only when **Board Mode** is set to **ODU0 Mode**. ● When **Service Type** is **GE(TTT-GMP)**, it is recommended to set this parameter to **Synchronous Mode**, providing better performance for transparent transmission of clock. ● When **Service Type** is **GE(GFP_T)**, retain the default value for this parameter. The boards that are interconnected with each other must be in the same mode for transparent transmission of clock.
ALS Overhead Use Mode	Standard Mode, Compatible Mode (52TOM) Default: Standard Mode	This parameter is valid only when **Board Mode** is set to **ODU0 Mode**. ● Generally, retain the default value for this parameter. ● When the LDE board is interconnected with the TN52TOM board for NG WDM products, set this parameter to **Compatible Mode (52TOM)**.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LDE board, do not disable the WDM-side lasers on the LDE board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent. **NOTE** When the client-side optical port on the LDE board receives EPON services, this parameter is unavailable.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses. **NOTE** The parameter can be set to **Inloop** or **Outloop** only when the GE service is accessed.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE(GFP-T)** or **GE(TTT-GMP)**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.

Field	Value	Description
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.3.9 LDE Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Module Description

Board Name	Optical Module on Client Side	Optical Module on ONU Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1ELQM	1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490)	EPON-OLT	GE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-56 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-57 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	**800ps/nm-fixed-PIN-eSFP**
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-58 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	**1000BASE-LX-10km**	**1000BASE-LX-40km**	**1000BASE-ZX-80km**
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-59 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-60 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Minimum receiver overload	dBm	-3	-3

Table 10-61 Specifications of EPON-OLT optical module

Item	Unit	Value
		EPON-OLT
Transmission rate	Gbit/s	1.25
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	7
Minimum mean launched power	dBm	2
Minimum extinction ratio	dB	9
Eye pattern mask	-	IEEE802.3ah-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-27
Minimum receiver overload	dBm	-6

Specifications for Client-Side Electrical Modules

Table 10-62 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.82 kg (1.81 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 12.6 W
- Maximum Power Consumption at 55°C (131°F): 16.8 W

10.4 LDGF

LDGF: Double GE Services & Double FE Services Wavelength Conversion Board with FEC

10.4.1 Version Description

The available hardware version of the LDGF is TNF1.

Version

Table 10-63 describes the version mapping of the LDGF board. The mapping version of the equipment is V100R001C01 or later.

Table 10-63 Version description of the LDGF

Item	Description
Board hardware version	TNF1

10.4.2 Application

The LDGF is mainly used to multiplex two channels of GE service signals (GE optical signal or GE electrical signal) and two channels of FE electrical signals into a channel of OTU1 signals, and convert the signals into a DWDM standard wavelength compliant with ITU-T G.694.1 or CWDM standard wavelength compliant with ITU-T G.694.2.

Service Access Description

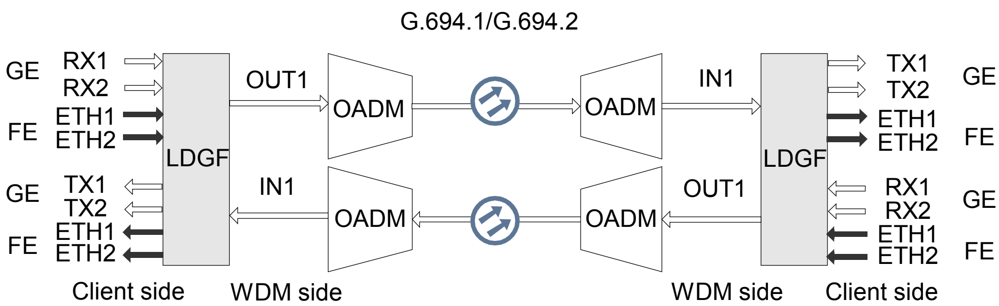
Table 10-64 describes the principle for configuring the ports of the LDGF board.

Table 10-64 Principle for configuring the ports of the LDGF board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Multiplex two channels of GE service signals and two channels of FE electrical signals	● GE optical signal or GE electrical signal ● FE electrical signals	4	● GE optical signal or GE electrical signal: TX1/RX1 and TX2/RX2 ● FE electrical signals: ETH1 and ETH2

Figure 10-46 shows the LDGF board application in a WDM system.

Figure 10-46 LDGF board application in a WDM system



NOTE

Figure 10-46 shows that the optical SFP module is used in RX1/TX1 and RX2/TX2 optical ports on the client side.

10.4.3 Functions and Features

The main functions and features supported by the LDGF are wavelength conversion, service convergence, and ALS.

For detailed functions and features, see **Table 10-65**.

Table 10-65 Functions and features of the LDGF

Functions and Features	Description
Basic function	● 2 x GE & 2 x FE <-> 1 x OTU1 ● The optical port on the WDM side provides the dual fed and selective receiving function.
Service type	● Convergence services: – GE: Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals or GE electrical signals. – FE (Fast Ethernet): Fast Ethernet services, the rate is 125 Mbit/s. Supports FE electrical signals.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes.
Alarms and performance events monitoring	Provides the Ethernet service performance monitoring function. Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of GE/FE services.
Regeneration board	The WDM-side signals of the LDGF board can be regenerated by the LWX2, LQM, or TNF1LQM2 board.
OTN function	● Provides the OTU1 interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM functions for ODU1. ● Supports SM functions for OTU1.
Intelligent Fiber (IF) function	The board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board.

<table>
<tr><th>Functions and Features</th><th colspan="2">Description</th></tr>
<tr><td>Protection schemes</td><td colspan="2">● Supports client 1+1 protection
● Supports intra-board 1+1 protection</td></tr>
<tr><td>Loopback</td><td colspan="2">● Supports WDM side inloop
● Supports WDM side outloop
● Supports client side inloop
● Supports client side outloop</td></tr>
<tr><td>ALS function</td><td colspan="2">Supports the ALS function on the client side.</td></tr>
<tr><td>ESC function</td><td colspan="2">Supported</td></tr>
<tr><td>Cross-connect function</td><td colspan="2">Not supported</td></tr>
<tr><td>LPT function</td><td colspan="2">The board supports the LPT function only when the client-side service type is GE or FE services.</td></tr>
<tr><td>PRBS test</td><td colspan="2">Not supported</td></tr>
<tr><td>Ethernet port working mode</td><td colspan="2">● GE optical port: 1000M full-duplex or auto-negotiation
● GE electrical port: auto-negotiation
● FE electrical port: 100M full-duplex</td></tr>
<tr><td>WDM specification</td><td colspan="2">Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.</td></tr>
<tr><td>Protocol or standard compliance</td><td>Protocols or standards (non-performance monitoring) with which transparently transmitted services comply</td><td>IEEE 802.3u
IEEE 802.3z</td></tr>
</table>

Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.4.4 Working Principle and Signal Flow

The LDGF board consists of the client-side GE optical module or the client-side GE electrical module, the RJ-45 connector, the WDM-side optical module, the service en/de-capsulation and processing module, clock module, the communication module, and the power supply module.

Figure 10-47 and **Figure 10-48** are the functional block diagram of the LDGF board. **Figure 10-47** shows that the optical SFP module is used in the RX1/TX1 and RX2/TX2 ports, and **Figure 10-48** shows the electrical SFP module is used in the RX1/TX1 and RX2/TX2 ports.

Figure 10-47 Functional block diagram of the LDGF board (TX1/RX1 and TX2/RX2 ports access GE optical signals)

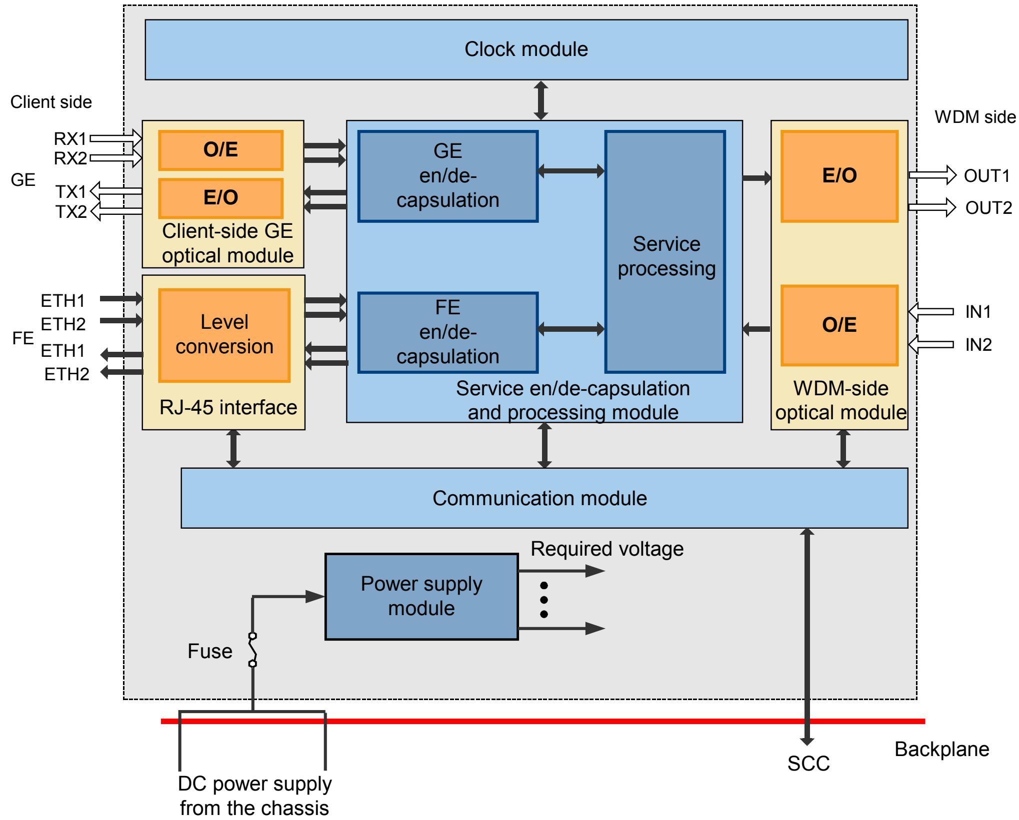
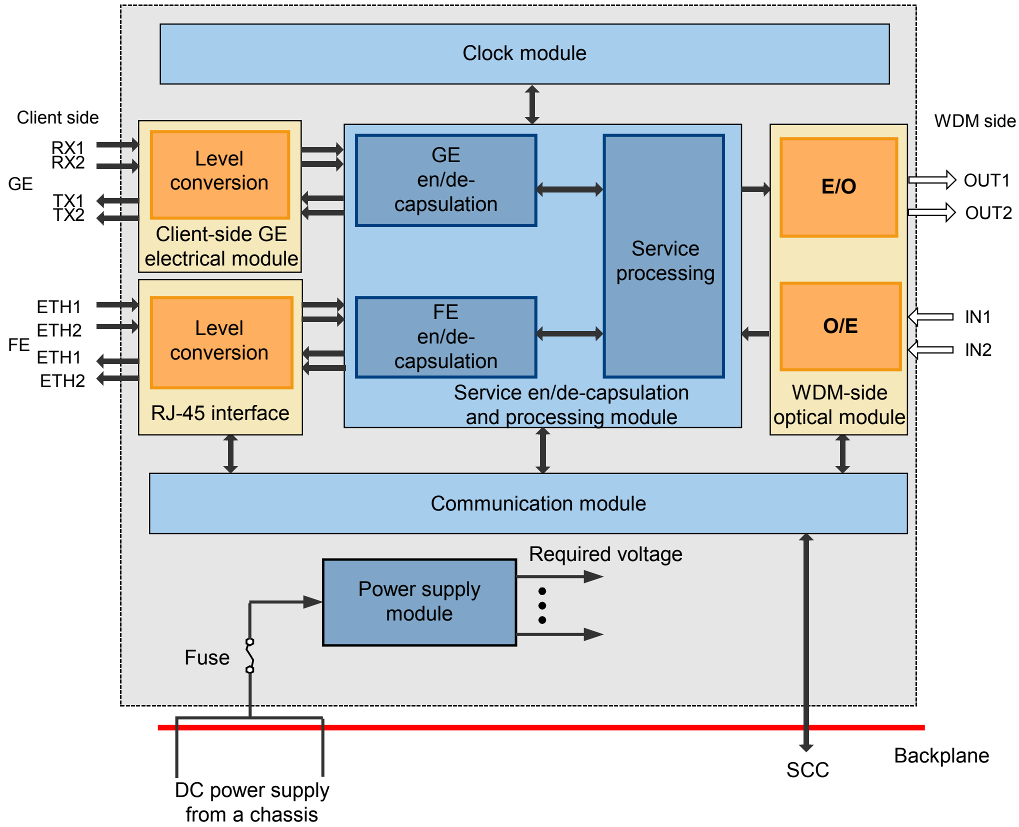


Figure 10-48 Functional block diagram of the LDGF board (TX1/RX1 and TX2/RX2 ports access GE electrical signals)



Signal Flow

In the signal flow of the LDGF board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LDGF to the WDM side of the LDGF, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side GE optical module receives GE optical signals from client equipment through the RX1-RX2 ports, and performs O/E conversion.
  - The client-side GE electrical module receives GE electrical signals from client equipment through the RX1-RX2 ports, and performs level conversion.

  The RJ-45 connector receives two channels of FE electrical signals from the client-side equipment through the ETH1 and ETH2 electrical ports, and performs the level conversion.

  After conversion, the four channels of electrical signals are sent to the service en/de-capsulation and processing module. The module performs processes such as multiplexing, frame processing and overhead insertion. Then, the module outputs one channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant 2.67 Gbit/s OTU1 optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s OTU1 optical signals at CWDM standard wavelengths. The OTU1 optical signals are output through the OUT optical port.

- Receive direction

  The WDM-side optical module receives the G.694.1-compliant 2.67 Gbit/s OTU1 optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s OTU1 optical signals at CWDM standard wavelengths from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

  After O/E conversion, the OTU1 signals are sent to the service en/de-capsulation and processing module. The module performs processes such as decapsulation and demultiplexing. Then, the module outputs two channels of GE signals and two channels of FE signals.

  The client-side GE optical module performs E/O conversion and the client-side GE electrical module performs level conversion of GE electrical signals, and then outputs client-side GE optical signals and GE electrical signals through the TX1-TX2 ports.

  The RJ-45 connector performs the level conversion of the two channels of FE electrical signals, and then outputs two channels of client-side FE signals through the ETH1-ETH2 electrical ports.

Module Function

- Client-side GE optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE optical signals from the client side devices and performs the O/E conversion of the GE optical signals to internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE optical signals, and transmits the GE optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- Client-side GE electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE electrical signals from the client side devices and performs the level conversion of the GE electrical signals to internal electrical signals.
  - Client-side transmitter: Performs level conversion from internal electrical signals to GE electrical signals, and transmits the GE electrical signals to client side devices.

- RJ-45 connector

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives FE electrical signals from the client side devices and performs the level conversion of the FE electrical signals to internal electrical signals.
  - Client-side transmitter: Performs level conversion from internal electrical signals to FE electrical signals, and transmits the FE electrical signals to client side devices.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of OTU1 optical signals at 2.67 Gbit/s.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to OTU1 optical signals at 2.67 Gbit/s.
  - Reports the performance of the WDM-side optical port.

  – Reports the working state of the WDM-side laser.

- Service en/de-capsulation and processing module

  The module consists of the GE en/de-capsulation module, FE en/de-capsulation module and the service processing module. It implements the en/de-capsulation of GE and FE signals and service convergence.

  – GE en/de-capsulation module: Processes the encapsulation and decapsulation of GE signals, and reports the performance monitoring state of service signals.

  – FE en/de-capsulation module: Processes the encapsulation and decapsulation of FE signals, and reports the performance monitoring state of service signals.

  – Service processing module: Achieves the multiplexing from GE/FE to OTU1 and the demultiplexing from OTU1 to GE/FE, and performs processes such as encoding/decoding and scrambling/descrambling of signals.

- Clock module

  – Provides a clock for the board.

- Communication module

  – Collects the information of alarms, performance events, and working states of each functional module of the unit.

  – Communicates with the SCC unit, to control and operate on each module of the unit.

- Power supply module

  – Converts the DC power into the power required by each module of the unit.

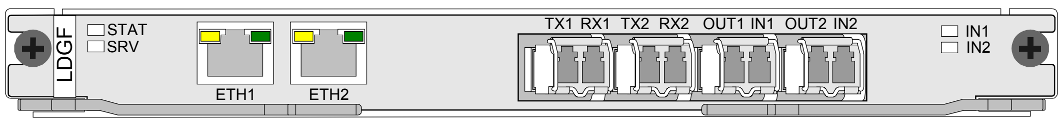
10.4.5 Front Panel

There are indicators and ports on the LDGF front panel.

Appearance of the Front Panel

Figure 10-49 shows the front panel of the LDGF.

Figure 10-49 Front panel of the LDGF



NOTE

Figure 10-49 shows the situation that the ports are inserted with optical SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-66 lists the type and function of each port.

Table 10-66 Types and functions of the LDGF ports

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/ transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/ transmit the WDM signals coming from the standby channel.
TX1/RX1 to TX2/ RX2	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the GE optical or electrical service signals to client-side equipment.
ETH1/ETH2	RJ-45	Transmits/receives the FE electrical signals to client-side equipment.

NOTE

- The ETH1 and ETH2 ports on the client side are used to access FE electrical signals. The RX1/TX1 and RX2/TX2 optical ports on the client side support the optical SFP module, single-fiber bidirectional GE SFP module, and electrical SFP module. The preceding SFP modules can be used on the client side at the same time. The optical ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.
- Shielded cables should be used to transmit FE electrical signals.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.4.6 Valid Slots

The LDGF occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.4.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Ports

Table 10-67 lists the sequence number displayed in an NMS system of the port on the LDGF board front panel.

Table 10-67 Display of the LDGF ports

Ports on the Front Panel	Ports Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
TX1/RX1	3
TX2/RX2	4
ETH1	5
ETH2	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.4.8 LDGF Parameters on the NMS

Precautions

TIP

In the case of the LDGF board, you can connect a portable computer to the FE port by using a network cable when the FE port is in **Used** state. Then issue the **ping** command for connecting to the opposite client equipment to check whether a normal connection can be established on the channel.

Parameter Description

Field	Value	Description
Service Type	GE, GE(GFP-T) Default: GE(GFP-T)	• Usually, **GE(GFP-T)** is recommended. In this mode, the transmission delay is small and all control protocol packets are transparently transmitted. • In other cases, set this parameter to **GE** according to the service encapsulation mode. • Service types of the two boards that are interconnected with each other must be consistent. **NOTE** Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	• The default value is recommended. • On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. • If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. • If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. • If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.

Field	Value	Description
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LDGF board, do not disable the WDM-side lasers on the LDGF board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid only when **Service Type** is set to **GE**. The default value is recommended.
SF Switching Trigger Condition	None, OTUK_BDI Default: None	Intra-board 1+1 protection switching is performed only at the affected end once a fault occurs if the parameter is set to **None**. Intra-board 1+1 protection switching is performed at both ends once an OTUK_BDI alarm is detected when the parameter is set to **OTUK_BDI**. **NOTE** This parameter is only supported by the TNF1LDGF.

Field	Value	Description
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group.
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE** or **GE(GFP-T)**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.

Field	Value	Description
Optical Interface/ Channel	-	-

10.4.9 LDGF Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LDGF	1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490)	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-68 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-69 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-70 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-71 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	**1000BASE-BX-10km (SM1490)**
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-72 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Specifications for Client-Side Electrical Modules

Table 10-73 Specifications of FE electrical service at client side

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100
Transmission bandwidth	-	98%
Maximum transmission packet	byte	1534
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-74 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.75 kg (1.65 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 13.6 W
- Maximum Power Consumption at 55°C (131°F): 18.0 W

10.5 LDGF2

LDGF2: Double 2 x GE Wavelength Conversion Board

10.5.1 Version Description

The available hardware versions for the LDGF2 are TNF1 and TNF2.

Version

Table 10-75 describes the version mapping of the LDGF2 board.

Table 10-75 Version description of the LDGF2

Item	Description
Board hardware version	TNF1: The mapping version of the equipment is V100R001C01 or later. TNF2: The mapping version of the equipment is V100R003C01 or later.

Differences Between Versions

Table 10-76 lists differences between LDGF2 board versions.

Table 10-76 Differences between LDGF2 board versions

Item	TNF1LDGF2	TNF2LDGF2
Protection schemes	Does not support ODUk SNCP protection.	Supports ODUk (k = 0, 1) SNCP protection.
Synchronous Ethernet transparently transmitting	Does not support synchronous Ethernet services.	Supports synchronous Ethernet services.

Item	TNF1LDGF2	TNF2LDGF2
Mapping path	Supports ODU1-level mapping.	Supports ODU0-level and ODU1-level mapping.
Encapsulation mode	Supports encapsulation of GE services in GFP_F and GFP_T modes.	Supports encapsulation of GE services in GFP_T and GE (TTT-GMP) modes.

Substitution Relationship

Table 10-77 lists the substitution relationship for LDGF2 boards.

Table 10-77 Substitution relationship for LDGF2 boards

Original Board	Substitute Board	Substitution Rules
TNF1LDGF2	TNF2LDGF2	The TNF2LDGF2 board can be created as TNF1LDGF2 on the NMS to function as a TNF1LDGF2 board. In this scenario, the TNF2LDGF2 only provides the functions of the TNF1LDGF2 board. **NOTE** If the NE software version is V100R003C01 or later, the NE software does not need to be upgraded during the substitution. If the NE software version is earlier than V100R003C01, the NE software needs to be upgraded to V100R003C01 or a later version. The TNF2LDGF2 board does not support GE (GFP-F) services. When it is used to substitute for a TNF1LDGF2 board provisioned with GE (GFP-F) services, change the service type to GE (GFP-T) after the substitution.
TNF2LDGF2	None	-

10.5.2 Application

The LDGF2 is mainly used to multiplex two channels of 2 x GE service signals into two channels of OTU1 signals, and convert the signals into a DWDM standard wavelength compliant with ITU-T G.694.1 or CWDM standard wavelength compliant with ITU-T G.694.2.

Service Access Description

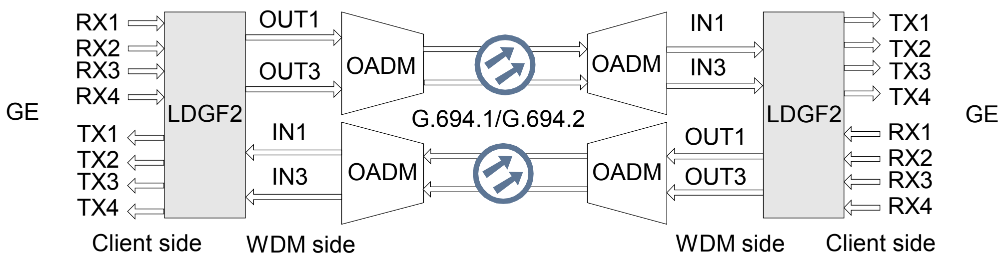
Table 10-78 describes the principle for configuring the ports of the LDGF2 board.

Table 10-78 Principle for configuring the ports of the LDGF2 board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Multiplex two channels of 2 x GE service signals into two channels of OTU1 signals	GE optical signal or GE electrical signal	4	● The first group of 2 x GE service signals: TX1/RX1 and TX2/RX2 ● The second group of 2 x GE service signals: TX3/RX3 and TX4/RX4

Figure 10-50 shows the LDGF2 board application in a WDM system.

Figure 10-50 LDGF2 board application in a WDM system



NOTE

Figure 10-50 shows that the optical SFP module is used in every port on the client side.

10.5.3 Functions and Features

The main functions and features supported by the LDGF2 are wavelength conversion, service convergence, and ALS.

For detailed functions and features, see Table 10-79.

Table 10-79 Functions and features of the LDGF2

Functions and Features	Description
Basic function	● Dual 2 x GE <-> 2 x OTU1 ● The group of client-side ports (TX1/RX1 and TX2/RX2) corresponds to WDM-side ports IN1/OUT1 and IN2/OUT2, and the group of WDM-side ports (TX3/RX3 and TX4/RX4) correspond to WDM-side ports IN3/OUT3 and IN4/OUT4. Both the groups of client-side ports support the dual feeding and selective receiving function.

Functions and Features	Description
Service type	• Convergence services: – GE: Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals or GE electrical signals.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	TNF1LDGF2: • Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes. TNF2LDGF2: • Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes.
Alarms and performance events monitoring	Provides the Ethernet service performance monitoring function. Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of GE services.
Regeneration board	The WDM-side signals of the LDGF2 board can be regenerated by the LWX2, LQM, or TNF1LQM2 board.
Synchronous Ethernet services	The TNF2LDGF2 board supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
OTN function	• Provides the OTU1 interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports PM functions for ODU1. • Supports PM functions for ODU0. • Supports SM functions for OTU1.
Intelligent Fiber (IF) function	The TNF1LDGF2 board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board. TNF2LDGF2: Not supported

<table>
<tr><th>Functions and Features</th><th colspan="2">Description</th></tr>
<tr><td>Protection schemes</td><td colspan="2">TNF1LDGF2:
● Supports client 1+1 protection
● Supports intra-board 1+1 protection
TNF2LDGF2:
● Supports client 1+1 protection
● Supports intra-board 1+1 protection
● Supports ODUk SNCP (k=0,1) protection</td></tr>
<tr><td>Loopback</td><td colspan="2">● Supports WDM side inloop
● Supports WDM side outloop
● Supports client side inloop
● Supports client side outloop</td></tr>
<tr><td>ALS function</td><td colspan="2">Supports the ALS function on the client side.</td></tr>
<tr><td>ESC function</td><td colspan="2">Supported</td></tr>
<tr><td>Cross-connect function</td><td colspan="2">Not supported</td></tr>
<tr><td>LPT function</td><td colspan="2">The board supports the LPT function only when the client-side service type is GE services.</td></tr>
<tr><td>PRBS test</td><td colspan="2">TNF1LDGF2: Not supported
TNF2LDGF2: Supports the PRBS function on the client side.
NOTE
The PRBS function on the client side is supported only when the client-side service type is GE(GFP-T).</td></tr>
<tr><td>Ethernet port working mode</td><td colspan="2">TNF1LDGF2:
● GE optical port: 1000M full-duplex or auto-negotiation
● GE electrical port: auto-negotiation
TNF2LDGF2:
● GE optical port: 1000M full-duplex
● GE electrical port: 1000M full-duplex</td></tr>
<tr><td>WDM specification</td><td colspan="2">Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G. 694.2-compliant CWDM specifications.</td></tr>
<tr><td>Protocol or standard compliance</td><td>Protocols or standards (non-performance monitoring) with which transparently transmitted services comply</td><td>IEEE 802.3z</td></tr>
</table>

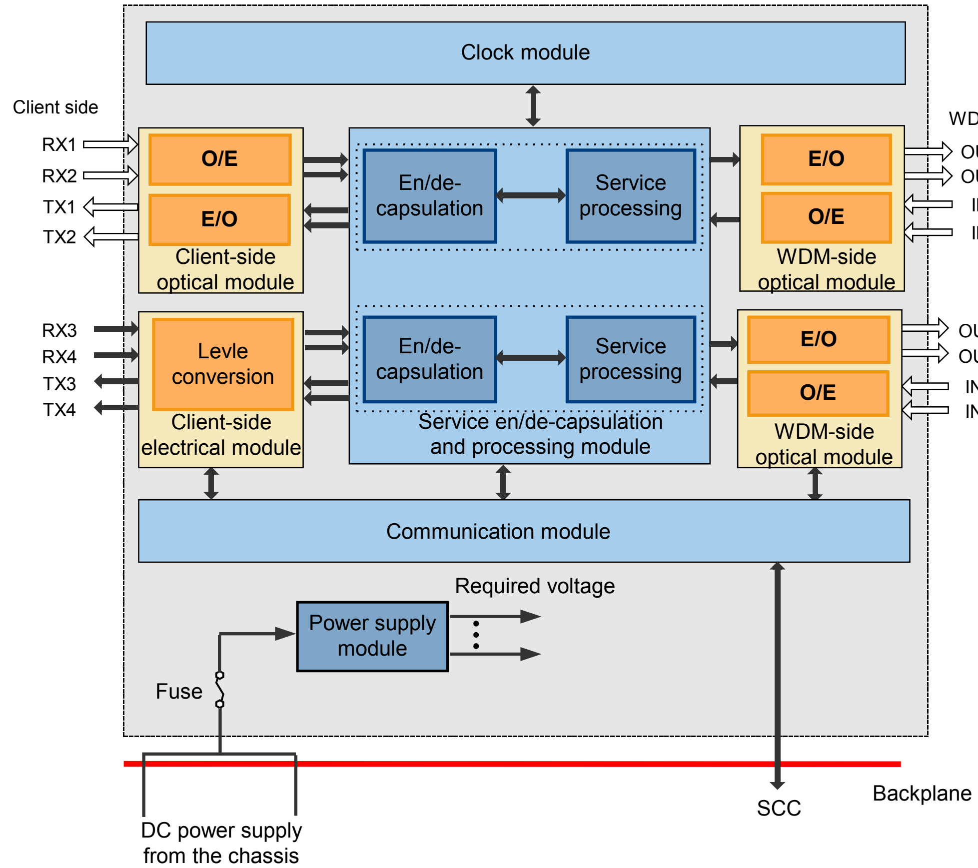
Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2 **NOTE** Only the TNF2LDGF2 board support ITU-T G.873.1.

10.5.4 Working Principle and Signal Flow

The LDGF2 board consists of the client-side optical module or the client-side electrical module, WDM-side optical module, service en/de-capsulation and processing module, clock module, communication module, and power supply module.

Figure 10-51 is the functional block diagram of the LDGF2 board. The diagram shows that the optical SFP module is used in the RX1/TX1 and RX2/TX2 ports and the electrical SFP module is used in the RX3/TX3 and RX4/TX4 ports.

Figure 10-51 Functional block diagram of the LDGF2 board



Signal Flow

In the signal flow of the LDGF2 board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side to the WDM side of the LDGF2, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives GE optical signals from client equipment through the RX1 to RX4 ports, and performs O/E conversion.
  - The client-side electrical module receives GE electrical signals from client equipment through the RX1 to RX4 ports, and performs level conversion.

  After conversion, the four channels of electrical signals are sent to the two service en/de-capsulation and processing modules respectively. The modules perform processing such as multiplexing, clock generating and frame processing. Then, the modules output two channels of OTU1 signals.

  The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant 2.67 Gbit/s OTU1 optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s OTU1 optical signals at CWDM standard wavelengths. The OTU1 optical signals are output through the OUT1-OUT4 optical ports.
- Receive direction

The WDM-side optical module receives the G.694.1-compliant 2.67 Gbit/s OTU1 optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s OTU1 optical signals at CWDM standard wavelengths from the WDM side through the IN1 to IN4 optical ports. Then, the module performs O/E conversion.

After O/E conversion, the OTU1 signals are sent to the service en/de-capsulation and processing modules. The modules perform processing such as decapsulation, clock recovery and demultiplexing. Then, the modules output four channels of GE electrical signals.

The client-side optical module performs E/O conversion and the client-side electrical module performs level conversion of the electrical signals, and then outputs client-side GE optical signals and client-side GE electrical signals through the TX1 to TX4 ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE optical signals from the client side devices and performs the O/E conversion of the GE optical signals to internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE optical signals, and transmits the GE optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- Client-side electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE electrical signals from the client side devices and performs the level conversion of the GE electrical signals to internal electrical signals.
  - Client-side transmitter: Performs level conversion from internal electrical signals to GE electrical signals, and transmits the GE electrical signals to client side devices.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of OTU1 optical signals at 2.67 Gbit/s.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to OTU1 optical signals at 2.67 Gbit/s.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module

  The module consists of the en/de-capsulation module and the service processing module. It implements en/de-capsulation and convergence of GE signals.

  - En/de-capsulation module: Processes the encapsulation and decapsulation of GE signals, and reports the performance monitoring state of service signals.
  - Service processing module: Achieves the multiplexing from GE to OTU1 and the demultiplexing from OTU1 to GE, and performs processes such as encoding/decoding and scrambling/descrambling of signals.
- Clock module

  Provides a clock for the board and implements clock transparent transmission.

- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

10.5.5 Front Panel

There are indicators and ports on the LDGF2 front panel.

Appearance of the Front Panel

Figure 10-52 and **Figure 10-53** show the front panel of the LDGF2.

Figure 10-52 Front panel of the TNF1LDGF2

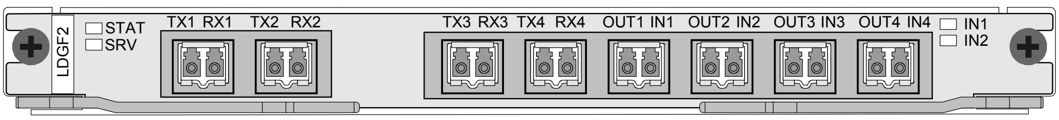
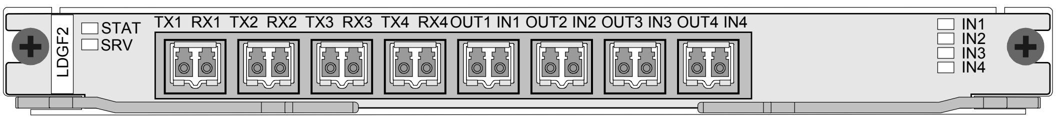


Figure 10-53 Front panel of the TNF2LDGF2



NOTE

Figure 10-52 and **Figure 10-53** show the situation that the ports are inserted with optical port SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

NOTE

For TNF1LDGF2, IN1 maps the WDM-side module IN1/OUT1 and IN3/OUT3, and IN2 maps the WDM-side module IN2/OUT2 and IN4/OUT4.

For the TNF2LDGF2, IN1, IN2, IN3, and IN4 indicate ports IN1/OUT1, IN2/OUT2, IN3/OUT3, and IN4/OUT4 respectively.

NOTE

Indicator IN1 indicates ports IN1/OUT1 and IN3/OUT3 in turn while indicator IN2 indicates ports IN3/OUT3 and IN4/OUT4 in turn. The interval is one minute. For example:

During the first minute, IN1 indicates IN1/OUT1 and IN2 indicates IN2/OUT2.

During the second minute, IN1 indicates IN3/OUT3 and IN2 indicates IN4/OUT4.

...

Every 10s, the status of IN1 and IN2 indicate the status of which group of optical ports is presented in the next 10s.

If IN1 is green and blinks and IN2 is off, it indicates that in the next 10s, IN1 presents the status of IN1/OUT1 and IN2 presents the status of IN2/OUT2.

If IN1 is off and IN2 is green and blinks, it indicates that in the next 10s, IN1 presents the status of IN3/OUT3 and IN2 presents the status of IN4/OUT4.

Ports

Table 10-80 lists the type and function of each port.

Table 10-80 Types and functions of the LDGF2 ports

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the first channel of the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the first channel of the WDM signals coming from the standby channel.
IN3/OUT3	LC	Connected to the OADM board to receive/transmit the second channel of the WDM signals coming from the active channel.
IN4/OUT4	LC	Connected to the OADM board to receive/transmit the second channel of the WDM signals coming from the standby channel.
TX1/RX1 to TX2/RX2	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the first group of 2 x GE service signals to client-side equipment.
TX3/RX3 to TX4/RX4	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the second group of 2 x GE service signals to client-side equipment.

NOTE

- The RX1/TX1-RX4/TX4 ports on the client side support the optical SFP module, single-fiber bidirectional GE SFP module, and electrical SFP module. The preceding SFP modules can be used on the client side at the same time. The ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.5.6 Valid Slots

The LDGF2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.5.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Ports

Table 10-81 lists the sequence number displayed in an NMS system of the ports on the LDGF2 board front panel.

Table 10-81 Display of the LDGF2 ports

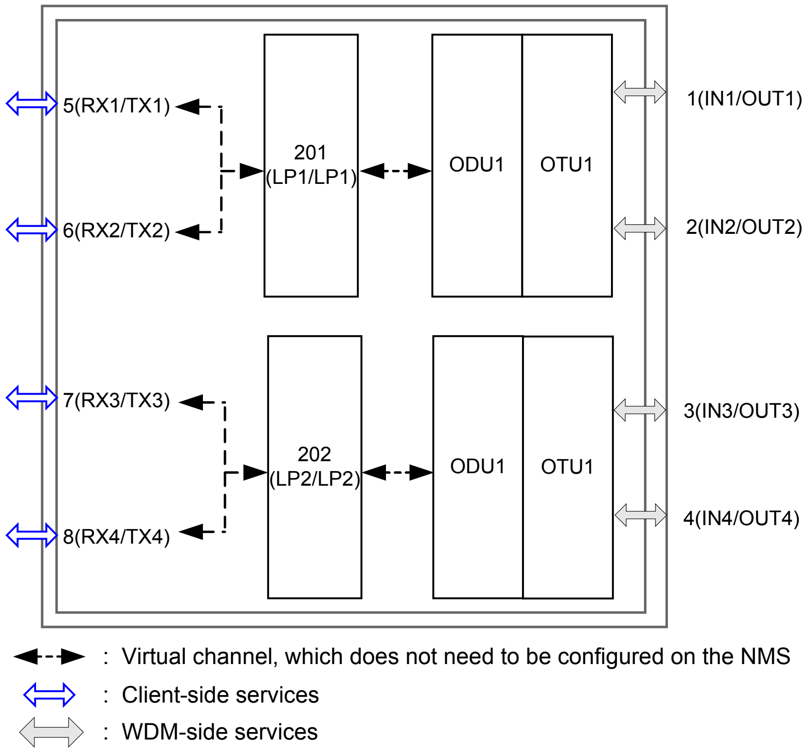
Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
IN3/OUT3	3
IN4/OUT4	4
TX1/RX1	5
TX2/RX2	6
TX3/RX3	7
TX4/RX4	8

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model of TNF1LDGF2 board

Figure 10-54 Port model of the TNF1LDGF2 board



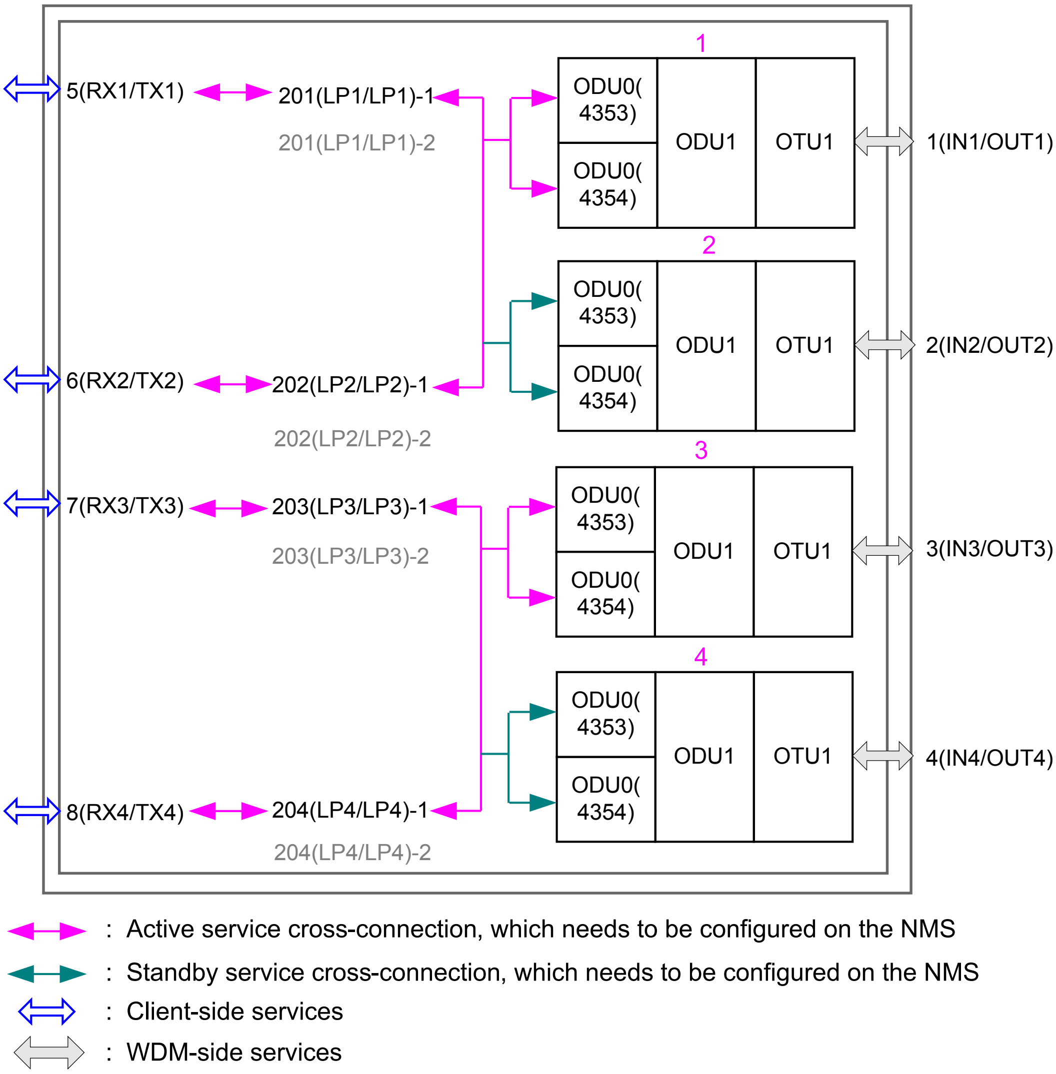
- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 5-8 (RX1/TX1 to RX4/TX4).
- Alarms and performance events related to OTN electrical-layer overheads are reported on channels 1 and 2 of logical ports 201 and 202.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) to 4 (IN4/OUT4).
- Cross-connections are automatically generated and no configuration is required on the NMS.

Port model of TNF2LDGF2 board

The TNF2LDGF2 board can work in two different modes: 2 x AP2 ODU0 mode, 2 x AP2 ODU1 mode.

- 2 x AP2 ODU0 mode

Figure 10-55 Port model of the TNF2LDGF2 board (2 x AP2 ODU0 mode)

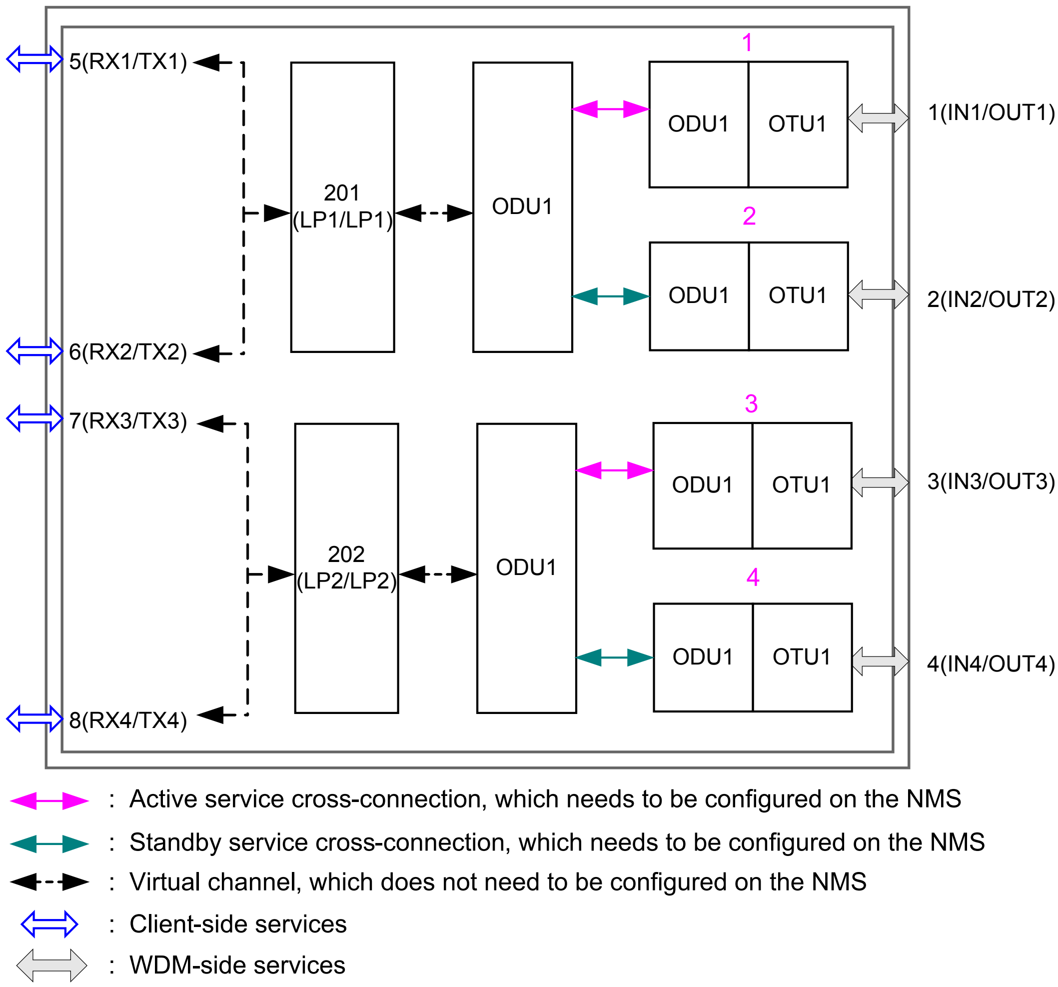


- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 5-8 (RX1/TX1 to RX4/TX4).
- Alarms, performance events, and configurations related to ODU0 signal overheads are reported on channels 4353 and 4354 of WDM-side optical ports.
- Alarms, performance events, and configurations related to ODU1/OTU1 signal overheads are reported on channel 1 of optical ports 1, 2, 3, and 4.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) to 4 (IN4/OUT4).
- Cross-connections from ports 5–8 (RX1/TX1–RX4/TX4) to channel 1 of ports 201–204 need to be configured. When the board is interconnected with a TN52TOM board for NG WDM products, you can configure the cross-connections from optical ports 5–8 (RX1/TX1–RX4/TX4) to channel 2 of ports 201–204 to ensure channel ID consistency for the TN52TOM board.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 0) protection. However, the two types of protection cannot be configured simultaneously. When intra-

board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to channel 4353 of optical port 1 and unidirectional cross-connections from port 201 to channel 4353 of optical port 2; bidirectional cross-connections from port 202 to channel 4354 of optical port 1 and unidirectional cross-connections from port 202 to channel 4354 of optical port 2; bidirectional cross-connections from port 203 to channel 4353 of optical port 3 and unidirectional cross-connections from port 203 to channel 4353 of optical port 4; bidirectional cross-connections from port 204 to channel 4354 of optical port 3 and unidirectional cross-connections from port 204 to channel 4354 of optical port 4. When ODUk SNCP (k = 0) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 2 x AP2 ODU1 mode

Figure 10-56 Port model of the TNF2LDGF2 board (2 x AP2 ODU1 mode)



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 5-8 (RX1/TX1 to RX4/TX4).
- Alarms, performance events, and configurations related to OTU1/ODU1 signal overheads are reported on channel 1 of optical ports 1, 2, 3, and 4.

- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) to 4 (IN4/OUT4).
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 1) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2; bidirectional cross-connections from port 202 to optical port 3 and unidirectional cross-connections from port 202 to optical port 4. When ODUk SNCP (k = 1) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

10.5.8 LDGF2 Parameters on the NMS

Parameter Description

Field	Value	Description
Board Working Mode	2 x AP2 ODU0 mode, 2 x AP2 ODU1 mode Default: 2 x AP2 ODU1 mode	● **2 x AP2 ODU0 mode**: The ELOM board supports ODU0 service encapsulation. ● **2 x AP2 ODU1 mode**: The ELOM board supports ODU1 service encapsulation. **NOTE** This parameter is only supported by the TNF2LDGF2.
Cross-Connection Configuration Mode	● Automatic, Manual ● Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**. **NOTE** This parameter is only supported by the TNF2LDGF2.

Field	Value	Description
Service Type	TNF1LDGF2: ● GE, GE(GFP-T) ● Default: GE(GFP-T) TNF2LDGF2: ● GE(TTT-GMP), GE(GFP-T) ● Default: GE(GFP-T)	● Set this parameter according to the service encapsulation mode. Usually, **GE(GFP-T)** is recommended. In this mode, the transmission delay is small and all control protocol packets are transparently transmitted. ● Service types of the two boards that are interconnected with each other must be consistent. ● For the TNF2LDGF2 board, GE(TTT-GMP) is supported only when the board works in **2*AP2 ODU0 mode**. **NOTE** Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally. ● When a board is used to transmit synchronous Ethernet services, this parameter must be set to **GE(TTT-GMP)**. ● When a board is used to transmit ordinary Ethernet services, this parameter must be set to **GE** or **GE(GFP_T)**.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.

Field	Value	Description
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LDGF2 board, do not disable the WDM-side lasers on the LDGF2 board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid only when **Service Type** is set to **GE**. The default value is recommended. **NOTE** This parameter is only supported by the TNF1LDGF2.
SF Switching Trigger Condition	None, OTUK_BDI Default: None	Intra-board 1+1 protection switching is performed only at the affected end once a fault occurs if the parameter is set to **None**. Intra-board 1+1 protection switching is performed at both ends once an OTUK_BDI alarm is detected when the parameter is set to **OTUK_BDI**. **NOTE** This parameter is only supported by the TNF1LDGF2.
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group. **NOTE** This parameter is only supported by the TNF1LDGF2.

Field	Value	Description
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled. **NOTE** This parameter is only supported by the TNF1LDGF2.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE**, **GE(GFP-T)** or **GE(TTT-GMP)**. ● The LPT function can work only with intra-board 1+1 protection or ODUk SNCP protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete. **NOTE** This parameter is only supported by the TNF2LDGF2.
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **NOTE** This parameter is only supported by the TNF2LDGF2. **CAUTION** The settings of **GCC Receive/Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.

Field	Value	Description
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.5.9 LDGF2 Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LDGF2	1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490)	GE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-82 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-83 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-84 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-85 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	**1000BASE-BX-10km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-86 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Specifications for Client-Side Electrical Modules

Table 10-87 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight:
  - TNF1LDGF2: 0.7 kg (1.54 lb.)
  - TNF2LDGF2: 0.6 kg (1.32 lb.)

Power Consumption

Board	Typical Power Consumption at 25°C (77°F)	Maximum Power Consumption at 55°C (131°F)
TNF1LDGF2	21.3W	27.8W
TNF2LDGF2	12.5W	15.7W

10.6 LDX

LDX: 2 x 10 Gbit/s Wavelength Conversion Board

10.6.1 Version Description

The available hardware version for the LDX is TNF1.

Version

Table 10-88 describes the version mapping of the LDX board. The mapping version of the equipment is V100R003C01 or later.

Table 10-88 Version description of the LDX

Item	Description
Board hardware version	TNF1

10.6.2 Application

The LDX board implements the transmission of two channels of 10 Gbit/s optical signals.

Service Access Description

Table 10-89 describes the principle for configuring the ports of the LDX board.

Table 10-89 Principle for configuring the ports of the LDX board

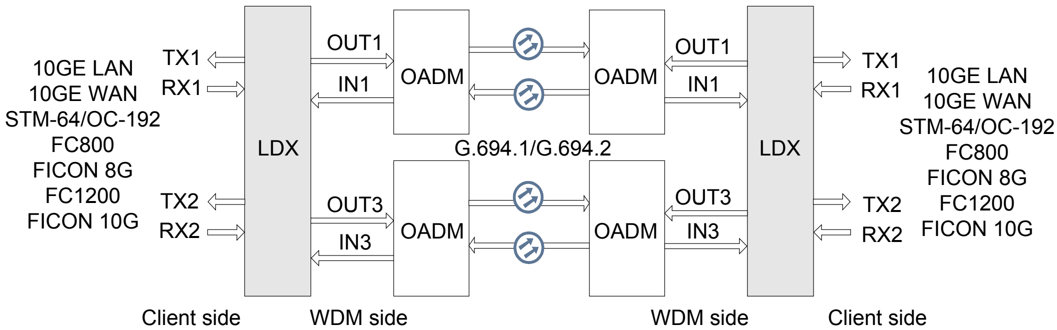
Application Scenario of the Board	Service Access	Names of Available Ports	Remarks
Access two channels of optical signals	Any optical signals at the rate of 10 Gbit/s	TX1/RX1 TX2/RX2	Null

Application Scenario: Implements the Transparent Transmission of Two Channels of 10 Gbit/s Optical Signals

The LDX is mainly used to map two channels of 10 Gbit/s service signals into OTU2 or OTU2e signals and convert the converged OTU2 signals into signals borne on a standard DWDM wavelength compliant with ITU-T G.694.1 or signals borne on a standard CWDM wavelength compliant with ITU-T G. 694.2. At the same time, the board completes the reverse process.

For the application of the board to implement the transparent transmission of two channels of optical signals, see **Figure 10-57**

Figure 10-57 Application of the LDX board (access two channels of optical signals)



NOTE

In the above-mentioned applications, the board supports dual-fed selective receiving on the WDM side. The two services received and transmitted by the RX1/TX1 and RX2/TX2 ports are independent from each other. The RX1/TX1 port corresponds to the OUT1/IN1 and OUT2/IN2 ports, and the RX2/TX2 port corresponds to the OUT3/IN3 and OUT4/IN4 ports. The OUT1/IN1 and OUT3/IN3 ports function as the working channels and the OUT2/IN2 and OUT4/IN4 ports function as the protection channels.

10.6.3 Functions and Features

The main functions and features supported by the LDX are wavelength conversion, OTN ports, and ESC.

For detailed information about the functions and features, see **Table 10-90**.

Table 10-90 LDX Functions and Features

Functions and Features	Description
Basic function	2 x 10Gbit/s service signals<-> 2 x OTU2/OTU2e
Services type	• Transparent transmission services: - 10GE LAN: Ethernet services, the rate is 10.31 Gbit/s. **NOTE** The 10GE LAN services can be mapped in two modes: Bit Transparent Mapping (11.1 G) and MAC Transparent Mapping (10.7 G). - 10GE WAN: Ethernet services, the rate is 9.95 Gbit/s. - STM-64: SDH services, the rate is 9.95 Gbit/s. - OC-192: SONET services, the rate is 9.95 Gbit/s. - FC800: Fiber channel services with the rate being 8.5 Gbit/s. - FICON 8G: Fiber channel services with the rate being 8.5 Gbit/s. - FC1200: Fiber channel services with the rate being 10.51 Gbit/s. - FICON 10G: Fiber channel services with the rate being 10.51 Gbit/s. - OTU2: OTN services, the rate is 10.71 Gbit/s. - OTU2e: OTN services, the rate is 11.1 Gbit/s.
OTN function	• Provides the OTU2 and OTU2e interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports PM functions for ODU2. • Supports SM functions for OTU2.
Tunable wavelength function	Supports the tunable wavelength optical module. Equipped with this module, the board can tune the optical signal output on the WDM side within the range of 40 wavelengths in C-band with the channel spacing of 100 GHz.
Alarms and performance events monitoring	Monitors B1, SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of 10GE LAN services.

Functions and Features	Description
Regeneration board	The TNF1LSX board
Non-Intrusive Monitoring Function	Not supported
FEC function	• Supports forward error correction (FEC) that complies with ITU-T G.709. • Supports AFEC-2 that complies with ITU-T G.975.1. **NOTE** Boards that use different FEC modes cannot interoperate with each other.
Synchronous Ethernet services	When receiving 10GE LAN services on the client side, and the services are mapped in Bit Transparent Mapping (11.1 G), the board supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
Protection schemes	• Supports client 1+1 protection • Supports intra-board 1+1 protection • Supports ODUk SNCP (k=2) protection
Loopback	• Supports WDM side inloop • Supports WDM side outloop • Supports client side inloop • Supports client side outloop
ALS function	Supports the ALS function on the client side.
ESC function	Supported
Cross-connect function	Not Supported

Functions and Features	Description	
LPT function	The board supports the LPT function only when the client-side service type is 10GE LAN services.	
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is 10GE LAN/10GE WAN/STM-64/OC-192.	
Ethernet port working mode	Supports 10 Gbit/s full duplex when the client-side service type is 10GE LAN or 10GE WAN.	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.707 ITU-T G.782 ITU-T G.783 NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI) NCITS FIBRE CHANNEL LINK SERVICES (FC-LS) NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2) NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3) NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3) IEEE 802.3ae

Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

NOTE

The LDX board can work at room temperature below 45°C (113°F) at a long term or below 55°C (131°F) at a short term. A short term refers to a maximum of 72 consecutive hours or fewer than 15 days in a year in total.

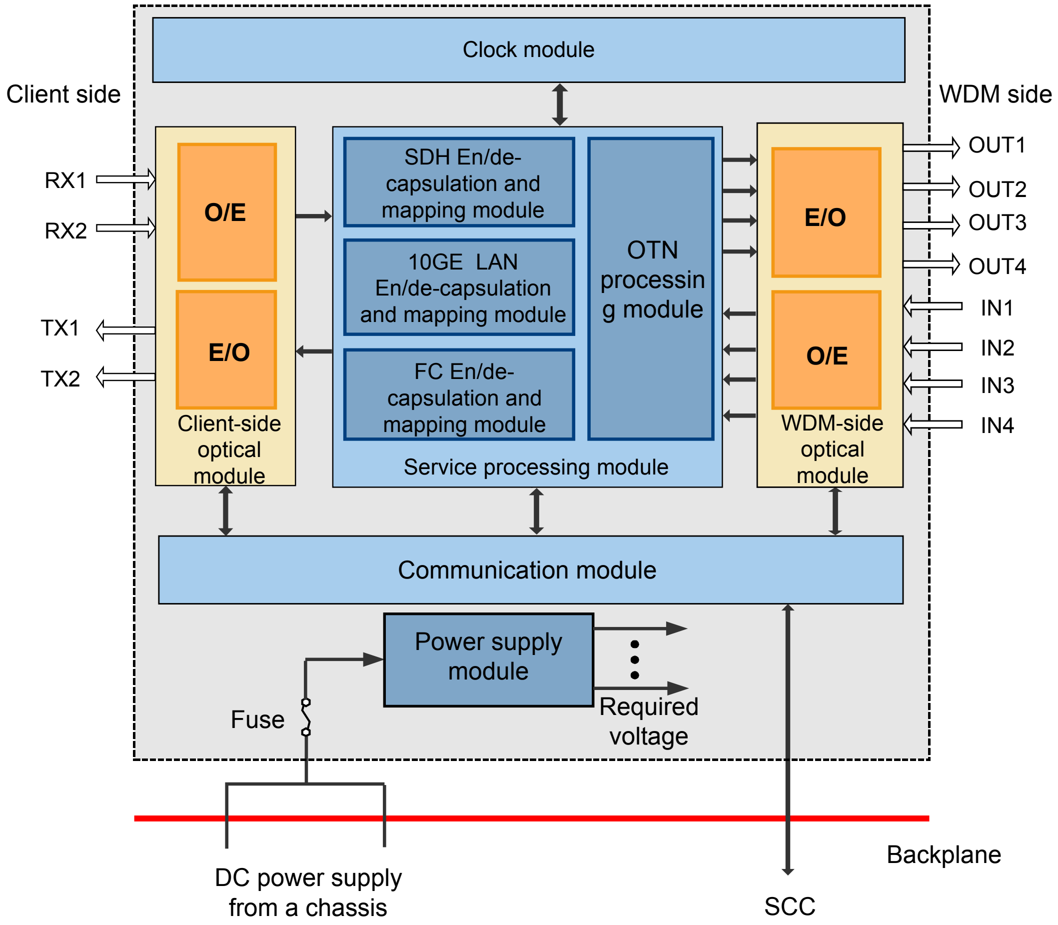
10.6.4 Working Principle and Signal Flow

The LDX board consists of the client-side optical module, WDM-side optical module, service processing module, the clock module, communication module, and power supply module.

Signal Flow of Transparent Transmission of Two Channels of 10 Gbit/s Optical Signals

Figure 10-58 is the functional block diagram of the LDX that implement the transparent transmission of two channels of 10 Gbit/s optical signals.

Figure 10-58 Functional block diagram of the LDX (transparent transmission of two channels of 10 Gbit/s optical signals)



In the signal flow of the LDX board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LDX to the WDM side of the LDX, and the receive direction is defined as the reverse direction.

- In the transmit direction

  The client-side optical module receives two channels of the optical signals from client equipment through the RX1/RX2 optical port, and performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module. Different types of signals are sent to different encapsulation and mapping modules for encapsulation and mapping. In the end, operations such as the OTN framing are performed. Then, the module outputs four channels of OTU2/OTU2e electrical signals.

  The OTU2/OTU2e signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals through the OUT1/OUT2/OUT3/OUT4 optical port.

- In the receive direction

  The WDM-side optical module receives four channels of the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals from the WDM side through the IN optical port. Then, the module performs the O/E conversion.

After the O/E conversion, the OTU2/OTU2e signals are sent to the service processing module. The module performs operations such as OTU2/OTU2e in frame, and decapsulation processing. Then, the module outputs two channels of STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G/OTU2/OTU2e electrical signal.

The client-side optical module performs the E/O conversion of the electrical signal, and then outputs client-side optical signals through the TX1/TX2 optical port.

NOTE

The RX1/TX1 port on the client side corresponds to the OUT1/IN1 and OUT2/IN2 ports on the WDM side; The RX2/TX2 port on the client side corresponds to the OUT3/IN3 and OUT4/IN4 ports on the WDM side. The OUT1/IN1 and OUT2/IN2 ports and the OUT3/IN3 and OUT4/IN4 ports can be used to implement dual-fed selective receiving of an OTU2/OTU2e signal.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the O/E conversion of STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G/OTU2/OTU2e optical signals.
  - Client-side transmitter: Performs the E/O conversion from the internal electrical signals to STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G/OTU2/OTU2e optical signals.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs the O/E conversion of OTU2/OTU2e optical signals.
  - WDM-side transmitter: Performs the E/O conversion from the internal electrical signals to OTU2/OTU2e optical signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.

- Service processing module

  The module consists of the SDH en/de-capsulation and mapping module, 10GE LAN en/de-capsulation and mapping module, FC en/de-capsulation and mapping module, and OTN processing module.

  - SDH en/de-capsulation and mapping module

    Encapsulates two channels of SDH/10GE WAN signals and maps the signals into the OTU2 payload area. The module also performs the reverse process and has the SDH/10GE WAN performance monitoring function.

  - 10GE LAN en/de-capsulation and mapping module

    Encapsulates two channels of 10GE LAN signals and maps the signals into the OTU2/OTU2e payload area. The module also performs the reverse process and has the 10GE LAN performance monitoring function.

  - FC en/de-capsulation and mapping module

    Encapsulates two channels of FC800/FICON 8G signals and maps the signals into the OTU2 payload area. Encapsulates two channels of FC1200/FICON 10G signals and maps the signals into the OTU2e payload area. The module also performs the reverse process and has the FC800/FICON 8G/FC1200/FICON 10G performance monitoring function.

  - OTN processing module

    Implements the framing of OTU2/OTU2e signals, processes the overheads of the OTU2/OTU2e signals, and performs the encoding and decoding.

- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

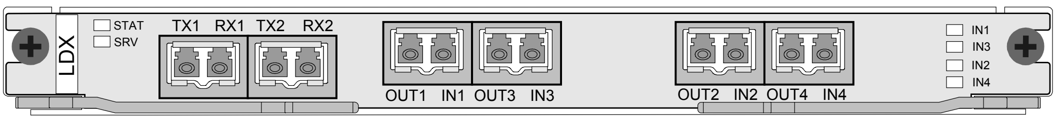
10.6.5 Front Panel

There are indicators and ports on the LDX front panel.

Appearance of the Front Panel

Figure 10-59 shows the front panel of the LDX.

Figure 10-59 Front panel of the LDX



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

- When the LDX board implements to access two channels of optical signals, **Table 10-91** lists the type and function of each port.

Table 10-91 Types and functions of the LDX ports (access two channels of optical signals)

<table>
<tr><th>Port</th><th>Port Type</th><th>Function</th><th>Remarks</th></tr>
<tr><td>TX1/RX1</td><td>LC</td><td>Transmits/Receives service signals of the client side.</td><td rowspan="3">The TX1/RX1 port corresponds to the IN1/OUT1 and IN2/OUT2 ports, which can be used to implement dual-fed selective receiving of a WDM-side signal.</td></tr>
<tr><td>IN1/OUT1</td><td>LC</td><td>Receives/Transmits the signal over the working channel of the optical add/drop multiplexer board on WDM equipment.</td></tr>
<tr><td>IN2/OUT2</td><td>LC</td><td>Receives/Transmits the signal over the protection channel of the optical add/drop multiplexer board on WDM equipment.</td></tr>
<tr><td>TX2/RX2</td><td>LC</td><td>Transmits/Receives service signals of the client side.</td><td rowspan="3">The TX2/RX2 port corresponds to the IN3/OUT3 and IN4/OUT4 ports, which can be used to implement dual-fed selective receiving of a WDM-side signal.</td></tr>
<tr><td>IN3/OUT3</td><td>LC</td><td>Receives/Transmits the signal over the working channel of the optical add/drop multiplexer board on WDM equipment.</td></tr>
<tr><td>IN4/OUT4</td><td>LC</td><td>Receives/Transmits the signal over the protection channel of the optical add/drop multiplexer board on WDM equipment.</td></tr>
</table>

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.6.6 Valid Slots

The LDX occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6. To ensure board performance, it is recommended that the LDX board be inserted into SLOT1, SLOT3 or SLOT5.

NOTE

When the LDX board is installed in slot IU1, IU3, or IU5, the board supports long-term operation at a temperature below 45°C (113°F) and supports short-term operation at a temperature above 45°C (113°F) but below 55°C (131°F). (Short-term operation means that the continuous working time does not exceed 72 hours and the accumulated working time per year does not exceed 15 days.)

When the LDX board is installed in slot IU2, IU4, or IU6, the board supports long-term operation at a temperature below 45°C (113°F).

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.6.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Display of Ports

Table 10-92 lists the sequence number displayed on the U2000 of the port on the LDX board front panel.

Table 10-92 Display of the LDX ports

Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
IN3/OUT3	3
IN4/OUT4	4
RX1/TX1	5
RX2/TX2	6

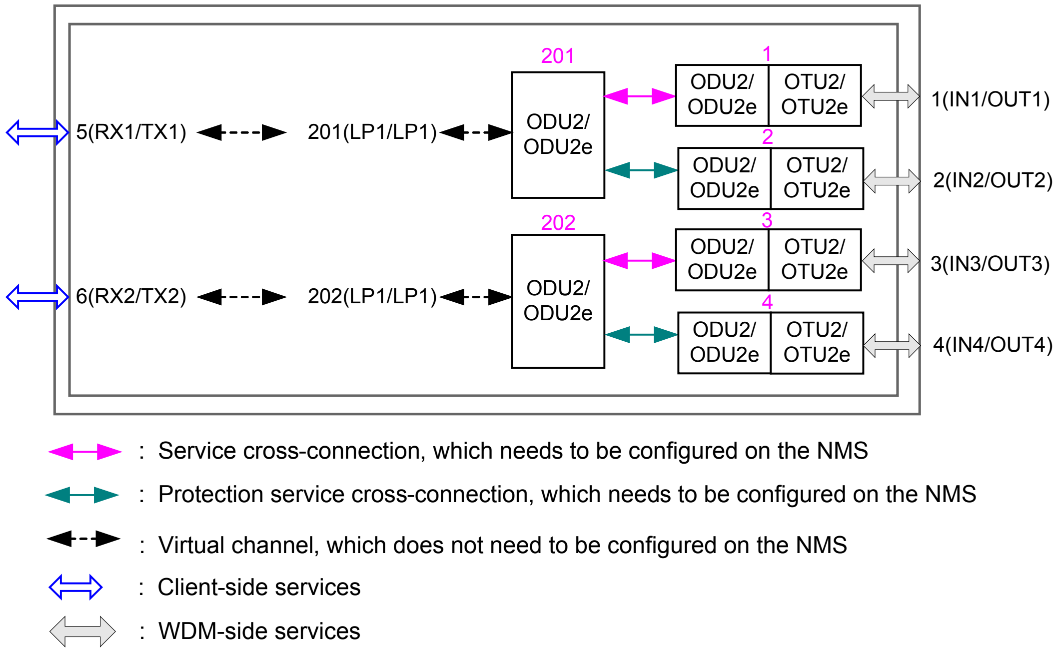
NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model of TNF1LDX board

Figure 10-60 shows the port model of the LDX board.

Figure 10-60 Port model of the TNF1LDX board



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 5(RX1/TX1) and 6(RX2/TX2).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1, 2, 3, and 4 (IN1/OUT1, IN2/OUT2, IN3/OUT3, and IN4/OUT4).
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 2) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2; bidirectional cross-connections from port 202 to optical port 3 and unidirectional cross-connections from port 202 to optical port 4. When ODUk SNCP (k = 2) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

10.6.8 LDX Parameters on the NMS

Parameter Description

Field	Value	Description
Cross-Connection Configuration Mode	● Automatic, Manual ● Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**.

Field	Value	Description
Service Type	10GE LAN, 10GE WAN, FC-1200, FICON 10G, FC-800, FICON 8G, STM-64, OC-192, OTU2, OTU2e Default: 10GE LAN	Select a proper value according to the received services. **NOTE** ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Port Mapping	Bit Transparent Mapping (11.1 G), MAC Transparent Mapping (10.7 G) Default: Bit Transparent Mapping (11.1 G)	This parameter is valid when **Service Type** is set to **10GE LAN**. ● When a board is used to transparently transmit synchronous Ethernet services, this parameter must be set to **Bit Transparent Mapping (11.1 G)**. ● Select **Bit Transparent Mapping (11.1 G)** when there are OTU2e signals on the WDM side. ● Select **MAC Transparent Mapping (10.7 G)** when there are OTU2 signals on the WDM side. **NOTE** Bit Transparent Mapping (11.1 G): Supports transparent bit (11.1 G) transport for 10GE LAN signals. In this port mapping mode, transmission of signals are achieved by increasing the OTU frame frequency. This ensures the encoding gain and correction capability of FEC. In this mode, the bit rate is 11.1 Gbit/s, which is higher than the standard bit rate of OTU2 signals. MAC Transparent Mapping (10.7 G): In this port mapping mode, 10GE LAN signals are encapsulated in the GFP-F format and then are mapped into standard OTU frames. This mode supports transparent transmission of only client 10GE MAC frames. In this mode, the signals are encapsulated in standard OTU2 frames and the bit rate of the signals is 10.71 Gbit/s. In addition, the FEC/AFEC code pattern is applicable to 10GE LAN services in this mode. Originally, the FEC code pattern is intended for 10G SDH services. **NOTE** ● Port mapping of the two boards that are interconnected with each other must be consistent.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.

Field	Value	Description
FEC Mode	FEC, AFEC Default: FEC	This parameter is available only when you set **FEC Working State** to **Enabled**. ● The default value is recommended. To improve the error correction capability, set this parameter to **AFEC**. ● **FEC Mode** of the two boards that are interconnected on the WDM side must be consistent. Otherwise, services are interrupted. **NOTE** The actual value is **AFEC-2**, but **AFEC** is displayed on the NMS. Users only can set the FEC mode for WDM-side ports .
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LDX board, the following situations occur when neither a standby channel is available nor protection is configured: ● When the LDX board is used for transparently transmitting the 10 Gbit/s optical signals, the NE becomes unreachable after the lasers at the IN and OUT optical ports on the LDX board are disabled.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid when **Service Type** is set to **10GE LAN** and **Port Mapping** is set to **MAC Transparent Mapping (10.7 G)**. The default value is recommended.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **10GE LAN**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.

Field	Value	Description
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **CAUTION** The settings of **GCC Receive/Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**. **NOTE** The LDX board only supports **Dual fed and selective receiving**.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./ optical port wavelength/ frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.6.9 LDX Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LDX	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP Multi-rate-10km-SFP+ Multi-rate-40km-SFP+ 10G BASE-SR 10G BASE-LR	N/A	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 10Gbit/s Multi-rate-10km 10Gbit/s Multi-rate-40km 10Gbit/s Multi-rate-80km

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

A margin of the lower threshold of input optical power compared with the receiver sensitivity of the board and a margin of the upper threshold of output optical power compared with the overload point of the board are reserved on the U2000 for precaution.

Table 10-93 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-94 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	1600ps/nm-fixed-APD-XFP
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	1600ps/nm-fixed-APD-XFP
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-95 Specifications of 1400ps/nm-fixed-APD-XFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	4 (1471 nm to 1571 nm) 3 (1591 nm to 1611 nm)

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Minimum mean launched power	dBm	0
Minimum extinction ratio	dB	8.2
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	±6.5
Maximum -20 dB spectral width	nm	1
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	Compliant with Telcordia GR-253/ IEEE802.3ae/G.959
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1460 to 1620
Receiver sensitivity	dBm	-23 (1471 nm to 1551 nm) -22 (1571 nm) -21 (1591 nm to 1611 nm)
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-96 Specifications of 10 Gbit/s Multi-rate optical modules

Item	Unit	Value		
Supported optical interface type	-	10 Gbit/s Multi-rate -10 km	10 Gbit/s Multi-rate -40 km	10 Gbit/s Multi-rate -80 km
Optical line code	-	NRZ	NRZ	NRZ
Light source type	-	SLM	SLM	SLM
Target distance	km	10	40	80
Transmitter characteristics at point S				
Operating wavelength range	nm	1290 to 1330	1530 to 1565	1530 to 1565
Maximum mean launched optical power	dBm	-1	2	4

Item	Unit	Value		
Minimum mean launched optical power	dBm	-6	-1	0
Minimum extinction ratio	dB	6	8.2	10
Maximum -20 dB spectrum width	nm	NA	NA	NA
Minimum side-mode suppression ratio	dB	NA	NA	NA
Eye pattern	-	Compliant with IEEE 802.3		
Receiver characteristics at point R				
Receiver type	-	PIN	PIN	APD
Operating wavelength range	nm	1290 to 1330	1260 to 1605	1270 to 1600
Receiver sensitivity (multirate)	dBm	-11	-14	-24
Receiver sensitivity (10GE LAN)	dBm	-14.4	-15.8	-24
Minimum overload point (multirate)	dBm	-1	-1	-7
Minimum overload point (10GE LAN)	dBm	0.5	-1	-7
Maximum reflectance	dB	-27	-27	-27

NOTE

The preceding optical modules can be used on the WDM side grey optical modules.

Table 10-97 Specifications of Multi-Rate-SFP+ (with CDR) optical module

Item	Unit	Value	
		Multi-Rate-10km-SFP+	**Multi-Rate-40km-SFP+**
Rate	Gbit/s	9.95 to 11.1	9.95 to 11.1
Line code format	-	NRZ	NRZ
Optical source type	-	SLM	SLM
Target distance	km	10	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		Multi-Rate-10km-SFP+	Multi-Rate-40km-SFP+
Operating wavelength range	nm	1260 to 1355	1530 to 1565
Maximum mean launched power	dBm	-1	2
Minimum mean launched power	dBm	-6	-1
Minimum extinction ratio	dB	6	8.2
Maximum -20 dB spectral width	nm	NA	0.5
Minimum side mode suppression ratio	dB	NA	30
Eye pattern mask	-	Compliant with IEEE802.3/G.959.1/G.691	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	1260 to 1600	1260 to 1605
Receiver sensitivity	dBm	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	-16 (9.95Gbit/s) -15.8(10.3Gbit/s)
Minimum receiver overload	dBm	0.5	-1
Maximum reflectance	dB	-14	-27

Table 10-98 Specifications of 10G BASE-SR/10G BASE-LR optical modules

Item	Unit	Value	
Supported optical interface type	-	10G BASE-SR	10G BASE-LR
Line code format	-	NRZ	NRZ
Light source type	-	Multi-mode	SLM
Target distance	km	0.3	10

Item	Unit	Value	
Transmitter parameter specifications at point S			
Operating wavelength range	nm	840 to 860	1290 to 1330
Maximum mean launched power	dBm	-1	0.5
Minimum mean launched power	dBm	-7.3	-8.2
Minimum extinction ratio	dB	3	3.5
Eye pattern mask	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	840 to 860	1290 to 1330
Receiver sensitivity	dBm	-11.1	-14.4
Minimum receiver overload	dBm	-1	0.5
Maximum reflectance	dB	-12	-12

Mechanical Specifications

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 1 kg (2.2 lb.)

Power Consumption

- Typical Power Consumption at 25°C (77°F): 31 W
- Maximum Power Consumption at 55°C (131°F): 32 W

10.7 LEM18

LEM18: 16 x GE + 2 x 10GE LAN + 2 x OTU2 Ethernet Switch board

10.7.1 Version Description

The available hardware version for the LEM18 is TNF1.

Version

Table 10-99 describes the version mapping of the LEM18 board. The mapping version of the equipment is V100R003C00 or later.

Table 10-99 Version description of the LEM18

Item	Description
Board hardware version	TNF1

10.7.2 Application

The LEM18 board can work in OTN mode, OTN extended mode and 10GE mode. The board is applicable to three scenarios (two convergence scenarios and one cross-connection scenario) when working in either mode.

Service Access Description

Table 10-100 describes the principle for configuring the interfaces on the LEM18 board.

Table 10-100 Principle for configuring the interfaces of the LEM18 board

Service Access	Number of Available Interfaces	Names of Available Interfaces	Remarks
GE optical signals	18	TX1/RX1 to TX18/RX18	The LEM18 board can work in either OTN mode, OTN extended mode or 10GE mode. When the LEM18 board works in OTN mode or OTN extended mode, the WDM-side IN1/OUT1 and IN2/OUT2 interfaces output OTU2 signals. When the LEM18 board works in 10GE mode, the WDM-side IN1/OUT1 and IN2/OUT2 interfaces output 10GE LAN signals. The OTU mode is the default mode.
GE electrical signals	17	TX1/RX1 to TX9/RX9, TX11/RX11 to TX18/RX18	
FE optical signals	16	TX3/RX3 to TX18/RX18	
FE electrical signals	15	TX3/RX3 to TX9/RX9, TX11/RX11 to TX18/RX18	
10GE LAN	4	TX1/RX1 to TX2/RX2, IN1/OUT1 to IN2/OUT2	
OTU2 optical signals	2	IN1/OUT1 to IN2/OUT2	

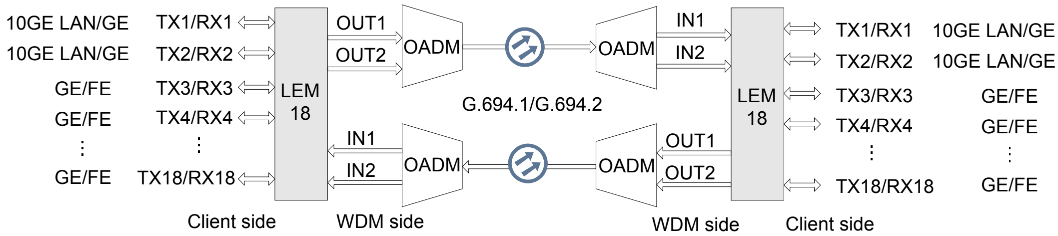
NOTE

- Only RX1/TX1 and RX2/TX2 interfaces support SFP+ modules.
- RX10/TX10 interfaces do not support electrical interface SFP modules.

Working Modes

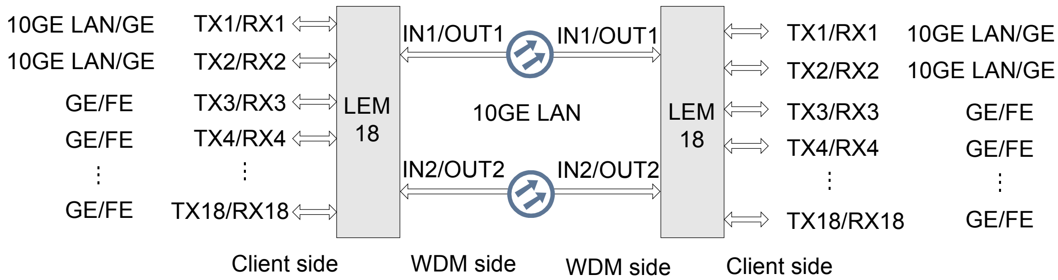
When working in OTN mode and OTN extended mode , the LEM18 board outputs OTU2 signals at the WDM-side optical interfaces IN1/OUT1 and IN2/OUT2. That is, the board encapsulates client signals into OTU2 signals and transmits the signals to an OTN network. **Figure 10-61** shows the network.

Figure 10-61 Network in which the LEM18 board works in OTN mode and OTN extended mode



When working in 10GE mode, the LEM18 board outputs 10GE LAN signals at the WDM-side optical interfaces IN1/OUT1 and IN2/OUT2. That is, the board encapsulates client signals into 10GE LAN signals and transmits the signals to a 10GE LAN ring network. **Figure 10-62** shows the network.

Figure 10-62 Network in which the LEM18 board works in 10GE mode



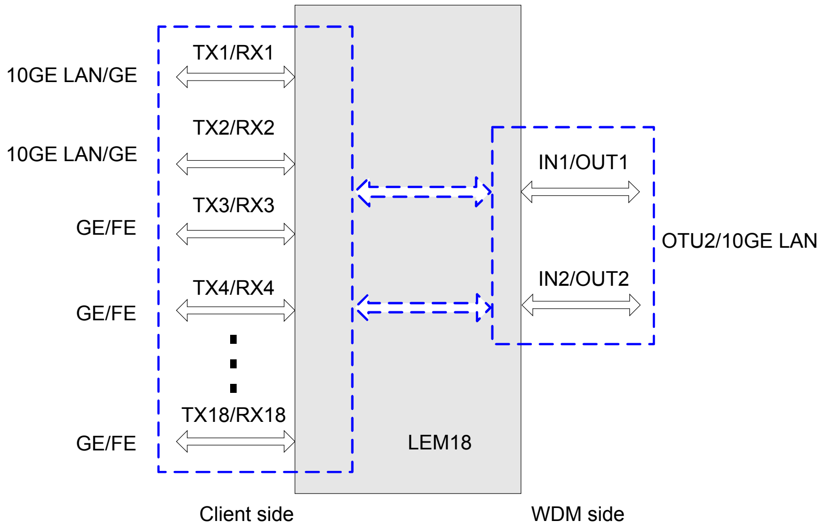
Application Scenarios

When working in either mode, the LEM18 board is applicable to the following scenarios.

- Application scenario 1: Converging client-side GE/FE/10GE LAN signals to WDM-side OTU2/10GE LAN signals

After receiving 18 GE/FE signals, or receiving 16 GE/FE signals and 2 10GE LAN signals from client equipment, the LEM18 board converts them to two channels of OTU2 or 10GE LAN signals and sends the signals out through the WDM-side interface. In this manner, Ethernet services are transported to an OTN network. See **Figure 10-63**.

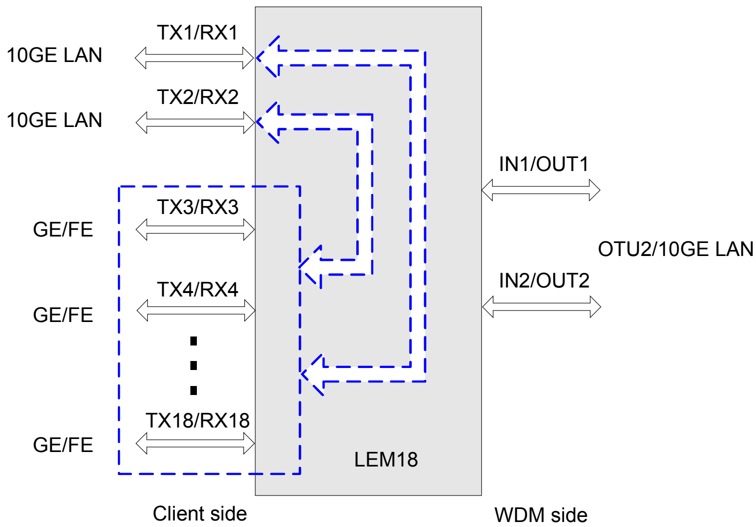
Figure 10-63 Application scenario 1 of the LEM18 board



- Application scenario 2: Converging client-side GE/FE signals to client-side 10GE LAN signals

The LEM18 board converges client-side 16 GE/FE signals to 2 10GE LAN signals, and sends the signals through the client-side TX1 and TX2 interfaces. In this scenario, multiple LEM18 boards can be cascaded at a site for convergence of multiple GE/FE services. For example, if two LEM18 boards are cascaded, 32 channels of GE/FE signals can be converged. **Figure 10-64** shows the application scenario.

Figure 10-64 Application scenario 2 of the LEM18 board



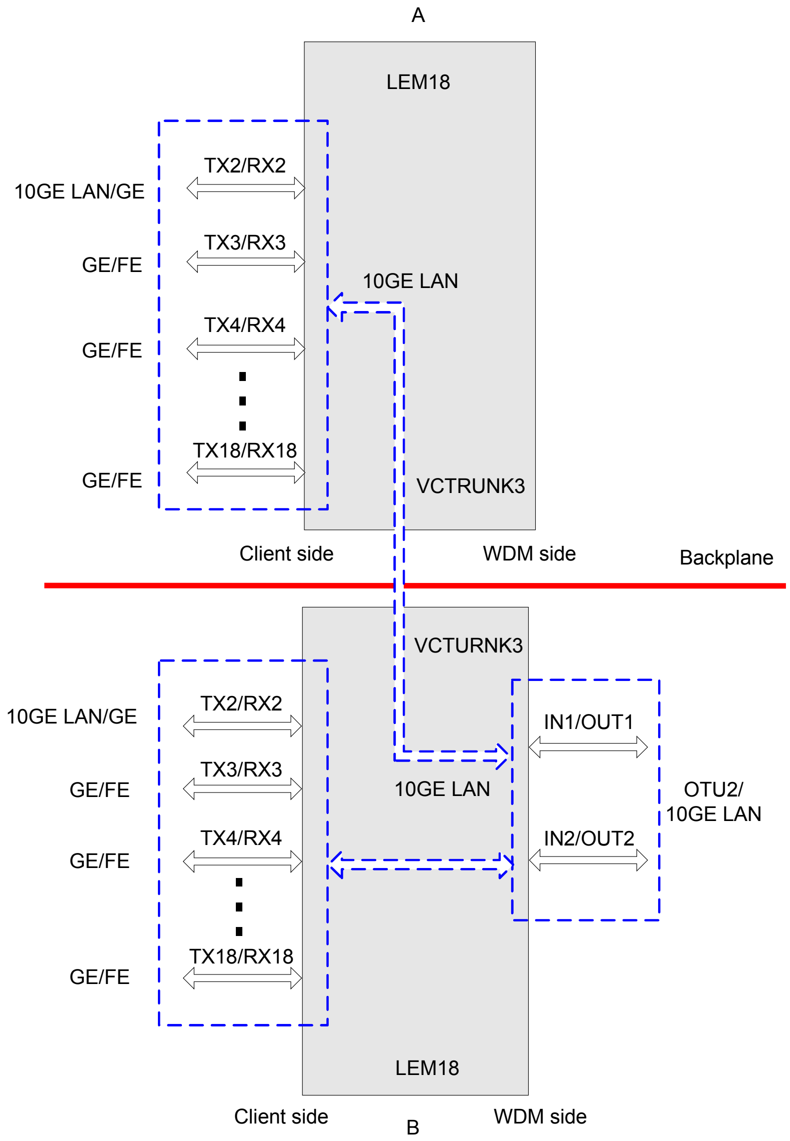
- Application scenario 3: Cross-connecting one channel of 10GE LAN signals in paired slots

One channel of 10GE LAN signals can be cross-connected by using two LEM18 boards housed in two paired slots, for example, slot A and B. In this scenario, 34 GE/FE signals, or 32 GE/FE signals and 2 10GE LAN signals can be converged to an OTU2 or 10GE LAN signal ring.

On the LEM18 board housed in slot A, 17 channels of client-side GE/FE signals, or 16 channels of GE/FE signals and one channel of 10GE LAN signals can be converged to one channel of 10GE LAN signals, and then, the 10GE LAN signals are sent to the LEM18 board housed in slot B through the backplane. **Figure 10-65** shows the LEM18 board housed in slot A.

The LEM18 board housed in slot B receives the 10GE LAN signals from the LEM18 board housed in slot A through the backplane, converts them to two channels of OTU2 signals or 10GE LAN signals, and sends them through a WDM-side interface. **Figure 10-65** shows the LEM18 board housed in slot B.

Figure 10-65 Application scenario 3 of the LEM18 board



NOTE

In this scenario, optical interfaces TX1/RX1 are unavailable.

10.7.3 Functions and Features

The LEM18 board is an Ethernet data board and it supports Layer 2 switching, wavelength conversion, and service convergence.

For detailed information about the basic functions and WDM features of the LEM18 board, refer to **Table 10-101**; for detailed information about data features of the LEM18 board, refer to **Table 10-102**.

Table 10-101 Basic functions and WDM features of the LEM18

Functions and Features	Description
Basic function	● 18 x GE/FE <-> 2 x OTU2 ● 16 x GE/FE & 2x10GE LAN <-> 2 x OTU2 ● 18 x GE/FE/10GE LAN (flat-rate) <-> 2 x 10GE LAN ● Supports Layer 2 switching, EPL/EVPL/EPLAN/EVPLAN services, and data features such as QinQ and link aggregation.
Service type	Convergence services: ● GE: Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals or GE electrical signals. ● FE: Ethernet services, the rate is 125 Mbit/s. Supports FE optical signals and FE electrical signals. ● 10GE LAN: Ethernet services, the rate is 10.31 Gbit/s.
FEC function	When the LEM18 board works in OTN mode or OTN extended mode, it supports forward error correction (FEC) that complies with ITU-T G.709.
Synchronous Ethernet services	Supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G. 862.1.
Protection schemes	When the LEM18 board works in OTN extended mode, it supports the ODUk SNCP (k = 2) protection.
Alarms and performance events monitoring	Provides the Ethernet service performance monitoring function. Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the client side. Monitors the RMON performance of 10GE LAN signals, GE optical/ electrical signals and FE optical/electrical signals.
Ethernet service mapping mode	10GE LAN, GE, and FE services are encapsulated in GEP_F (ITU-T G. 7041) format.

Functions and Features	Description			
Regenerator board	When the LEM18 board works in OTN mode or OTN extended mode, the WDM-side signals of the board can be regenerated by the TNF1LSX board.			
OTN function	● Provides the OTU2 and OTU2e interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM functions for ODU2. ● Supports SM functions for OTU2.			
Tunable wavelength function	Supports the tunable wavelength optical module. Equipped with this module, the board can tune the optical signal output on the WDM side within the range of 40 wavelengths in C-band with the channel spacing of 100 GHz.			
Loopback	10GE optical interface	MAC	Inloop	Supported
			Outloop	Supported
		PHY	Inloop	Supported
			Outloop	Supported
	GE optical interface	MAC	Inloop	Supported
			Outloop	Not supported
		PHY	Inloop	Supported
			Outloop	Not supported
	GE electric interface	MAC	Inloop	Supported
			Outloop	Not supported
		PHY	Inloop	Supported
			Outloop	Supported
	FE optical interface	MAC	Inloop	Supported
			Outloop	Not supported
		PHY	Inloop	Supported
			Outloop	Not supported
	FE electric interface	MAC	Inloop	Supported
			Outloop	Not supported
		PHY	Inloop	Supported
			Outloop	Supported

Functions and Features	Description			
	IN1/OUT1 and IN2/OUT2 (ETH mode)	MAC	Inloop	Supported
			Outloop	Supported
		PHY	Inloop	Not supported
			Outloop	Not supported
	IN1/OUT1 and IN2/OUT2 (OTN mode)		Inloop	Supported
			Outloop	Supported
ALS function	Not supported			
ESC function	When the LEM18 board works in OTN mode or OTN extended mode, it supports the ESC function.			
Cross-connect function	Cross-connects one channel of 10GE LAN signals between two LEM18 boards in paired slots. In this process, the VCTRUNK3 virtual interface is used and the TX1/RX1 optical interface is unavailable.			
PRBS test	Not supported			
Physical clock	Supports the physical clock that accord with the SSM protocol. The LEM18 board can restore clock frequencies from physical optical signals and synchronize the frequencies at the upstream and downstream interfaces. Frequency synchronization ensures normal service transmission.			
Ethernet port working mode	● 10GE optical port: 10G full-duplex ● GE optical port: 1000M full-duplex or auto-negotiation ● GE electrical port: auto-negotiation ● FE optical port: 100M full-duplex ● FE electrical port: 100M full-duplex			
WDM specification	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G. 694.2-compliant CWDM specifications.			

Table 10-102 Data Features of the LEM18

Data Features	Description	
Interface characteristics	Port working mode	10GE optical port: 10GE LAN, 10GE WAN GE optical port: 1000MFULL, auto-negotiation GE electrical port: auto-negotiation FE optical port: 100MFULL FE electrical port: 10MHALF, 10MFULL, 100MHALF, 100MFULL, auto-negotiation

Data Features	Description	
	MTU	Supports a maximum of 9600 bytes frames.
Multicast	VLAN multicast	Supported
	IGMP snooping.	Supported
Layer 2 switching	Supports IEEE802.1Q, IEEE802.1ad, and IEEE 802.1D. Supports MAC address learning and aging. Supports IEEE802.1d-compliant STP, IEEE802.1d-compliant and IEEE802.1w-compliant RSTP, and IEEE 802.1s-compliant MSTP. Supports 32k MAC addresses.	
Ethernet service	EPL EVPL (VLAN) EVPL (QinQ) EPLAN (IEEE 802.1D) EVPLAN (IEEE 802.1Q) EVPLAN (IEEE 802.1ad)	
Protection schemes	VLAN SNCP	Supported
	ERPS	Supported
	LPT	Supported **NOTE** The LPT function cannot be configured for EVPL services but only for bidirectional EPL services. When the LPT function is enabled, **Source C-VLAN** and **Sink C-VLAN** of an EPL service must be left empty. FE/GE electrical ports of the LEM18 board do not support the LPT function.
	LAG	• Supports the IEEE802.3ad-compliant LAG protocol running at IP and trunk ports. • Supports manual and static LAGs. • Supports load-sharing and non-load-sharing LAGs.
Maintenance features	ETH-OAM	Supports ETH OAM protocols defined by IEEE802.1ag and IEEE802.3ah.
	RMON	Supported
QoS	Supports committed access rate (CAR) and class of service (CoS). Supports IEEE802.1p. Supports DSCP.	
Flow control	Supports the IEEE 802.3X-compliant Ethernet flow control protocol and flow control termination.	

Data Features	Description	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.1q VLAN All L2 protocols including xSTP, LACP, EthOAM, DHCP, and PPP. MPLS protocols All L3 protocols including ARP, IGMP, OSPF, RIP, and IGRP.
	Protocols or standards (performance monitoring) for processing services	IEEE 802.3x pause frame IEEE 802.3ad LACP IEEE 802.1p priority IEEE 802.1q VLAN IEEE 802.1ag OAM IEEE 802.3ah OAM IEEE IGMP STP, RSTP, MSTP R-APS

NOTE

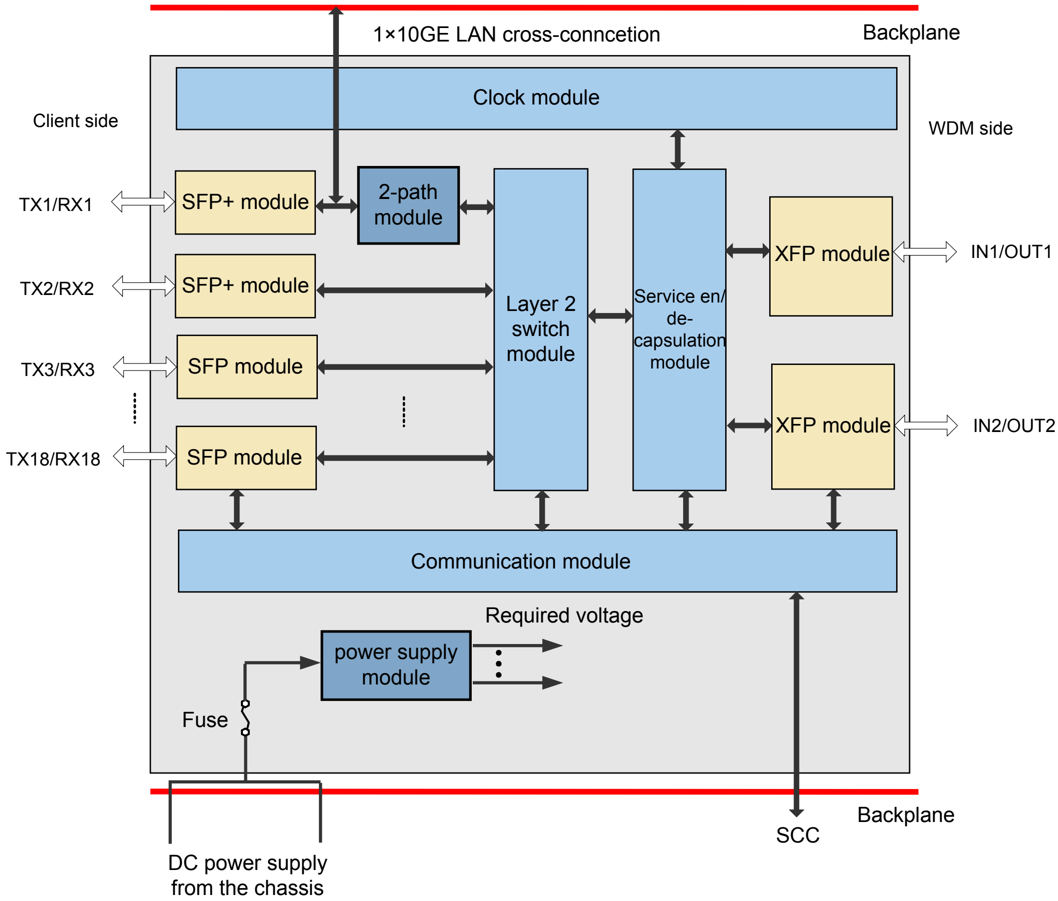
The LEM18 board can work at room temperature below 50°C (122°F) at a long term or below 55°C (131°F) at a short term. A short term refers to a maximum of 72 consecutive hours or fewer than 15 days in a year in total.

10.7.4 Working Principle and Signal Flow

The LEM18 board consists of the client-side module (optical SFP+ module, optical SFP module or electrical SFP module), the WDM-side module (XFP module or TXFP module), the Layer 2 switch module, the service en/de-capsulation module, the clock module, the 2-path module, the communication module, and the power supply module.

Figure 10-66 is the functional block diagram of the LEM18 board. The diagram shows that the optical SFP+ modules are used in the RX1/TX1 and RX2/TX2 interfaces, and the optical SFP modules are used in the RX3/TX3 to RX18/TX18 interfaces.

Figure 10-66 Functional block diagram of the LEM18 board



NOTE

The signal flow of the LEM18 board involves two directions, namely, transmit direction and receive direction. The following scenarios use the transmit direction as an example to illustrate the signal flow. The signal flow in the receive direction is reverse to that in the transmit direction.

Signal Flow of Application Scenario 1

Refer to **Figure 10-63** in Application.

- In the client-side RX1-RX18 optical interfaces, SFP+ and SFP modules receive 10GE LAN optical signals and GE/FE optical signals from client equipment, respectively, and then, convert them into electrical signals. SFP modules in the electrical interfaces receive GE/FE electrical signals from client equipment, and then performs the level conversion of the GE/FE electrical signals.
- After conversion, the electrical signals are sent to the Layer 2 switch module, and converge into two channels of 10GE LAN electrical signals.
- The 10GE LAN electrical signals are sent to the service en/de-capsulation module. After performing OTN framing, and FEC coding, the module sends out two channels of OTU2 optical signals, or after performing overhead processing, the module sends out two channels of 10GE LAN optical signals. The optical signals are output through the OUT1 and OUT2 optical interfaces.

Signal Flow of Application Scenario 2

Refer to **Figure 10-64** in Application.

- In the client-side RX3-RX18 optical interfaces, SFP modules receive GE/FE optical signals from client equipment, and then, convert them into electrical signals. SFP modules in the electrical interfaces receive GE/FE electrical signals from client equipment, and then performs the level conversion of the GE/FE electrical signals.
- After conversion, the electrical signals are sent to the Layer 2 switch module, and converge into two channels of 10GE LAN electrical signals.
- 10GE LAN electrical signals are converted into two channels of 10GE LAN optical signals passing through SFP+ modules and the 10GE LAN optical signals are output through the TX1 and TX2 interfaces.

Signal Flow of Application Scenario 3

Refer to **Figure 10-65** in Application.

Signal flow of the LEM18 board in slot A:

- In the client-side RX2-RX18 optical interfaces, SFP+ and SFP modules receive 10GE LAN optical signals and GE/FE optical signals from client equipment, respectively, and then, convert them into electrical signals. SFP modules in the electrical interfaces receive GE/FE electrical signals from client equipment, and then performs the level conversion of the GE/FE electrical signals.
- After conversion, the electrical signals are sent to the Layer 2 switch module, and converge into one channel of 10GE LAN electrical signals.
- The two channels of 10GE LAN electrical signals enter the 2-path module and then are sent to the paired slots through the backplane.

Signal flow of the LEM18 board in slot B:

- Receives one channel of 10GE LAN electrical signals from the paired slot through backplane.
- After conversion, the electrical signals are sent to the Layer 2 switch module, and converge into one channel of 10GE LAN electrical signals.
- The 10GE LAN electrical signals are sent to the OTN en/de-capsulation module. After performing encapsulation, OTN framing, and FEC coding, the module sends out one channel of OTU2 optical signals at DWDM standard wavelengths or CWDM standard wavelengths. The optical signals are output through the OUT1 or OUT2 optical interface.
- The 10GE LAN electrical signals are sent to the service en/de-capsulation module. After performing OTN framing, and FEC coding, the module sends out one channel of OTU2 optical signals, or after performing overhead processing, the module sends out one channel of 10GE LAN optical signals. The optical signals are output through the OUT1 or OUT2 optical interface.

Module Function

- Optical SFP+ module
  - Performs the E/O and O/E conversion between 10GE LAN optical signals and internal electrical signals.
  - Reports the performance of the client-side optical interface.

  - Reports the working state of the client-side laser.
- Optical SFP module
  - Performs the E/O and O/E conversion between GE or FE optical signals and internal electrical signals.
  - Reports the performance of the client-side optical interface.
  - Reports the working state of the client-side laser.
- Electrical SFP module

  Performs the level conversion between GE or FE electrical signals and internal electrical signals.
- XFP/TXFP module
  - Performs the E/O and O/E conversion between OTU2/10GE LAN optical signals and internal electrical signals.
  - Reports the performance of the WDM-side optical interface.
  - Reports the working state of the WDM-side laser.
- Layer 2 switch module
  - Forwards Ethernet packets.
  - Converges and deconverges service signals.
- Service en/de-capsulation module
  - Achieves the encapsulation from GE/FE/10GE LAN signals to OTU2 signals and the decapsulation from OTU2 signals to GE/FE/10GE LAN signals.
  - Performs processes such as encapsulation/decapsulation of FEC, encoding/decoding and scrambling/descrambling.
  - Achieves the encapsulation from GE/FE or flat-rate 10GE LAN signals to standard 10GE LAN signals and the decapsulation from standard 10GE LAN signals to GE/FE or flat-rate 10GE LAN signals.
  - Reports the performance of the service signals.
- Clock module

  Selects clock sources and performs clock source switching.
- 2-path module

  The Layer 2 switching module sends one channel of 10GE LAN signals passing through the 2-path module, and then the system selects one output port of the 2-path module and sends the channel of 10GE LAN signals through the backplane for cross-connection or to the TX1/RX1 interface.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

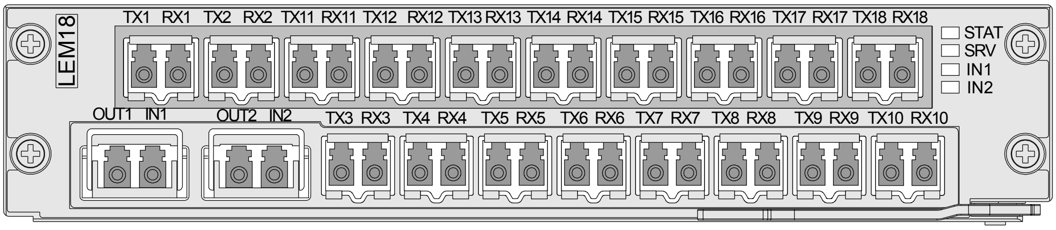
10.7.5 Front Panel

There are indicators and interfaces on the LEM18 front panel.

Appearance of the Front Panel

Figure 10-67 shows the front panel of the LEM18.

Figure 10-67 Front panel of the LEM18



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Interfaces

Table 10-103 lists the type and function of each interface.

Table 10-103 Types and functions of the LEM18 interfaces

Interface	Interface Type	Function
IN1/OUT1 to IN2/OUT2	LC	Connected to the OADM board on the WDM equipment to receive/transmit the OTU2 signals, or connected to another LEM18 board to receive/ transmit the 10GE LAN signals.
TX1/RX1 to TX2/RX2	LC (optical interfaces) RJ-45 (electrical interfaces)	Transmits/receives the GE/ 10GE LAN optical signals or GE electrical signals to client-side equipment.
TX3/RX3 to TX18/RX18	LC (optical interfaces) RJ-45 (electrical interfaces)	Transmits/receives the GE/FE optical signals or GE/FE electrical signals to client-side equipment.

CAUTION

- FE electrical ports can use only crossover cables.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.7.6 Valid Slots

The LEM18 board occupies two slots.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slot of the LEM18 board is SLOT1.

In the OptiX OSN 1800 II chassis, the valid slot of the LEM18 board can be SLOT1 to SLOT5. To ensure board performance, it is recommended that the LEM18 board be inserted into SLOT3 to SLOT5.

NOTE

The LEM18 board occupies two slots. The pins on the board are located on the lower part of the board; therefore, the board is inserted into the lower slot between the two slots. **Table 10-104** describes the mapping between the slot where the LEM18 board is inserted and the slots that the LEM18 board occupies.

When the LEM18 board is installed in slot IU1, IU3, or IU5, the board supports long-term operation at a temperature below 45°C (113°F) and supports short-term operation at a temperature above 45°C (113°F) but below 55°C (131°F). (Short-term operation means that the continuous working time does not exceed 72 hours and the accumulated working time per year does not exceed 15 days.)

When the LEM18 board is installed in slot IU2 or IU4, the board supports long-term operation at a temperature below 45°C (113°F).

Table 10-104 Mapping between the slot where the LEM18 board is inserted and the slots between the LEM18 board occupies

Chassis	Valid Slot	Occupied Slots
OptiX OSN 1800 I	SLOT1	SLOT1 and SLOT3
OptiX OSN 1800 II	SLOT1	SLOT1 and SLOT3
	SLOT2	SLOT2 and SLOT4
	SLOT3	SLOT3 and SLOT5
	SLOT4	SLOT4 and SLOT6
	SLOT5	SLOT5 and SLOT7

Display of Slots

The LEM18 board occupies two slots on the U2000. The slot ID of the board displayed on the NMS is the slot of lower-position between the two slots that the board occupies. For example, if the board is installed in SLOT1 and SLOT3, the slot displayed on the NMS is SLOT1.

Slots for Cross-Connect Boards

- In the OptiX OSN 1800 I chassis, the LEM18 board does not support cross-connections.
- In the OptiX OSN 1800 II chassis, the LEM18 board supports cross-connections of one channel of 10GE LAN services between SLOT1 and SLOT2.

NOTE

The LEM18 board can be only configured on master subrack, and cannot be configured in slave subrack.

10.7.7 Physical and Logical Ports

This section describes how the ports on the LEM18 board front panel are displayed on the NMS and how to configure services for this board.

Display of Ports

Table 10-105 lists the sequence numbers of the ports on the LEM18 board front panel displayed on the U2000.

Table 10-105 Display of the LEM18 ports

Port on the Front Panel	Port Displayed on the NMS	Layer 2 External Port	Layer 2 Internal Port
IN1/OUT1	3	PORT3	VCTRUNK1
IN2/OUT2	4	PORT4	VCTRUNK2
TX1/RX1	5	PORT5	VCTRUNK3
TX2/RX2	6	PORT6	/
...	...	...	/
TX18/RX18	22	PORT22	/

NOTE

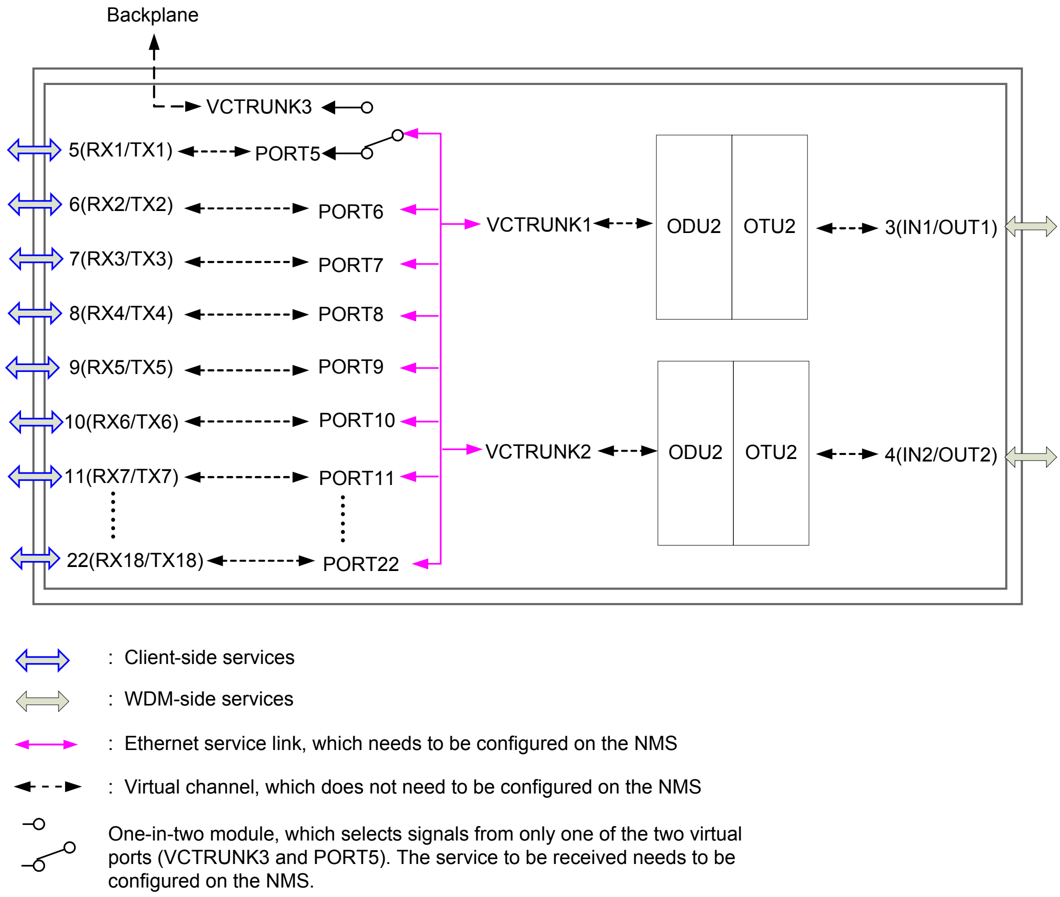
- An optical port displayed on the NMS indicates a pair of actual optical ports, one for transmitting signals and the other for receiving signals.
- The Layer 2 logical ports that map ports IN1/OUT1 and IN2/OUT2 vary according to board modes. When the board works in OTN mode or OTN extended mode, the mapping Layer 2 logical ports are internal ports VCTRUNK1 and VCTRUNK2; when the board works in 10GE mode, the mapping Layer 2 logical ports are external ports PORT3 and PORT4.
- PORT5 and VCTRUNK3 share the same virtual port and only one port is valid at a time. PORT5 is valid by default. When VCTRUNK3 is used, VCTRUNK3 can be displayed on the NMS only when TX1/RX1 is deleted from the NMS.
- VCTRUNK3 is used only to enable cascading of boards housed in paired slots.

Port Model

- OTN mode

  The port model for LEM18 board in OTN mode is shown in **Figure 10-68**.

Figure 10-68 Port model for the LEM18 board working in OTN mode

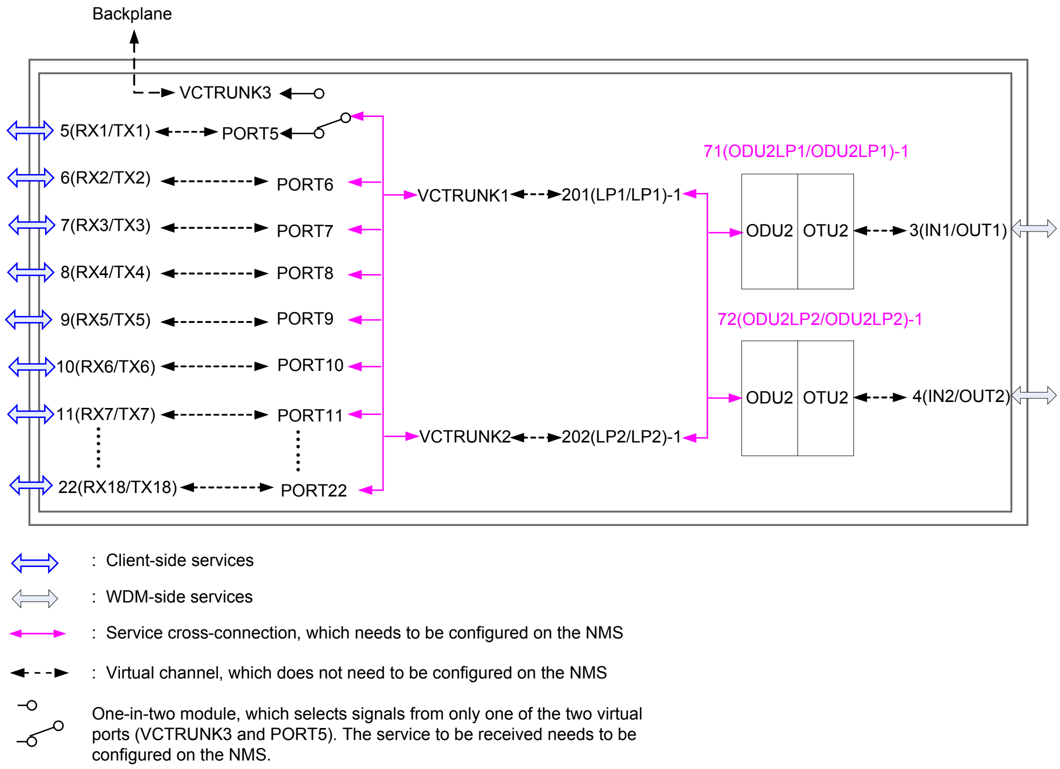


  - Alarms and performance events related to client signal overheads are reported through ports VCTRUNK1 to VCTRUNK3 or channel 1 of client-side optical ports 5-22 (RX1/TX1 to RX18/TX18).
  - Alarms and performance events related to OTN electrical-layer overheads are reported through channel 1 of optical ports 3 (IN1/OUT1) and 4 (IN2/OUT2).
  - Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 3 (IN1/OUT1) and 4 (IN2/OUT2).

- OTN extended mode

  The port model for LEM18 board in OTN extended mode is shown in **Figure 10-69**.

Figure 10-69 Port model for the LEM18 board working in OTN extended mode

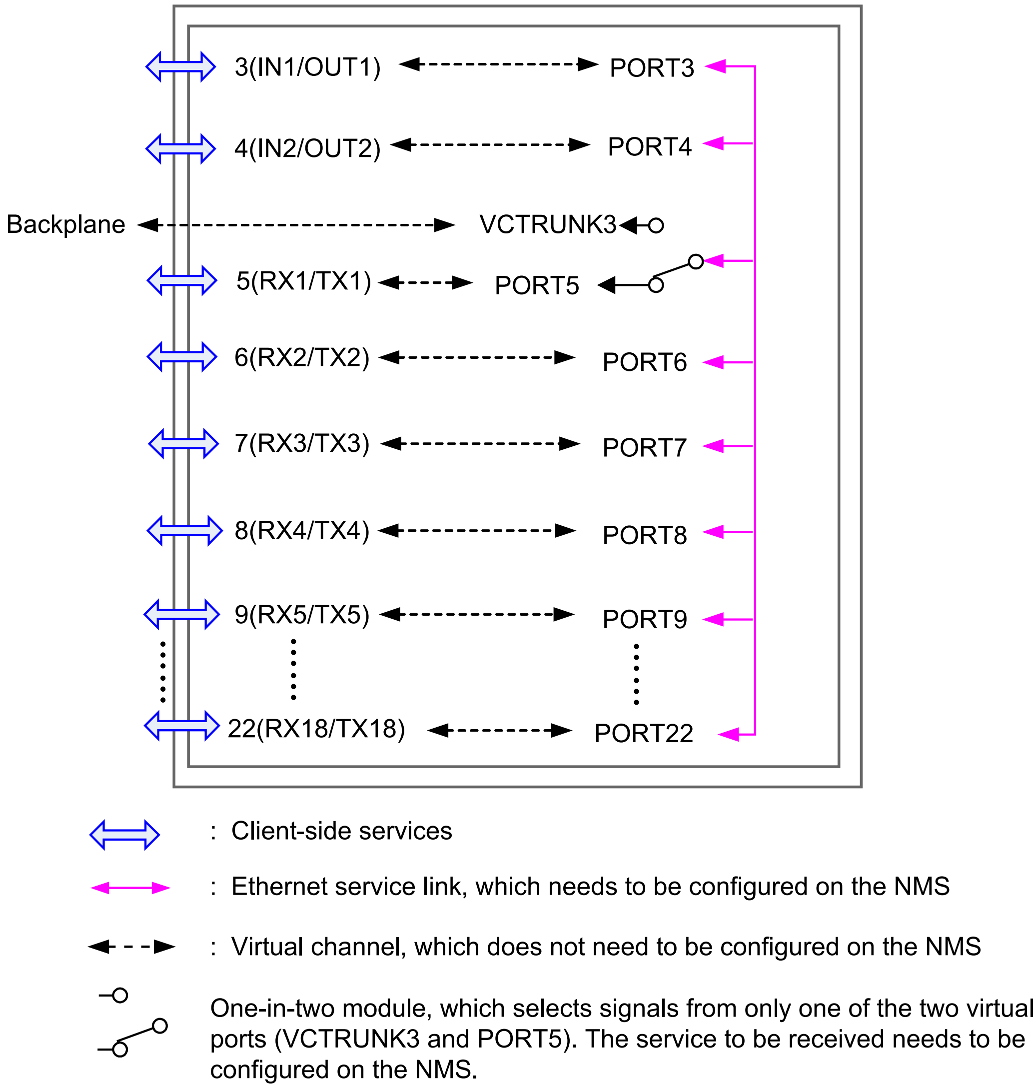


- Alarms and performance events related to client signal overheads are reported through ports VCTRUNK1 to VCTRUNK3 or channel 1 of client-side optical ports 5-22 (RX1/TX1 to RX18/TX18).
- Alarms and performance events related to OTN electrical-layer overheads are reported through channel 1 of optical ports 3 (IN1/OUT1) and 4 (IN2/OUT2).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of optical ports 71(ODU2LP1/ODU2LP1) and 72(ODU2LP2/ODU2LP2).

- 10GE mode

  The port model for LEM18 board in 10GE mode is shown in **Figure 10-70**.

Figure 10-70 Port model for the LEM18 board working in 10GE mode



Alarms and performance events related to client signal overheads are reported through port VCTRUNK3 or channel 1 of client-side optical ports 3 (IN1/OUT1), 4 (IN2/OUT2), and 5-22 (RX1/TX1 to RX18/TX18).

10.7.8 Board Data Features

The LEM18 board provides multiple Ethernet functions and features such as Layer 2 switching, LAG, and QoS.

You can configure the following Ethernet functions for the LEM18 by using the U2000:

- Ethernet Ring Protection
- LAG
- STP/RSTP
- MSTP
- IGMP Snooping

- ETH-OAM(IEEE 802.1ag)
- ETH-OAM(IEEE 802.3ah)
- RMON
- QoS
- Service-based LPT
- VLAN SNCP

10.7.9 LEM18 Parameters on the NMS

Parameter Description (WDM-Side Ports)

Field	Value	Description
Service Type	GE, FE, 10GE LAN Default: • The default service type at the TX1/RX1 to TX2/RX2 port is **10GE LAN**. • The default service type at the TX3/RX3 to TX18/RX18 port is **GE**.	**Service Type** of the two boards that are interconnected with each other must be consistent. **CAUTION** • Before services are connected to the board, configure the service types on the client side by using the U2000 according to the actually accessed services. If no service type is configured on the client side, services cannot be connected normally.
Board Mode	OTN Mode, OTN Extended Mode, 10GE Mode Default: OTN Mode	**Board Mode** of the two boards that are interconnected with each other must be consistent. • OTN Mode: The IN1/OUT1 and IN2/OUT2 ports output OTU2 signals and can receive and process OTU2 signals only. • OTN Extended Mode: The IN1/OUT1 and IN2/OUT2 ports output OTU2 signals and can receive and process OTU2 signals only, and the board supports ODUk SNCP (k=2) protection. • 10GE Mode: The IN1/OUT1 and IN2/OUT2 ports output 10GE LAN signals and can receive and process 10GE LAN signals only. • When **Board Mode** is changed, signal output at the IN1/OUT1 and IN2/OUT2 ports immediately changes.
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used.

Field	Value	Description
Laser Status	ON, OFF Default: ON	Lasers at all ports are generally set to **ON**. **CAUTION** When NEs communicate with each other through the electric supervisory channel (ESC) and **Board Mode** of the LEM18 board is set to **OTN Mode** or **OTN extended mode**, the NEs will be unreachable if all the lasers at ports IN1/OUT1 and IN2/OUT2 on the WDM side of the LEM18 board are disabled.
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	If a fault occurs on the WDM-side receiver of the local board, the laser on the WDM-side transmitter of the local board must be shut down. For this situation, set **ALC Auxiliary Condition** to **BW_WDM_Defect**. **NOTE** **FW_Defect** and **BW_Client_R_LOS** are reserved.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is for query only.
Synchronous Clock Enabled	Enabled, Disabled Default: Disabled	Select the required clock port and set its status to **Enabled**. Users can enable a maximum of six ports and they are 3(IN1/OUT1), 4(IN2/OUT2), 5(TX1/RX1), 6 (TX2/RX2), and two of ports 7(TX3/RX3) to 22 (TX18/RX18).
FEC Working State	Enabled, Disabled Default: Enabled	This parameter is valid only when the **Board Mode** is set to **OTN Mode** or **OTN extended mode**. ● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
FEC Mode	FEC	This parameter is valid only when the **Board Mode** is set to **OTN Mode** or **OTN extended mode**. It is always set to **FEC** and cannot be changed.

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

Parameter Description (Ethernet Ports)

Table 10-106 Basic Attributes

Field	Value	Description
Port	OTN mode: PORT5 to PORT22 OTN extended mode: PORT5 to PORT22 10GE mode: PORT3 to PORT22	Select a proper port based on actual services.

Field	Value	Description
Enabled/ Disabled	Enabled, Disabled Default: Disabled	The attributes of a port take effect only after the port is enabled. If a port is disabled, the attributes of the port will be invalid and the service at this port will be interrupted.
Working Mode	10GE optical port: 10G Full_Duplex LAN. Default: 10G Full_Duplex LAN. GE optical/electrical port: Auto-Negotiation, 1000M Full_Duplex. Default: Auto-Negotiation. FE optical port: 100M Full_Duplex. Default: 100M Full_Duplex. FE electrical port: Auto-Negotiation, 10M Half_Duplex, 10M Full_Duplex, 100M Half_Duplex, 100M Full_Duplex. Default: Auto-Negotiation.	Set this parameter based on actual physical port types and service configurations. The value of this parameter must be consistent with the working mode of the client equipment.
Maximum Frame Length	1518–9600 Default: 1522	Set this parameter according to actual service configurations. It is recommended that the value be equal to or greater than the user-defined maximum frame length for transmitting data flows.
Port Physical Parameters	Enabled/Disabled, Working Mode, Flow Control, MAC LoopBack, PHY LookBack	This parameter is for query only.
MAC LoopBack	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.

Field	Value	Description
PHY LoopBack	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.

Table 10-107 Flow Control

Field	Value	Description
Port	OTN mode: PORT5 to PORT22 OTN extended mode: PORT5 to PORT22 10GE mode: PORT3 to PORT22	Select a proper port based on actual services.
Autonegotiation Flow Control Mode	Disabled, Enable Dissymmetric Flow Control, Enable Symmetric Flow Control, Enable Symmetric/ Dissymmetric Flow Default: Disabled	This parameter is available only when the working mode of an Ethernet port is auto-negotiation. ● Disabled: The flow control function is disabled in both the transmit and receive directions. ● Enable Dissymmetric Flow Control: Flow control frames cannot be received but can be transmitted. ● Enable Symmetric Flow Control: Only PAUSE frames can be transmitted and received. ● Enable Symmetric/Dissymmetric Flow: The auto-negotiation mechanism determines whether to enable symmetric or asymmetric flow control.

Field	Value	Description
Non-Autonegotiation Flow Control Mode	Disabled, Enable Symmetric Flow Control, Send Only, Receive Only Default: Disabled	This parameter is available only when the working mode of an Ethernet port is non-autonegotiation. • The flow control function is disabled in both the transmit and receive directions of a port. • Enable Symmetric Flow Control: In non-autonegotiation mode, flow control frames can be transmitted and received. • Send Only: In non-autonegotiation mode, flow control frames can be transmitted only. • Receive Only: In non-autonegotiation mode, flow control frames can be received only.

Table 10-108 TAG Attributes

Field	Value	Description
Port	OTN mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 OTN extended mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 10GE mode: PORT3-PORT22 or VCTRUNK3	Select a proper port based on actual services. **NOTE** Do not select PORT5 and VCTRUNK3 at the same time.
TAG	Tag Aware, Access, Hybrid Default: Tag Aware	This parameter is valid only when **Port Attributes** is set to UNI. Set this parameter based on VLAN IDs carried by supported services and types of required Ethernet services.
Default VLAN ID	1 to 4095 Default: 1	Specifies a default VLAN ID for an untagged packet. **NOTE** This parameter is invalid when **TAG** is set to Tag Aware.
VLAN Priority	0 to 7 Default: 0	Indicates the priority of **Default VLAN ID** at a port. The priority ascends with the parameter value. **NOTE** This parameter is invalid when **TAG** is set to Tag Aware.
Entry Detection	Enabled, Disabled Default: Enabled	Determines whether a port detects packets based on the **TAG** of a port.

Table 10-109 Network Attributes

Field	Value	Description
Port	OTN mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 OTN extended mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 10GE mode: PORT3-PORT22 or VCTRUNK3	Select a proper port based on actual services. **NOTE** Do not select PORT5 and VCTRUNK3 at the same time.
Port Attributes	UNI, C-Aware, S-Aware Default: UNI	● UNI: The **TAG** parameter can be set to Tag Aware, Access, or Hybrid. ● C-Aware: The TAG parameter is invalid. In addition, a port identifies the external VLAN of a tagged packet as a C-VLAN and transparently transmits untagged packets. ● S-Aware: The TAG parameter is invalid. In addition, a port identifies the external VLAN of a tagged packet as an S-VLAN and discards untagged packets. **NOTE** ● For EPL services, the default value is UNI. ● For QinQ services, this parameter can only be set to C-Aware and S-Aware.

Table 10-110 Advanced Attributes

Field	Value	Description
Port	OTN mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 OTN extended mode: PORT5-PORT22 or VCTRUNK1-VCTRUNK3 10GE mode: PORT3-PORT22 or VCTRUNK3	Select a proper port based on actual services. **NOTE** Do not select PORT5 and VCTRUNK3 at the same time.

Field	Value	Description
Broadcast Packet Suppression	Enabled, Disabled Default: Disabled	When this parameter is set to **Enabled**, broadcast packets are suppressed if the ratio (the bandwidth value of the current port that broadcast packets occupy to the total bandwidth value of the port) is greater than the **Broadcast Packet Suppression Threshold** value, so that the bandwidth ratio of the current port that broadcast packets occupy is lower than the threshold value.
Broadcast Packet Suppression Threshold	10% to 100% Default: 30%	This parameter functions with the **Enabling Broadcast Packet Suppression**.
Loop Detection	Disabled, Enabled Default: Disabled	Sets whether to enable loop detection for an external port, which is used to check whether a loop exists at the port.
Loop Port Shutdown	Enabled, Disabled Default: Enabled	Sets whether to enable shutdown of a loop port for an external port, which is used to set blocking for a loop port.
Threshold of Port Receiving Rates (Mbps)	OTN mode/OTN extended mode: ● PORT5 to PORT6: 0 to 10000, Default: 10000 ● PORT7 to PORT22: 0 to 1000, Default: 1000 10GE mode: ● PORT3 to PORT6: 0 to 10000, Default: 10000 ● PORT7 to PORT22: 0 to 1000, Default: 1000	Indicates the rate threshold for an external port to receive traffic.
Port Rates Time Slice (m)	0 to 30 Default: 0	Indicates the traffic rate time window of an external port.

CAUTION

- If the LEM18 board is deleted on the U2000, configuration information will disappear and the board will restore to the default configuration after it is configured again on the U2000.

10.7.10 LEM18 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LEM18	10Gbit/s Single rate-0.3km 10Gbit/s Multi-rate-10km 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 10G BASE-SR 10G BASE-LR 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) 100BASE-FX S-1.1 L-1.1 L-1.2	GE electrical module FE electrical module	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 1400ps/nm-fixed-APD-XFP 10Gbit/s Single rate-0.3km 10Gbit/s Multi-rate-10km 10Gbit/s Multi-rate-40km 10Gbit/s Multi-rate-80km

NOTE

Both optical SFP modules and optical interface XFP modules support grey optical module and colored optical module, optical SFP+ modules support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-111 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-112 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	1600ps/nm-fixed-APD-XFP
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/ G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-113 Specifications of 1400ps/nm-fixed-APD-XFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	4 (1471 nm to 1571 nm) 3 (1591 nm to 1611 nm)
Minimum mean launched power	dBm	0
Minimum extinction ratio	dB	8.2
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	±6.5
Maximum -20 dB spectral width	nm	1
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	Compliant with Telcordia GR-253/ IEEE802.3ae/G.959
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1460 to 1620
Receiver sensitivity	dBm	-23 (1471 nm to 1551 nm) -22 (1571 nm) -21 (1591 nm to 1611 nm)
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-114 Specifications of 10 Gbit/s single-rate and 10 Gbit/s Multi-rate optical modules

Item	Unit	Value			
Supported optical interface type	-	10 Gbit/s Single-rate -0.3 km	10 Gbit/s Multi-rate -10 km	10 Gbit/s Multi-rate -40 km	10 Gbit/s Multi-rate -80 km

Item	Unit	Value			
Optical line code	-	NRZ	NRZ	NRZ	NRZ
Light source type	-	Multi-mode	SLM	SLM	SLM
Target distance	km	0.3	10	40	80
Transmitter characteristics at point S					
Operating wavelength range	nm	840 to 860	1290 to 1330	1530 to 1565	1530 to 1565
Maximum mean launched optical power	dBm	-1.3	-1	2	4
Minimum mean launched optical power	dBm	-7.3	-6	-1	0
Minimum extinction ratio	dB	3	6	8.2	10
Maximum -20 dB spectrum width	nm	NA	NA	NA	NA
Minimum side-mode suppression ratio	dB	NA	NA	NA	NA
Eye pattern	-	Compliant with IEEE 802.3			
Receiver characteristics at point R					
Receiver type	-	PIN	PIN	PIN	APD
Operating wavelength range	nm	840 to 860	1290 to 1330	1260 to 1605	1270 to 1600
Receiver sensitivity (multirate)	dBm	-7.5	-11	-14	-24
Receiver sensitivity (10GE LAN)	dBm	-7.5	-14.4	-15.8	-24
Minimum overload point (multirate)	dBm	-1	-1	-1	-7
Minimum overload point (10GE LAN)	dBm	-1	0.5	-1	-7
Maximum reflectance	dB	-12	-27	-27	-27

Table 10-115 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-116 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-117 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-118 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Maximum -20 dB spectral width	nm	NA	NA	NA	1
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Table 10-119 Specifications of 10G BASE-SR/10G BASE-LR optical modules

Item	Unit	Value	
Supported optical interface type	-	10G BASE-SR	10G BASE-LR
Line code format	-	NRZ	NRZ
Light source type	-	Multi-mode	SLM
Target distance	km	0.3	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	840 to 860	1290 to 1330
Maximum mean launched power	dBm	-1	0.5
Minimum mean launched power	dBm	-7.3	-8.2

Item	Unit	Value	
Minimum extinction ratio	dB	3	3.5
Eye pattern mask	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	840 to 860	1290 to 1330
Receiver sensitivity	dBm	-11.1	-14.4
Minimum receiver overload	dBm	-1	0.5
Maximum reflectance	dB	-12	-12

Specifications for Client-Side Electrical Modules

Table 10-120 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-121 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100

Item	Unit	Value
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x width x Depth): 40.1 mm x 193.8 mm x 208.7 mm (1.6 in. x 7.6 in. x 8.2 in.)
- Weight: 1.3 kg (2.86 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 54.8 W
- Maximum Power Consumption at 55°C (131°F): 63.8 W

10.8 LOE

LOE: 8 Port EPON & GE Access Wavelength Conversion Board

10.8.1 Version Description

The available hardware version for the LOE is TNF1.

Version

Table 10-122 describes the version mapping of the LOE board. The mapping version of the equipment is V100R001C02 or later.

Table 10-122 Version description of the LOE

Item	Description
Board hardware version	TNF1

10.8.2 Application

The LOE can be used in three different application scenarios: convergence of eight channels of EPON optical signals, convergence of eight channels of GE signals, and hybrid transmission of EPON and GE signals.

Service Access Description

Table 10-123 describes the principle for configuring the ports of the LOE board.

Table 10-123 Principle for configuring the ports of the LOE board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Convergence of eight channels of EPON optical signals	EPON service: the service rate is 1.25 Gbit/s in both the uplink and downlink.	8	TX1/RX1 to TX8/RX8
Convergence of eight channels of GE optical signals	GE optical signal or GE electrical signal	8	TX1/RX1 to TX8/RX8
Hybrid transmission of EPON and GE services	● EPON service ● GE optical signal or GE electrical signal	8	TX1/RX1 to TX8/RX8

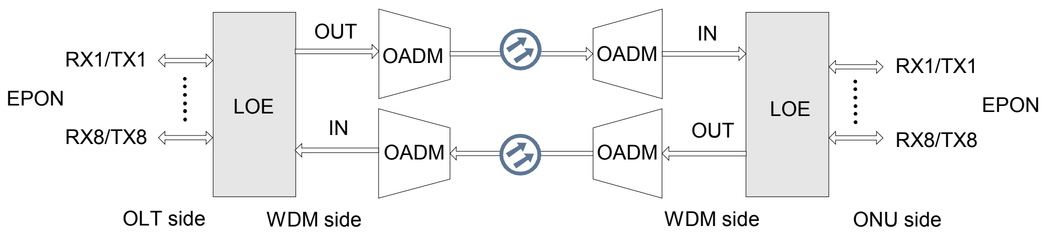
Application Scenario 1: Implements the Convergence of Eight Channels of EPON Optical Signals

RX1/TX1-RX8/TX8 ports of the LOE board can house the ONU optical module, the OLT optical module, and the client-side SFP module. When housing the ONU optical module and the OLT optical module, the ports are interconnected with the OLT equipment and the ONU equipment respectively to access EPON services. When housing the client-side SFP modules, the ports are interconnected with the client-side equipment to access GE services.

The LOE board can be connected to the ONU equipment and the OLT equipment to access eight channels of EPON services, which are converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access eight channels of EPON services, see **Figure 10-71**.

Figure 10-71 Application of the LOE to access eight channels of EPON services

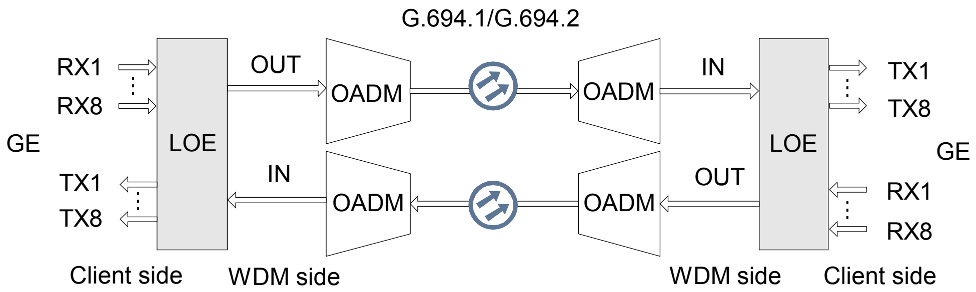


Application Scenario 2: Implements the Convergence of Eight Channels of GE Optical Signals

The LOE board can access eight channels of GE services, which are converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access eight channels of GE services, see **Figure 10-72**.

Figure 10-72 Application of the LOE to access eight channels of GE services



NOTE

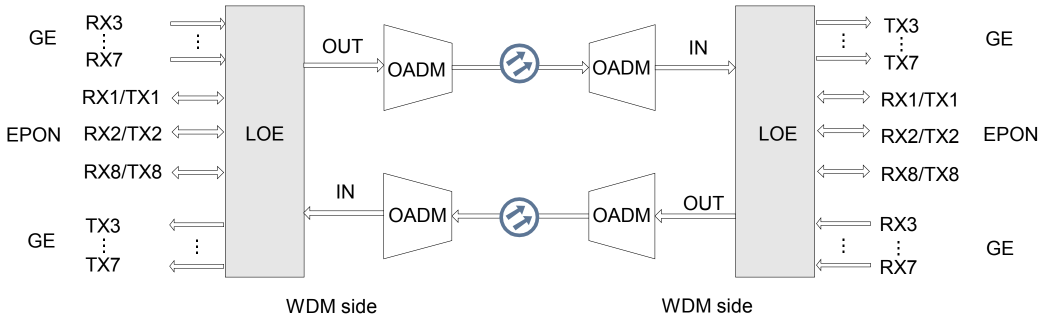
Figure 10-72 shows that the optical port SFP module is used in every port on the client side.

Application Scenario 3: Hybrid Transmission of EPON and GE Services

The LOE board can access EPON and GE services at the same time. The services are converged into OTU2 signals, which are then converted into standard WDM wavelengths for transmission.

Figure 10-73 shows the hybrid transmission of EPON and GE services.

Figure 10-73 Hybrid transmission of EPON and GE services



NOTE

In this scenario, RX1/TX1-RX8/TX8 ports can house the ONU optical module and client-side SFP module, or OLT optical module and client-side SFP module at the same time.

NOTE

- The maximum distance between the LOE board on the ONU-side and an ONU is 20 km; the maximum distance between the LOE board on the OLT-side and an OLT is 20 km; the maximum distance between an ONU and an OLT is 35 km.
- LOE boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

10.8.3 Functions and Features

The LOE board achieves the distance extension of eight EPON services, the convergence of eight GE services, the hybrid transmission of EPON and GE services, and the convergence of EPON and GE services into OTU2 services.

For detailed functions and features, see **Table 10-124**.

Table 10-124 Functions and features of the LOE board

Functions and Features	Description
Basic Function	● 8 x EPON <-> 1 x OTU2 ● 8 x GE <-> 1 x OTU2 ● 8 x EPON/GE <-> 1 x OTU2
Service type	● Convergence services: – GE: Gigabit Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. The GE services can be mapped in two modes: Encapsulated to GFP_OTU2 and Encapsulated to SDH_OTU2. – EPON: The service rate is 1.25 Gbit/s in both the uplink and downlink.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes.
Alarms and performance events monitoring	Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of GE and EPON services.

Functions and Features	Description
OTN function	• Provides the OTU2 interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports PM functions for ODU2. • Supports SM functions for OTU2.
Tunable wavelength function	Supports the tunable wavelength optical module. Equipped with this module, the board can tune the optical signal output on the WDM side within the range of 40 wavelengths in C-band with the channel spacing of 100 GHz.
Intelligent Fiber (IF) function	The board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board.
Regeneration board	When the LOE board accesses GE signals on the client side, the WDM-side signals of the LOE board can be regenerated by the TNF1LSX board.
Protection schemes	When the LOE board accesses GE services: • Supports client 1+1 protection • Supports intra-board 1+1 protection When the LOE board accesses EPON services: • Supports client 1+1 protection • Supports intra-board 1+1 protection **NOTE** • In the case of client 1+1 protection, if a fiber on the ONU side of the LOE board is broken, the protection switching cannot be performed. • If the LOE board is configured with intra-board 1+1 protection, the OLP board must be used to achieve the protection.
Loopback	When the LOE board accesses only GE services: • Supports WDM side inloop • Supports WDM side outloop • Supports client side inloop • Supports client side outloop When the LOE board accesses both GE and EPON services at the same time, the ports for receiving GE services are as follows: • Supports client side inloop • Supports client side outloop

<table>
<tr><th>Functions and Features</th><th colspan="2">Description</th></tr>
<tr><td>ALS function</td><td colspan="2">Supports the ALS function on the client side.</td></tr>
<tr><td>ESC function</td><td colspan="2">Supported</td></tr>
<tr><td>Cross-connect function</td><td colspan="2">Not supported</td></tr>
<tr><td>LPT function</td><td colspan="2">The board supports the LPT function only when the client-side service type is GE services.</td></tr>
<tr><td>PRBS test</td><td colspan="2">Supports the PRBS function on the client side.
NOTE
The PRBS function on the client side is supported only when the client-side service type is GE(GFP-T).</td></tr>
<tr><td>Ethernet port working mode</td><td colspan="2">● GE optical port: 1000M full-duplex or auto-negotiation
● GE electrical port: auto-negotiation</td></tr>
<tr><td>WDM specifications</td><td colspan="2">Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.</td></tr>
<tr><td>Protocol or standard compliance</td><td>Protocols or standards (non-performance monitoring) with which transparently transmitted services comply</td><td>IEEE 802.3z
IEEE802.3ah</td></tr>
</table>

Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.8.4 Working Principle and Signal Flow

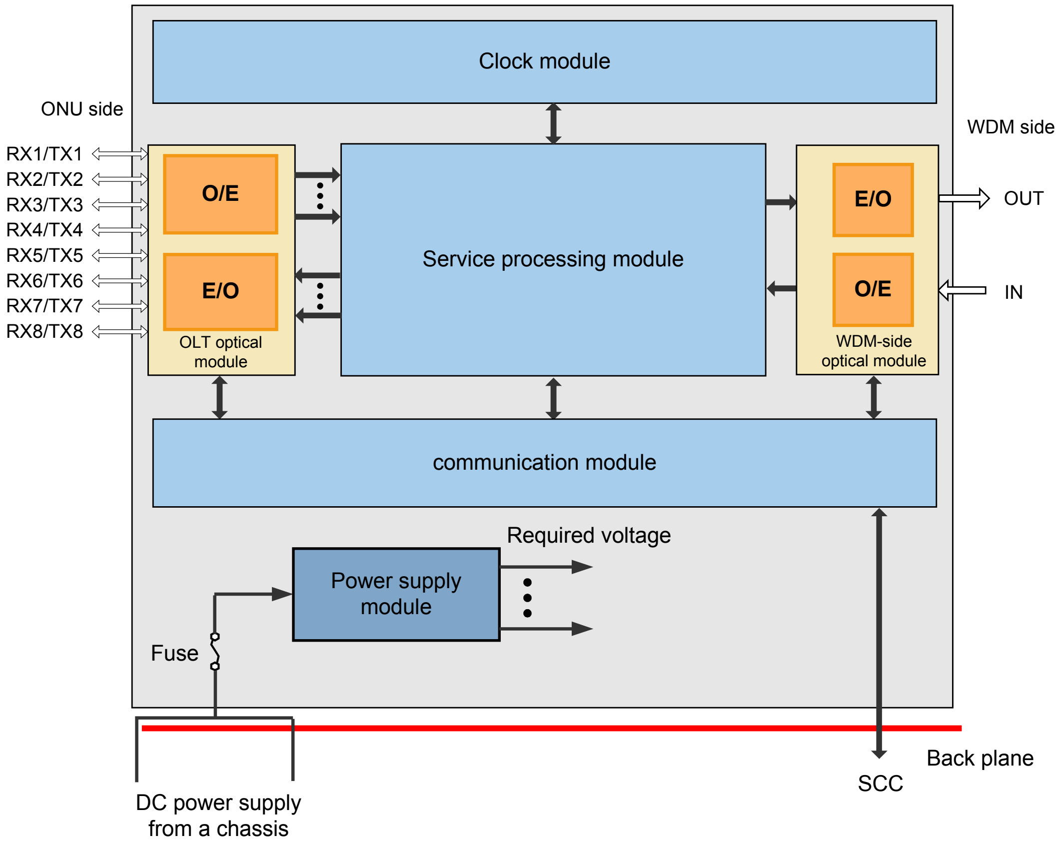
The LOE board consists of the ONU optical module (or OLT optical module/client-side optical module/client-side electrical module), WDM-side module, service processing module, clock module, communication module, detection module and power supply module.

Signal Flow of Convergence of Eight Channels of EPON Signals

When the LOE board aggregates eight channels of EPON services, the LOE boards must be used in pairs with one on the ONU side and the other on the OLT side. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

Figure 10-74 and **Figure 10-75** show the functional block diagram of the LOE to access eight channels of EPON signals.

Figure 10-74 Functional block diagram of the LOE (on the ONU side to access eight channels of EPON services)



- In the uplink direction

  The OLT optical module receives eight channels of EPON signals through the RX1/TX1 to RX8/TX8 ports, and then performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU2 signals.

  The OTU2 signals are sent to the WDM-side module and are then output through the OUT optical port after the E/O conversion.

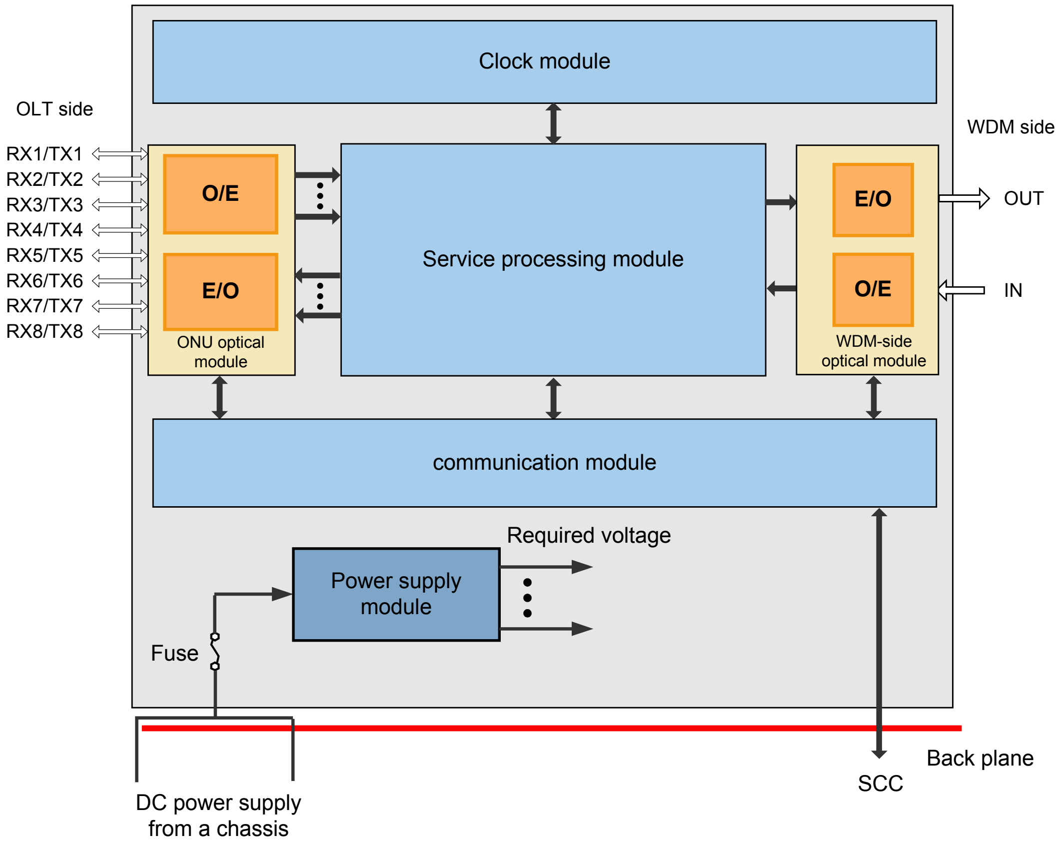
- In the downlink direction

  The WDM-side optical module receives one channel of OTU2 signals through the IN optical port, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs eight channels of EPON signals.

  The EPON signals are sent to the OLT optical module and are then output through the RX1/TX1 to RX8/TX8 ports after the E/O conversion.

Figure 10-75 Functional block diagram of the LOE (on the OLT side to access eight channels of EPON services)



- In the uplink direction

  The WDM-side optical module receives one channel of OTU2 signal through the IN optical port, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs eight channels of EPON signals.

  The EPON signals are sent to the ONU optical module and are then output through the RX1/TX1 to RX8/TX8 ports after the E/O conversion.

- In the downlink direction

  The ONU optical module receives eight channels of EPON signals from the OLT equipment through the RX1/TX1 to RX8/TX8 ports, and then performs the O/E conversion.

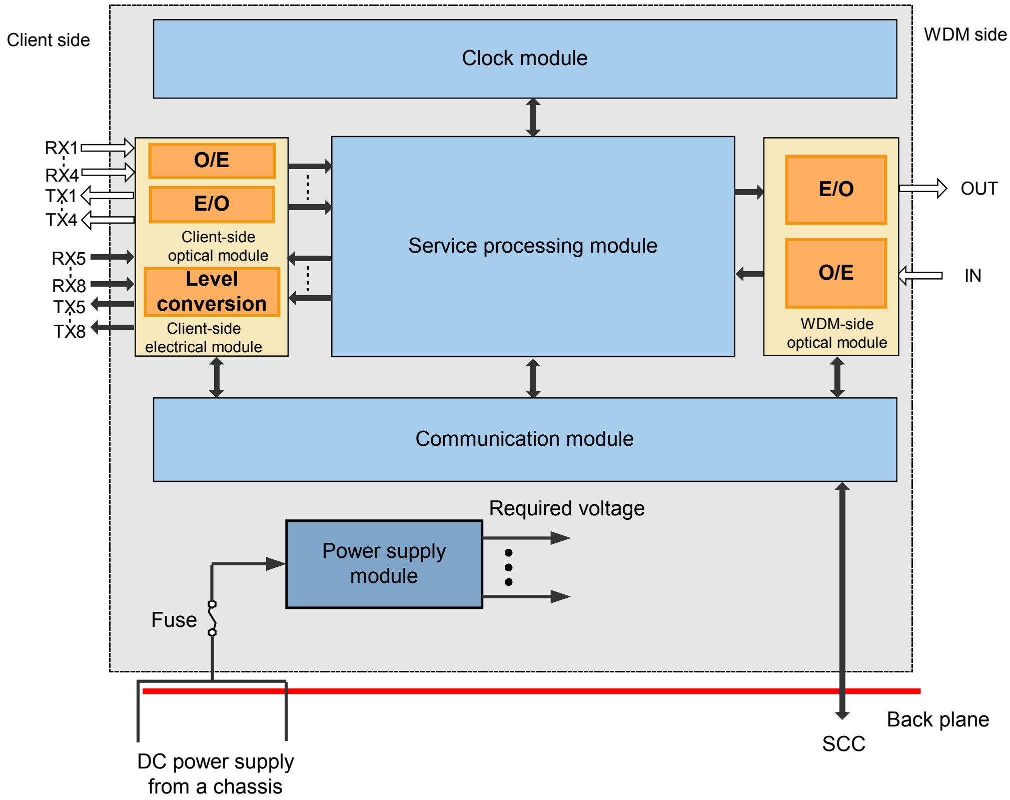
  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU2 signals.

  The OTU2 signals are sent to the WDM-side module and are then output through the OUT optical port after the E/O conversion.

Signal Flow of Convergence of Eight Channels of GE Signals

Figure 10-76 shows the functional block diagram of the LOE to access eight channels of GE signals. The diagram shows that the optical SFP module is used in the RX1/TX1-RX4/TX4 ports and the electrical SFP module is used in the RX5/TX5-RX8/TX8 ports.

Figure 10-76 Functional block diagram of the LOE (access eight channels of GE signals)



When the LOE board is used to access eight channels of GE services, in the signal flow of the board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LOE to the WDM side of the LOE, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives GE optical signals through the RX1 to RX8 ports, and then performs O/E conversion.
  - The client-side optical module receives GE electrical signals through the RX1 to RX8 ports, and then performs level conversion.

  After the conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU2 signals.

  The OTU2 signals are sent to the WDM-side module and are then output through the OUT optical port after the E/O conversion.
- Receive direction

The WDM-side optical module receives one channel of OTU2 signals through the IN optical port, and then performs the O/E conversion.

After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs eight channels of GE signals.

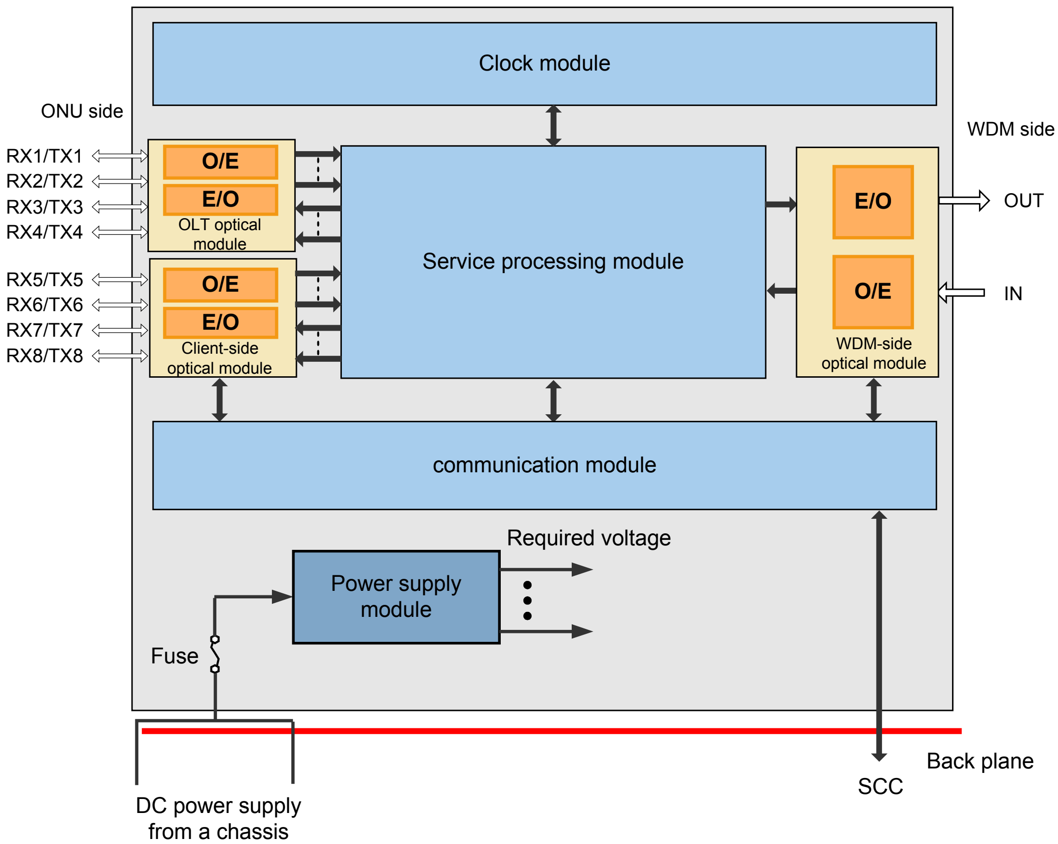
The GE signals are sent to the client-side optical module and the client-side electrical module, and then output through the TX1 to TX8 ports after the E/O conversion and level conversion.

Signal Flow of Hybrid Transmission of EPON and GE Services

When the LOE is used to converge both the EPON and GE services, two LOE boards are required. One LOE is used on the ONU side and the other OLE is used on the OLT side. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

Figure 10-77 and **Figure 10-78** show the functional block diagram of the LOE to access EPON signals and GE signals. **Figure 10-77** shows that the OLT optical module is used in the RX1/TX1-RX4/TX4 ports and the single-fiber bidirectional GE SFP module is used in the RX5/TX5-RX8/TX8 ports. **Figure 10-78** shows that the ONU optical module is used in the RX1/TX1-RX4/TX4 ports and the single-fiber bidirectional GE SFP module is used in the RX5/TX5-RX8/TX8 ports.

Figure 10-77 Functional block diagram of the LOE (used on the ONU side)



- In the uplink direction
  - The OLT optical module receives EPON signals from ONU equipment through the RX1/TX1 to RX8/TX8 ports, and then performs the O/E conversion.
  - The client-side optical module receives GE signals through the RX1/TX1 to RX8/TX8 ports, and then performs O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU2 signals.

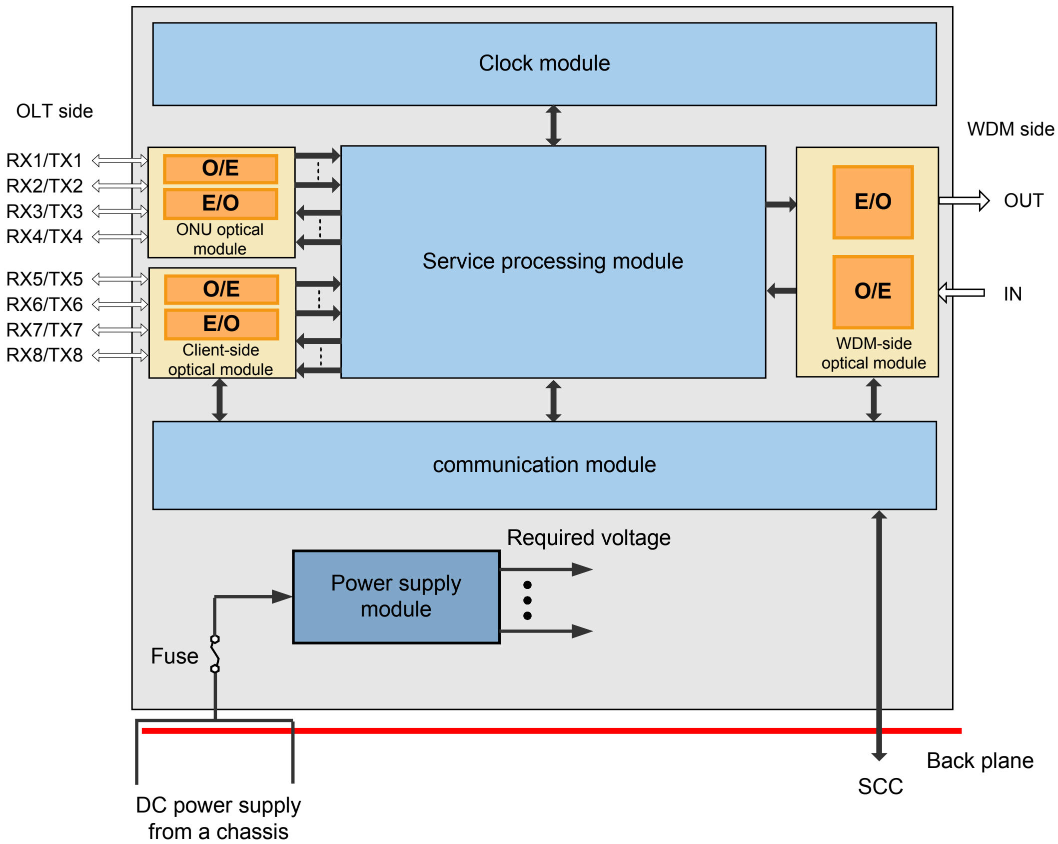
  The OTU2 signals are sent to the WDM-side module and are then output through the OUT optical port after the E/O conversion.
- In the downlink direction

  The WDM-side optical module receives one channel of OTU2 signals through the IN optical port, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs eight channels of electrical signals.

  The OLT optical power and client-side optical module perform O/E conversion for the eight channels of electrical signals. Then, RX1/TX1-RX8/TX8 ports output EPON signals and GE optical signals.

Figure 10-78 Functional block diagram of the LOE (used on the OLT side)



- In the uplink direction

  The WDM-side optical module receives one channel of OTU2 signal through the IN optical port, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs eight channels of electrical signals.

  The ONU optical power and client-side optical module perform O/E conversion for the eight channels of electrical signals. Then, RX1/TX1-RX8/TX8 ports output EPON signals and GE signals.
- In the downlink direction
  - The ONU optical module receives EPON signals from the OLT equipment through the RX1/TX1 to RX8/TX8 optical ports, and then performs the O/E conversion.
  - The client-side optical module receives GE signals through the RX1/TX1 to RX8/TX8 ports, and then performs O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU2 signals.

  The OTU2 signals are sent to the WDM-side module and are then output through the OUT optical port after the E/O conversion.

Module Function

- ONU optical module
  - OLT-side receiver: Receives EPON optical signals from the OLT devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - OLT-side transmitter: Performs E/O conversion from internal electrical signals to EPON optical signals, and transmits the optical signals to OLT devices.
  - Reports the performance of the OLT-side optical port.
  - Reports the working state of the OLT-side laser.
- OLT optical module
  - ONU-side receiver: Receives EPON optical signals from the ONU devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - ONU-side transmitter: Performs E/O conversion from internal electrical signals to EPON optical signals, and transmits the optical signals to ONU devices.
  - Reports the performance of the ONU-side optical port.
  - Reports the working state of the ONU-side laser.
- Client-side optical module
  - Client-side receiver: Receives GE optical signals from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE optical signals, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- Client-side electrical module

  - Client-side receiver: Receives GE electrical signals from the client side devices and performs level conversion of the signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to GE electrical signals, and transmits the signals to client side devices.
- WDM-side optical module
  - WDM-side receiver: Performs the O/E conversion of the OTU2 signals and then extracts clock signals from the electrical signals.
  - WDM-side transmitter: Performs the E/O conversion from internal electrical signals to OTU2 optical signals.
  - Reports performance events of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service processing module
  - Performs a series of operations for the signals, such as mapping/demapping, and clock transparent transmission.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

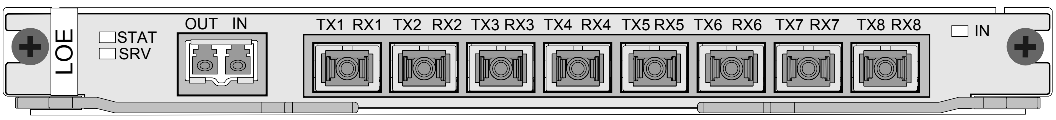
10.8.5 Front Panel

There are indicators and ports on the LOE front panel.

Appearance of the Front Panel

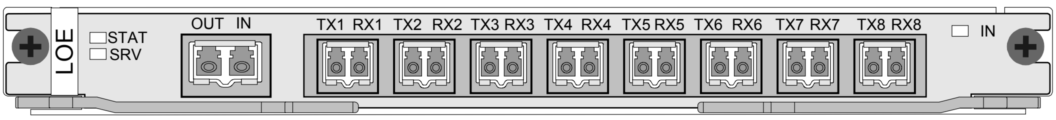
When the LOE board is used to access eight channels of EPON signals, the front panel of the board is shown in **Figure 10-79**.

Figure 10-79 Front panel of the LOE (used to access eight channels of EPON signals)



When the LOE board is used to access eight channels of GE signals, the front panel of the board is shown in **Figure 10-80**.

Figure 10-80 Front panel of the LOE (used to access eight channels of GE signals)



NOTE

Figure 10-80 shows the situation that the ports are inserted with optical SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to 20.2 Board Indicators.

Ports

Table 10-125 lists the type and function of each port.

Table 10-125 Types and functions of the LOE ports

Optical Port	Port Type	Function
IN/OUT	LC	Connected to the OADM board to receive/transmit the WDM signals.
RX1/TX1 to RX8/TX8	SC	Transmits/receives EPON service signals to ONU equipment.
	LC	Transmits/receives EPON service signals to OLT equipment.
	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives GE service signals to client-side equipment.

NOTE

- RX1/TX1-RX8/TX8 ports can house the ONU SFP optical module, OLT SFP optical module, and client-side SFP module. In addition, RX1/TX1-RX8/TX8 ports can house the ONU SFP optical module and client-side SFP module, or OLT SFP optical module and client-side SFP module at the same time. The port interconnecting with the ONU-side equipment must correspond to the port interconnecting with the OLT-side equipment one by one.
- The ONU SFP optical module also can be used to access GE single-fiber bidirectional optical signals, and the ONU SFP optical modules, client-side optical SFP modules and client-side electrical SFP modules can be used on the client side at the same time. The ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.8.6 Valid Slots

The LOE occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.8.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-126 lists the sequence number displayed on an NMS system of the optical port on the LOE board front panel.

Table 10-126 Display of the LOE optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	1
RX1/TX1	3
RX2/TX2	4
RX3/TX3	5
RX4/TX4	6
RX5/TX5	7
RX6/TX6	8
RX7/TX7	9
RX8/TX8	10

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.8.8 LOE Parameters on the NMS

Parameter Description

Field	Value	Description
Service Type	None, GE, GE(GFP-T), EPON_OLT, EPON_ONU Default: GE(GFP-T)	In case of GE services: ● Usually, **GE(GFP-T)** is recommended. In this mode, the transmission delay is small and all control protocol packets are transparently transmitted. ● In other cases, set this parameter to **GE** according to the service encapsulation mode. In case of EPON services: ● When the board is configured with an OLT optical module (to interconnect with the ONU side of PON equipment), set this parameter to **EPON_ONU**. ● When the board is configured with an ONU optical module and (to interconnect with the OLT side of PON equipment), set this parameter to **EPON_OLT**. **NOTE** When the service type changes between **EPON_ONU** and **EPON_OLT**, the service type of a channel carrying EPON services must be set to **GE(GFP-T)** or **NONE** first. For example, when the board receives four EPON services, the service type must be changed from **EPON_ONU** to **EPON_OLT**. In this case, you must set the service types of the four channels to **GE(GFP-T)** or **None** before you change the service type to **EPON_OLT**. If no services are received at the board, you can set the service type to **None**. In this case, the board does not report electrical-layer alarms on the channel. **NOTE** ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.

Field	Value	Description
Port Mapping	GFP_OTU2, SDH_OTU2 Default: GFP_OTU2	The default value is recommended. Different service types are supported in the two mapping modes. ● GFP_OTU2: None, GE(GFP-T), EPON_OLT, and EPON_ONU are supported. ● SDH_OTU2: GE and GE(GFP-T) are supported. **NOTE** ● Port mapping of the two boards that are interconnected with each other must be consistent. ● The value of this parameter can be changed only after the service type is set to **GE(GFP-T)**. ● When the LOE board is interconnected with the LOG board for NG WDM products, set this parameter to **SDH_OTU2**.
Board Mode	Common Mode, Optical Electrical Separate Mode Default: Common Mode	● Common Mode: Alarms and performance events related to the WDM-side optical module are reported through WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2). ● Optical Electrical Separate Mode: Alarms and performance events related to the WDM-side optical module are reported through logical ports 201. ● The default value is recommended. ● This parameter must be set to **Optical Electrical Separate Mode** when the board needs to be compatible with the equipment version V100R001. In this mode, the logical optical port 201 is available.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.

Field	Value	Description
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LOE board, do not disable the WDM-side lasers on the LOE board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses. **NOTE** The parameter can be set to **Inloop** or **Outloop** only when GE Service is accessed.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid only when **Service Type** is set to **GE**. The default value is recommended.

Field	Value	Description
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group.
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE** or **GE(GFP-T)**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./ optical port wavelength/ frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.

Field	Value	Description
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.8.9 LOE Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Optical Module on ONU Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LOE	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490)	EPON-OLT	GE electrical module	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-127 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-128 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	**1600ps/nm-fixed-APD-XFP**
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/ G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-129 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-130 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	**1000BASE-BX-10km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-131 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-132 Specifications of EPON-OLT optical module

Item	Unit	Value
		EPON-OLT
Transmission rate	Gbit/s	1.25
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	7
Minimum mean launched power	dBm	2
Minimum extinction ratio	dB	9
Eye pattern mask	-	IEEE802.3ah-compliant
Receiver parameter specifications at point R		

Item	Unit	Value
		EPON-OLT
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-27
Minimum receiver overload	dBm	-6

Specifications for Client-Side Electrical Modules

Table 10-133 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.82 kg (1.81 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 26.2 W
- Maximum Power Consumption at 55°C (131°F): 31.7 W

10.9 LQG

LQG: 4 x GE Wavelength Conversion Board

10.9.1 Version Description

The available hardware version for the LQG is TNF1.

Version

Table 10-134 describes the version mapping of the LQG board. The mapping version of the equipment is V100R001C01 or later.

Table 10-134 Version description of the LQG

Item	Description
Board hardware version	TNF1

10.9.2 Application

The LQG is mainly used to multiplex up to four channels of GE service signals into a channel of OTU 5G or FEC 5G signal compliant with ITU-T G.694.2 standard.

Service Access Description

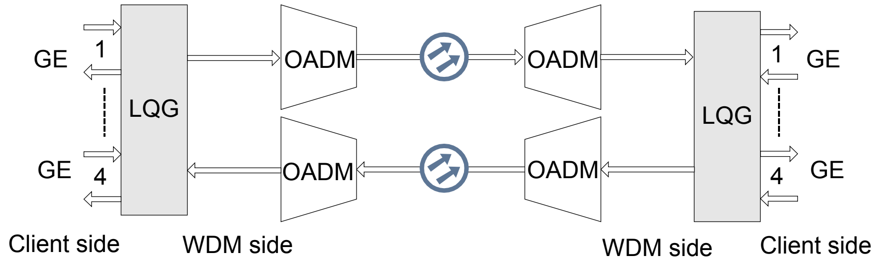
Table 10-135 describes the principle for configuring the ports of the LQG board.

Table 10-135 Principle for configuring the ports of the LQG board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports	Remarks
Multiplex up four channels of GE service signals	GE service	4	TX1/RX1 to TX4/RX4	Null

For the application of the board in WDM systems, see **Figure 10-81**.

Figure 10-81 Application of the LQG in WDM systems



NOTE

- The LQG board converges four GE service signals into a channel of FEC 5G signal by default.

10.9.3 Functions and Features

The main functions and features supported by the LQG are wavelength conversion, service convergence, GE ADM and ALS.

For detailed functions and features, see **Table 10-136**.

Table 10-136 The functions and features of the LQG

Functions and Features	Description
Basic function	● 4 x GE <—> 1 x OTU 5G/FEC 5G ● The optical ports on the WDM side provide the dual fed and selective receiving function.
Service type	● Convergence services: – GE: Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. The GE services can be mapped in two modes: FEC5G and OTU5G.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Ethernet service mapping mode	Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes.
Alarms and performance events monitoring	Provides the Ethernet service performance monitoring function. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power. Monitors the RMON performance of GE services.
Regeneration board	-

Functions and Features	Description
OTN function	• Supports the mapping of client-side services into OTU5G signals. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports the mapping of GE signals into OTU5G signals. The mapping process is compliant with ITU-T G.709. • Supports PM functions for ODU5G, and SM functions for OTU5G. • Provides the OTU5G interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports PM functions for ODU5G. • Supports SM functions for OTU5G.
Intelligent Fiber (IF) function	The board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board.
Protection schemes	• Supports client 1+1 protection • Supports intra-board 1+1 protection • Supports SW SNCP protection
Loopback	• Supports WDM side inloop • Supports WDM side outloop • Supports client side inloop • Supports client side outloop
ALS function	Supports the ALS function on the client side.
ESC function	Supported
Cross-connect function	Achieves the cross-connect function of GE optical services, and supports cross-connect between couple slots. For details, see **Slots for Cross-Connect Boards**. **NOTE** • The LQG board do not support the cross-connections of GE electrical signals.
LPT function	The board supports the LPT function only when the client-side service type is GE services.
PRBS test	Not supported
Ethernet port working mode	• GE optical port: 1000M full-duplex or auto-negotiation • GE electrical port: auto-negotiation

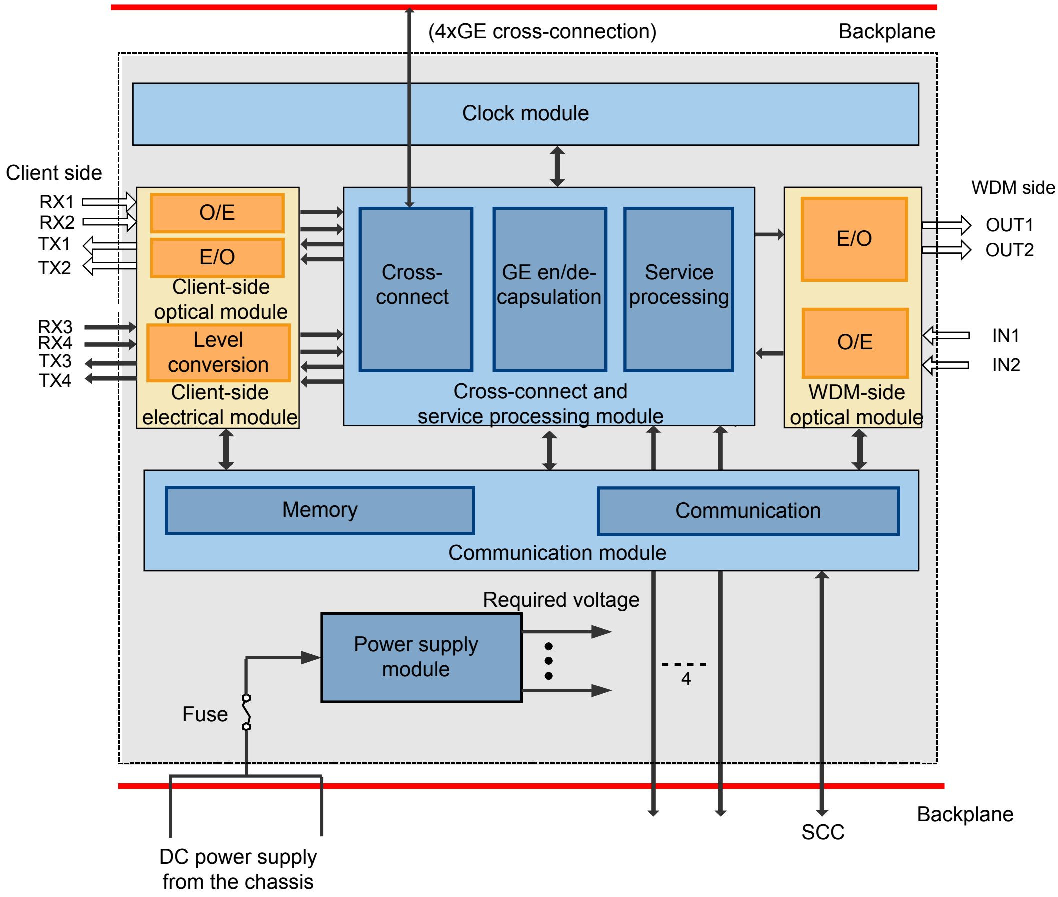
Functions and Features	Description	
WDM specification	Supports ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.3z
	Protocols or standards (performance monitoring) for processing services	-

10.9.4 Working Principle and Signal Flow

The LQG board consists of five parts: the client-side optical module or client-side electrical module, the WDM-side optical module, the cross-connect and service processing module, the clock module, the communication module, and the power supply module.

Figure 10-82 is the functional block diagram of the LQG board. The diagram shows that the optical SFP module is used in the RX1/TX1 and RX2/TX2 ports and the electrical SFP module is used in the RX3/TX3 and RX4/TX4 ports.

Figure 10-82 The functional block diagram of the LQG board



Signal Flow

In the signal flow of the LQG board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LQG board to the WDM side of the LQG board, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives GE optical signals from client equipment through the RX1-RX4 ports, and performs the O/E conversion.
  - The client-side electrical module receives GE electrical signals from client equipment through the RX1-RX4 ports, and performs level conversion.

  After the conversion, the four channels of electrical signals are sent to the cross-connect and service processing module. The module performs operations such as cross-connection, multiplexing, clock generating and frame processing. Then, the module outputs a channel of 5.33 Gbit/s signals.

  The 5.33 Gbit/s signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the ITU-T G.694.2-compliant 5.33 Gbit/s optical signals at CWDM standard wavelengths. The optical signals are output through the OUT1 and OUT2 optical ports.
- Receive direction

The WDM-side optical module receives the G.694.2-compliant optical signals at CWDM standard wavelengths from the WDM line side through the IN1 and IN2 optical ports. Then, the module performs the O/E conversion.

After the O/E conversion, the signals are sent to the cross-connect and service processing module. The module performs operations such as decapsulation, clock recovery, demultiplexing and cross-connection. Then, the module outputs four channels of GE signals.

The client-side optical module performs E/O conversion of the optical signals, and the client-side electrical module performs level conversion of the electrical signals, and then outputs four channels of client-side signals through the TX1-TX4 ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the O/E conversion of four channels of GE optical signals.
  - Client-side transmitter: Performs the E/O conversion from four channels of internal electrical signals to GE optical signals.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- Client-side electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the level conversion of four channels of GE electrical signals.
  - Client-side transmitter: Performs the level conversion from four channels of internal electrical signals to GE electrical signals.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs the O/E conversion of optical signals at 5.33 Gbit/s.
  - WDM-side transmitter: Performs the E/O conversion of the internal electrical signals and the optical signals at 5.33 Gbit/s.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.

- Cross-connect and service processing module

  Consists of the GE en/de-capsulation module, the service processing module, and the cross-connect module. The cross-connect and service processing module performs operations such as the en/de-capsulation of GE signals, service cross-connection, and service convergence.

  - GE service en/de-capsulation module: Processes the encapsulation and decapsulation of GE service signals, and reports the performance monitoring state of service signals.
  - Service processing module: Multiplexes GE signals into 5.33 Gbit/s electrical signals and demultiplexes 5.33 Gbit/s electrical signals into GE signals. It performs operations such as en/de-capsulation of OTN, en/de-coding, and scrambling/descrambling.
  - Cross-connect module: Cross-connects the client-side accessed signals with each other and passes them through, or cross-connects the client-side accessed signals with the

service signals from the backplane. The granularity of service cross-connection is GE. There are 4 channels of signals between the cross-connect module and the backplane. It supports the service grooming between paired slots.

- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

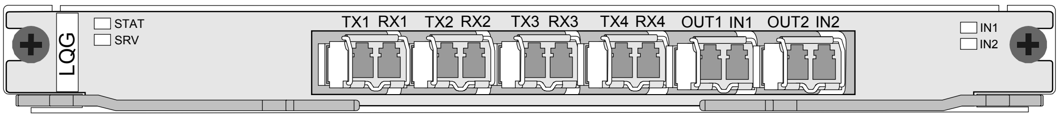
10.9.5 Front Panel

There are indicators and ports on the LQG front panel.

Appearance of the Front Panel

Figure 10-83 shows the front panel of the LQG.

Figure 10-83 Front panel of the LQG



NOTE

Figure 10-83 shows the situation that the ports are inserted with optical SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-137 lists the type and function of each port.

Table 10-137 Types and functions of the LQG ports

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the standby channel.
TX1/RX1 to TX4/RX4	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the service signals to client-side equipment.

NOTE

- The RX1/TX1-RX4/TX4 ports on the client side support the optical SFP module, electrical SFP module, and single-fiber bidirectional GE SFP module. The preceding SFP modules can be used on the client side at the same time. The ports on the client side can access GE optical signals or GE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.9.6 Valid Slots

The LQG occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

Slots for Cross-Connect Boards

The LQG board supports intra-board and inter-board cross-connection of the GE service and supports the cross-connection of a maximum of four services between paired slots.

- In the OptiX OSN 1800 I chassis,
  - SLOT3 and SLOT4 are paired slots. Each pair of slots supports the cross-connection of a maximum of four services.
- In the OptiX OSN 1800 II chassis,

- SLOT1 and SLOT2 are paired slots, SLOT3 and SLOT5 are paired slots, and SLOT4 and SLOT6 are paired slots. Each pair of slots supports the cross-connection of a maximum of four services.

10.9.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Display of Ports

Table 10-138 lists the sequence number displayed in an NMS system of the ports on the LQG board front panel.

Table 10-138 Display of the LQG ports

Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
TX1/RX1	3
TX2/RX2	4
TX3/RX3	5
TX4/RX4	6

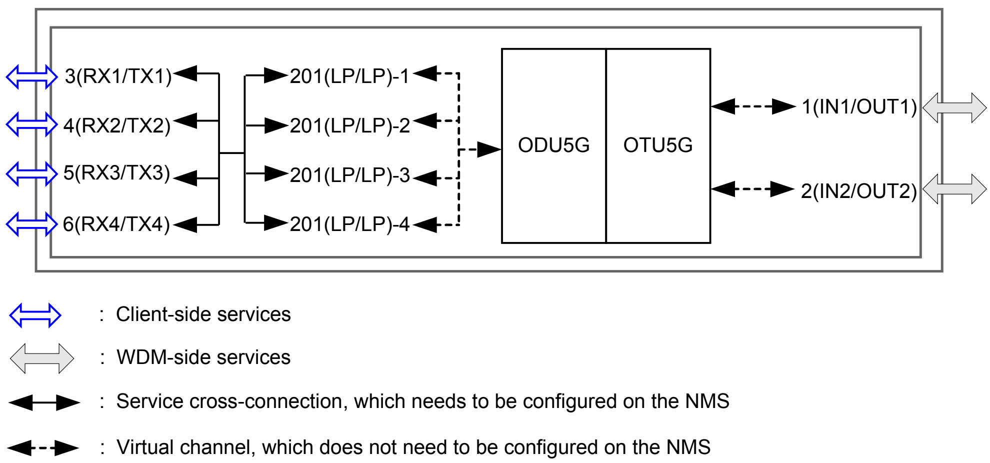
NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model

Figure 10-84 shows the port model on the LQG board.

Figure 10-84 Schematic diagram of the cross-connect ports on the LQG board

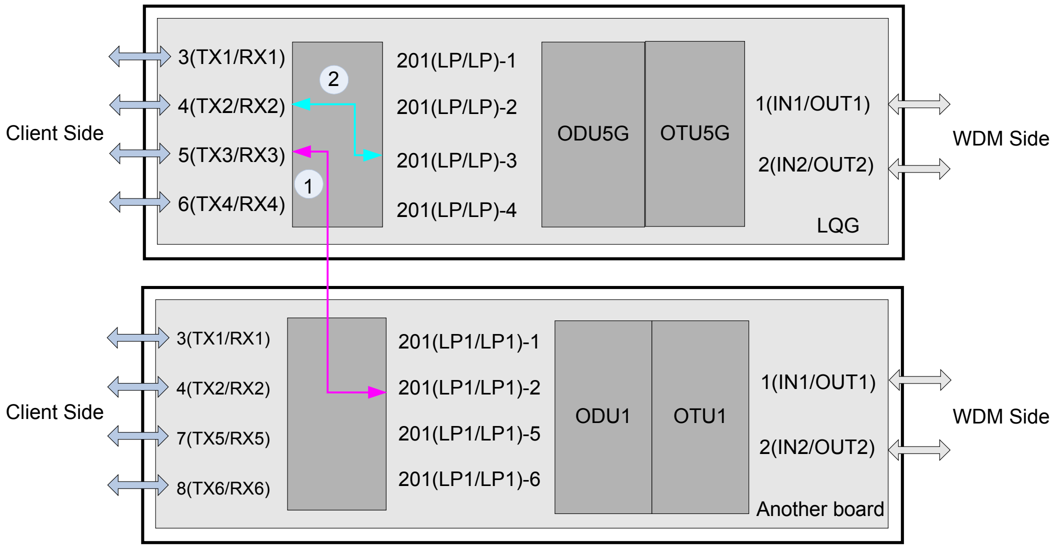


- Alarms and performance events related to client signal overheads are reported through channel 1 of client-side optical ports 3-6 (RX1/TX1, RX2/TX2, RX3/TX3, and RX4/TX4).
- Alarms and performance events related to OTN electrical-layer overheads are reported through channels 1 and 2 of logical port 201.
- Alarms related to the WDM-side optical module and OTN optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

Cross-Connect Ports

The LQG board supports inter-board cross-connections and intra-board cross-connections of GE optical signals. This board implements service cross-connections through its cross-connect module. **Figure 10-85** shows the cross-connections implemented on the LQG board.

Figure 10-85 Example of cross-connections of the LQG board



Another board: LQG or LQM2. The figure uses the LQM2 board in AP8 mode as an example.

- Inter-board cross-connection
  - The GE optical signals on the client side of the LQG board are cross-connected to the WDM-side ports 201 of LQM2 board or another LQG board. For details, see (1) in **Figure 10-85**.
- Intra-board cross-connection
  - The client-side GE optical signals of the LQG board are cross-connected to the WDM-side ports 201 of this board. For details, see (2) in **Figure 10-85**.

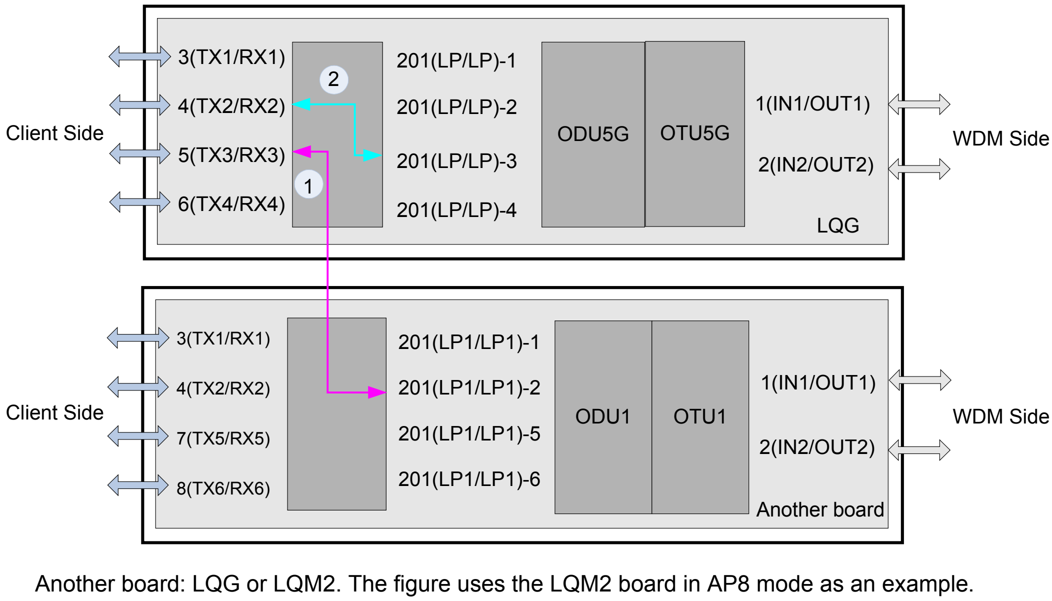
10.9.8 Configuration of Cross-connection

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Cross-Connect Ports

The LQG board supports inter-board cross-connections and intra-board cross-connections of GE optical signals. This board implements service cross-connections through its cross-connect module. **Figure 10-86** shows the cross-connections implemented on the LQG board.

Figure 10-86 Example of cross-connections of the LQG board



- Inter-board cross-connection
  - The GE optical signals on the client side of the LQG board are cross-connected to the WDM-side ports 201 of LQM2 board or another LQG board. For details, see 1 in **Figure 10-86**.
- Intra-board cross-connection
  - The client-side GE optical signals of the LQG board are cross-connected to the WDM-side ports 201 of this board. For details, see 2 in **Figure 10-86**.

10.9.9 LQG Parameters on the NMS

Parameter Description

Field	Value	Description
Service Type	GE, GE(GFP-T) Default: GE	● Set this parameter to a proper value according to the service type of the interconnected board. If **Service Type** needs to be changed from **GE** to **GE(GFP-T)**, set **Port Mapping** to **Encapsulated to OTU5G** before you change **Service Type** to **GE(GFP-T)**. In case of **GE (GFP-T)** services, **Port Mapping** must be set to **Encapsulated to OTU5G**. NOTE After you configure a cross-connection for the board, if the service type that you select when configuring the cross-connection is different from the value you set for the **Service Type** field, setting the **Service Type** field fails. In this case, you need to delete the cross-connection and set the **Service Type** field again. CAUTION ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Port Mapping	Encapsulated to FEC5G, Encapsulated to OTU5G Default: Encapsulated to FEC5G	The default value is recommended. Different service types are supported in the two mapping modes. ● Encapsulated to FEC5G: GE is supported. ● Encapsulated to OTU5G: GE and GE(GFP-T) are supported. NOTE **Port Mapping** of the two boards that are interconnected with each other must be consistent and **Service Type** of their WDM-side optical ports must be consistent.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.

Field	Value	Description
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LQG board, do not disable the WDM-side lasers on the LQG board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid only when **Service Type** is set to **GE**. The default value is recommended.
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group.

Field	Value	Description
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, CWDM/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.9.10 LQG Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LQG	1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490)	GE electrical module	1400ps/nm-fixed-APD-eSFP

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-139 Specifications of 1400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-eSFP
Maximum wavelength count	-	8
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	8
Minimum mean launched power	dBm	3
Minimum extinction ratio	dB	5
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	≤±6.5
Maximum -20 dB spectral width	nm	1

Item	Unit	Value
		1400ps/nm-fixed-APD-eSFP
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	G.959.1-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1450 to 1620
Receiver sensitivity (with FEC)	dBm	-25.5
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-140 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-141 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-142 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Specifications for Client-Side Electrical Modules

Table 10-143 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.57 kg (1.26 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 18.8 W
- Maximum Power Consumption at 55°C (131°F): 23.4 W

10.10 LQM

LQM: 4 x Multi-rate Ports Wavelength Conversion Board

10.10.1 Version Description

The available hardware version for the LQM is TNF1 and TNF2.

Version

Table 10-144 describes the version mapping of the LQM board.

Table 10-144 Version description of the LQM

Item	Description
Board hardware version	TNF1: The mapping version of the equipment is V100R001C01 or later. TNF2: The mapping version of the equipment is V100R003C01 or later.

Differences Between Versions

Table 10-145 lists differences between LQM board versions.

Table 10-145 Differences between LQM board versions

Item	TNF1LQM	TNF2LQM
Service type	Does not support CPRI option2, CPRI option3, OC-3, OC-12, OC-48.	Supports CPRI option2, CPRI option3, OC-3, OC-12, OC-48.
Regeneration function	Regenerates one channel of OTU1 signals.	Regenerates two channels of OTU1 signals.
EVOA port	Does not support EVOA ports.	Supports EVOA ports.
Synchronous Ethernet transparently transmitting	Does not support synchronous Ethernet services.	Supports synchronous Ethernet services.
Protection schemes	Does not support ODUk SNCP protection.	Supports ODUk (k = 0, 1) SNCP protection.
Mapping path	Supports ODU1-level mapping.	Supports ODU0-level and ODU1-level mapping.
Encapsulation mode	Supports encapsulation of GE services in GFP_F and GFP_T modes.	Supports encapsulation of GE services in GFP_T and GE (TTT-GMP) modes.

Substitution Relationship

Table 10-146 lists the substitution relationship for LQM boards.

Table 10-146 Substitution relationship for LQM boards

Original Board	Substitute Board	Substitution Rules
TNF1LQM	TNF2LQM	The TNF2LQM board can be created as TNF1LQM on the NMS to function as a TNF1LQM board. In this scenario, the TNF2LQM only provides the functions of the TNF1LQM board. **NOTE** If the NE software version is V100R003C01 or later, the NE software does not need to be upgraded during the substitution. If the NE software version is earlier than V100R003C01, the NE software needs to be upgraded to V100R003C01 or a later version. The TNF2LQM board does not support GE (GFP-F) services. When it is used to substitute for a TNF1LQM board provisioned with GE (GFP-F) services, change the service type to GE (GFP-T) after the substitution.
TNF2LQM	None	-

10.10.2 Application

The LQM can be used in two different application scenarios: convergence of Any service signals and regeneration of OTU1 optical signals.

Service Access Description

Table 10-147 and **Table 10-148** describe the principle for configuring the ports on the LQM board.

Table 10-147 Principle for configuring the ports on the TNF1LQM board

Application Scenario of the Board	Available Port	Service Access	Remarks
Convergence of four channels of signals at any rate	TX1/RX1 to TX4/RX4	125 Mbit/s to 1.25 Gbit/s	The overall bandwidth of the services received at TX1/RX1 to TX4/RX4 should not be more than 2.5 Gbit/s.
	TX1/RX1	125 Mbit/s to 2.5 Gbit/s	
Regeneration of one channel of OTU1 optical signals	TX1/RX1, IN1/OUT1	OTU1	-

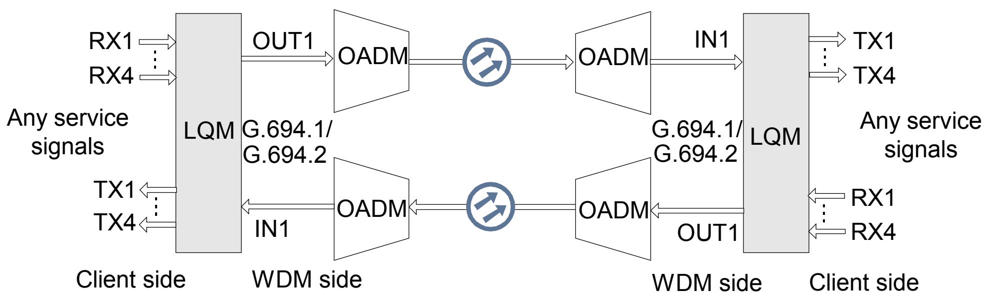
Table 10-148 Port configuration rule for the TNF2LQM board

Working Mode of the Board	Application Scenario	Working Mode of the Port	Available Port	Service Access	Remarks
1 x AP4 ODU1 mode	Convergence of four Any services and ODU1-level mapping	ODU1 convergence mode	TX1/RX1 to TX4/RX4	125 Mbit/s to 2.5 Gbit/s	The overall bandwidth of the services received at TX1/RX1 to TX4/RX4 should not be more than 2.5 Gbit/s.
		ODU1 non-convergence mode	TX1/RX1	1.25 Gbit/s to 2.5 Gbit/s	
1 x AP2 ODU0 mode	Convergence of two Any services and ODU0-level mapping	-	TX1/RX1 to TX2/RX2	125 Mbit/s to 1.25 Gbit/s	-
1 x AP2 regeneration mode	Regeneration of two OTU1 services	-	TX1/RX1 to TX2/RX2	OTU1	-

Application Scenario 1: Implements the Convergence of Any Services

The LQM board mainly used to converge a maximum of four channels of Any (at a rate of 125 Mbit/s to 2.5 Gbit/s) signals to one channel of OTU1 signals and convert the converged OTU1 signals into signals borne on a standard DWDM wavelength compliant with ITU-T G.694.1 or signals borne on a standard CWDM wavelength compliant with ITU-T G. 694.2. At the same time, the board completes the reverse process. See **Figure 10-87**.

Figure 10-87 Convergence of Any services implemented by the LQM board



NOTE

The TNF1LQM board can converge four Any services.

When used in 1 x AP4 ODU1 mode, the TNF2LQM board can converge four Any services. When used in 1 x AP2 ODU0 mode, the TNF2LQM board can converge two Any services. In the 1 x AP2 ODU0 mode, only ports TX1/RX1 and TX2/RX2 are available.

Application Scenario 2: Implements the Regeneration of OTU1 Optical Signals

The TNF1LQM board can regenerate one OTU1 service. **Figure 10-88** shows the application of the TNF1LQM board as a regeneration board.

When used in 1 x AP2 regeneration mode, the TNF2LQM board can regenerate two OTU1 services. **Figure 10-89** and **Figure 10-90** show the application of the TNF2LQM board as a regeneration board.

Figure 10-88 Application of the TNF1LQM as a regeneration board

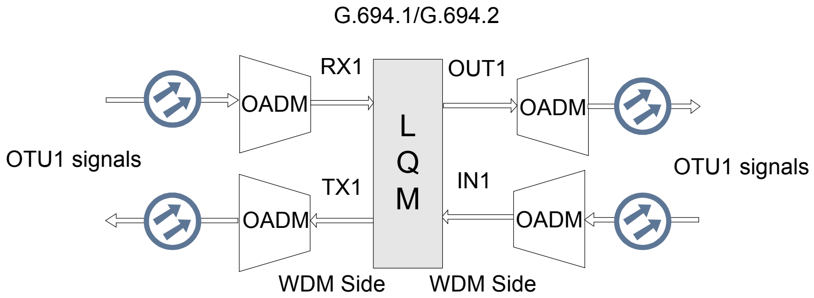


Figure 10-89 Application of the TNF2LQM as a regeneration board (regenerate two OTU1 services)

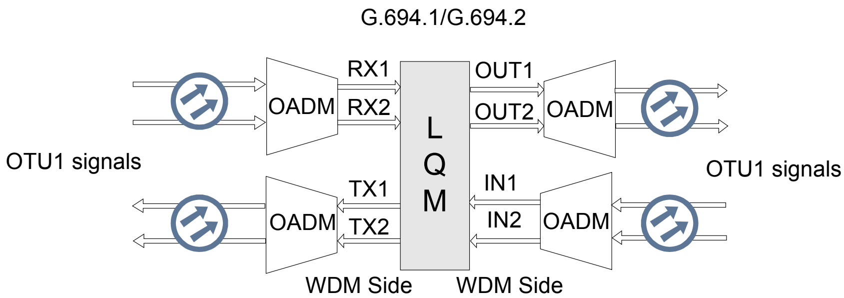
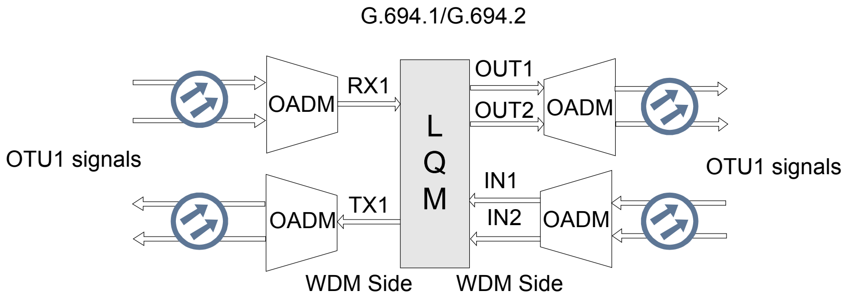


Figure 10-90 Application of the TNF2LQM as a regeneration board (regenerate one OTU1 service)



CAUTION

- When the TNF1LQM board is used as a regeneration board, only OTU1 services can be received at the RX1/TX1 port. When the TNF2LQM board is used as a regeneration board, the client-side ports TX1/RX1 and TX2/RX2 must receive OTU1 services. If other services are received, the ESC communication on the client side will be interrupted.
- When FE services are received on the client side, the TNF1LQM board cannot be interconnected with the TNF2LQM board.

Background Information

The service processing chip of the LQM board provides 16 timeslots for receiving services. Different types of services require different number of timeslots. The total number of timeslots for the services received at the LQM board must be smaller than the maximum number of timeslots that the service processing chip can provide. In addition, the total number of timeslots for the services configured at the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports must be not greater than 16.

Table 10-149 lists the number of timeslots required by common services.

Table 10-149 Number of timeslots required by common services

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
GE/GE(GFP_T)/GE (TTT-GMP)	7	FICON	6
STM-1	1	FICON EXPRESS	12
STM-4	4	ESCON	2
STM-16	16	DVB-ASI	2
FC200	12	SDI	3

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
FC100	6	HDSDI	12
FE	1	HDSDI14835	12
FC100_SLICE	8	OTU1	16
FC200_SLICE	16	FICON_SLICE	8
FICON_EXPRESS_SLICE	16	GE_SLICE	12

In case of GE services, the committed information rate can be configured to change the number of timeslots required. **Table 10-150** lists the number of timeslots required by GE services at different bandwidths.

Table 10-150 Number of timeslots required by GE services

Bandwidth (Mbit/s)	Number of Timeslots Required	Bandwidth (Mbit/s)	Number of Timeslots Required
931-1000	7	311-465	3
776-930	6	156-310	2
621-775	5	1-155	1
466-620	4	-	-

The TNF1LQM board supports slice services, such as GE_SLICE, FC100_SLICE, FC200_SLICE, FICON_SLICE, and FICON_EXPRESS_SLICE. Compared with common services, slice services feature better performance in transparent transmission of clock but require more timeslots. In practical application, select a proper service type according to the actual conditions. For example, when the LQM board is used to receive FC100 services, select FC100_SLICE if better performance in transparent transmission of clock is required and timeslots are sufficient. Otherwise, select FC100 so that more timeslots can be used to receive other types of services.

10.10.3 Functions and Features

The main functions and features supported by the LQM are wavelength conversion, service convergence, ALS, and the regeneration of the OTU1 optical signals.

For detailed functions and features, see **Table 10-151**.

Table 10-151 Functions and features of the LQM

<table>
<tr><th>Function and Feature</th><th>Description</th></tr>
<tr><td>Basic Function</td><td>TNF1LQM:
4 x Any (125 Mbit/s – 1.25 Gbit/s) <-> 1 x OTU1
NOTE
The RX1/TX1 port supports the signals at a rate of 125 Mbit/s to 2.5 Gbit/s.
Implements bidirectional regeneration of one OTU1 service.
WDM-side optical ports provide the dual fed and selective receiving function.
TNF2LQM:
4 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 1 x OTU1
Implements bidirectional regeneration of two OTU1 services.
WDM-side optical ports provide the dual fed and selective receiving function.</td></tr>
</table>

Function and Feature	Description
Service type	● Convergence services: – STM-1: SDH services, the rate is 155.52 Mbit/s. – STM-4: SDH services, the rate is 622.08 Mbit/s. – STM-16: SDH services, the rate is 2.488 Gbit/s. – OC-3: SONET services, the rate is 155.52 Mbit/s. (Only TNF2LQM supports) – OC-12: SONET services, the rate is 622.08 Mbit/s. (Only TNF2LQM supports) – OC-48: SONET services, the rate is 2.488 Gbit/s. (Only TNF2LQM supports) – FE: Fast Ethernet services, the rate is 125 Mbit/s. Supports FE optical signals and FE electrical signals. – GE: Gigabit Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. – ESCON: Enterprise system connection services, the rate is 200 Mbit/s. – FC100: Fiber channel services, the rate is 1.06 Gbit/s. – FC200: Fiber channel services, the rate is 2.12 Gbit/s. – FICON: Fiber channel services, the rate is 1.06 Gbit/s. – FICON EXPRESS: Fiber channel services, the rate is 2.12 Gbit/s. – DVB-ASI (Digital Video Broadcasting -Asynchronous Serial Interface): Digital TV services with the rate being 270 Mbit/s. – SDI (Digital Video Broadcasting - Serial Digital Interface): Digital TV services with the rate being 270 Mbit/s. – HD-SDI: High-definition digital TV services, the rate is 1.485 Gbit/s. – CPRI option2: The rate is 1.2288 Gbit/s. (Only TNF2LQM supports) – CPRI option3: The rate is 2.4576 Gbit/s. (Only TNF2LQM supports) ● Regeneration services: – OTU1: OTN services, the rate is 2.67 Gbit/s. (Only the TX1/RX1 port on the TNF1LQM board supports; Only the TX1/RX1 and TX2/RX2 ports on the TNF2LQM board support.) **NOTE** FC100, FC200, FICON, and FICON EXPRESS services that the TNF1LQM accessed can be configured as cut service. The "SDI" is also called the "SD-SDI" according to SMPTE 259M standard.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.

Function and Feature	Description
Ethernet service mapping mode	TNF1LQM: ● Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes. ● Supports encapsulation of FE services in GFP_F (ITU-T G.7041) modes (displayed as GE on the NMS) mode. TNF2LQM: ● Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes. ● Supports encapsulation of FE services in GFP_T (ITU-T G.7041) modes.
Alarms and performance events monitoring	Monitors B1, SM_BIP8, PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. LQM monitors the RMON performance of GE/FE services.
OTN function	● Provides the OTU1 interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM functions for ODU1 and ODU0. ● Supports SM functions for OTU1. **NOTE** When the LQM board is used as a regeneration board, it does not support the PM overhead configuration.
Variable optical attenuator	The TNF2LQM board can adjust the optical power of the WDM-side signals using the SFP EVOA module housed at the VO/VI port. The allowable attenuation range is from 0 dB to 20 dB.
Intelligent Fiber (IF) function	The TNF1LQM board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board. TNF2LQM: Not supported
Regeneration board	The WDM-side signals of the LQM board can be regenerated by the LWX2, LQM, or TNF1LQM2 board.
Synchronous Ethernet services	The TNF2LQM board supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.

Function and Feature	Description
Protection schemes	TNF1LQM: ● Supports intra-board 1+1 protection ● Supports client 1+1 protection TNF2LQM: ● Supports intra-board 1+1 protection ● Supports client 1+1 protection ● Supports ODUk SNCP (k = 0,1) protection
Loopback	● Supports WDM side inloop ● Supports WDM side outloop ● Supports client side inloop ● Supports client side outloop
ALS function	Supports the ALS function on the client side. **NOTE** ● When the client side receives OTU1 services, the ALS function is disabled. That is, the laser stays in enabling state.
ESC function	Supported
Cross-connect function	Not supported
LPT function	The board supports the LPT function only when the client-side service type is GE or FE services.
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is GE/STM-1/OC-3/STM-4/OC-12/STM-16/OC-48/OTU1.
Ethernet port working mode	TNF1LQM: ● GE optical port: 1000M full-duplex or auto-negotiation ● GE electrical port: auto-negotiation ● FE optical port: 100M full-duplex ● FE electrical port: 100M full-duplex TNF2LQM: ● GE optical port: 1000M full-duplex ● GE electrical port: 1000M full-duplex ● FE optical port: 100M full-duplex ● FE electrical port: 100M full-duplex

Function and Feature	Description	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.3u IEEE 802.3z ITU-T G.707 ITU-T G.782 ITU-T G.783 NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI) NCITS FIBRE CHANNEL LINK SERVICES (FC-LS) NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2) NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3) NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3) NCITS FIBRE CHANNEL - PHYSICAL AND SIGNALING INTERFACE (FC-PH) NCITS FIBRE CHANNEL SINGLE-BYTE COMMAND CODE SETS-2 MAPPING PROTOCOL (FC-SB-2) SMPTE 292M Bit-Serial Digital Interface for High-Definition Television Systems ETSI TR 101 891 Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI) SMPTE 259M 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals - Serial Digital Interface NCITS SBCON Single-Byte Command Code Sets CONnection architecture (SBCON) CPRI Specification V4.1 **NOTE** Only the TNF2LQM board supports CPRI Specification V4.1.

Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2 **NOTE** Only the TNF2LQM board supports ITU-T G.873.1.

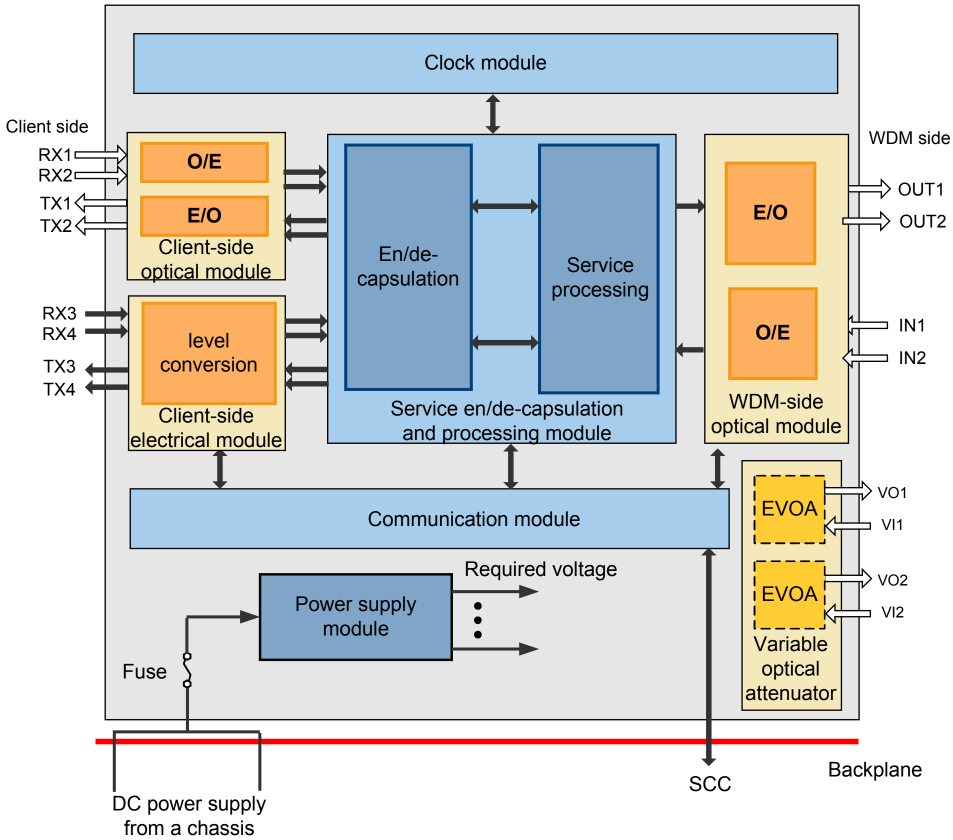
10.10.4 Working Principle and Signal Flow

The LQM board consists of the client-side optical module or client-side electrical module, the WDM-side optical module, the service en/de-capsulation and processing module, the clock module, the variable optical attenuator, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Signal Flow of LQM (Convergence of Any Services)

Figure 10-91 is the functional block diagram of the LQM that implement the convergence of four channels of signals at any rate. The diagram shows that the optical SFP module is used in the RX1/TX1 and RX2/TX2 ports and the electrical SFP module is used in the RX3/TX3 and RX4/TX4 ports.

Figure 10-91 Functional block diagram of the LQM (convergence of Any services)



NOTE

The variable optical attenuators are only supported by the TNF2LQM.

In the signal flow of the LQM board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LQM to the WDM side of the LQM, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives optical signals from client equipment through the RX1-RX4 ports, and performs O/E conversion.
  - The client-side electrical module receives electrical signals from client equipment through the RX1-RX4 ports, and performs level conversion.

  After conversion, the four channels of electrical signals are sent to the service en/de-capsulation and processing module. The module performs processes such as multiplexing, clock generating and frame processing. Then, the module outputs a channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant 2.67 Gbit/s optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s optical signals at CWDM standard wavelengths. The optical signals are output through the OUT1 and OUT2 optical ports.
- Receive direction

The WDM-side optical module receives the G.694.1-compliant 2.67 Gbit/s optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s optical signals at CWDM standard wavelengths from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

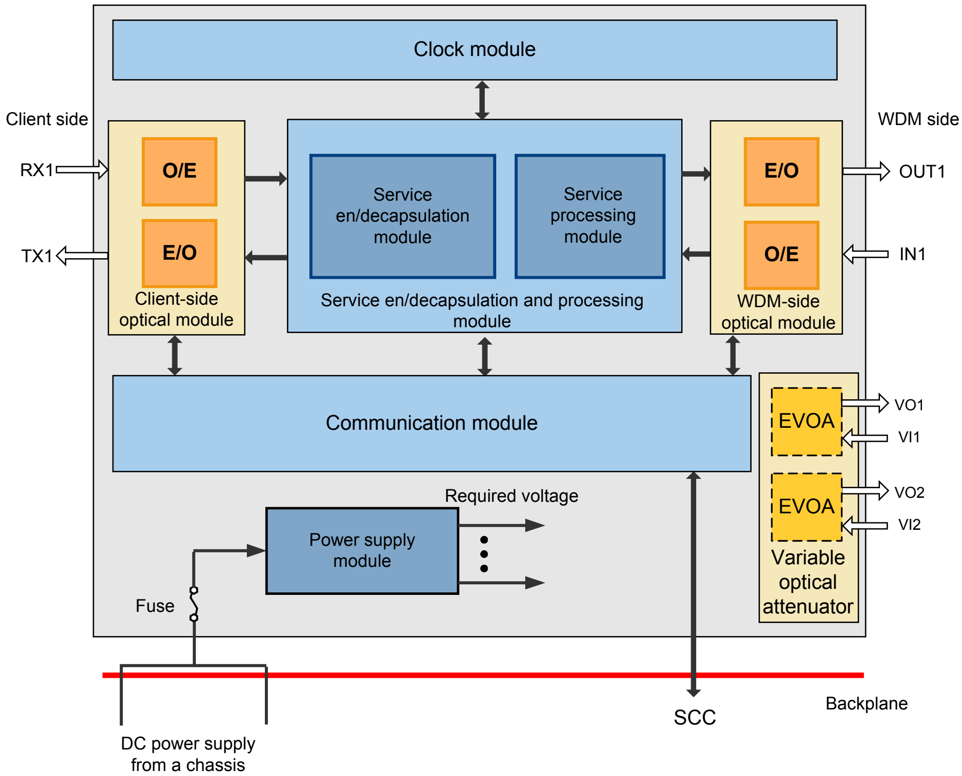
After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as decapsulation, clock recovery and demultiplexing. Then, the module outputs four channels of electrical signals at any rate.

The client-side optical module performs E/O conversion of the optical signals, and the client-side electrical module performs level conversion of the electrical signals, and then outputs four channels of client-side signals through the TX1-TX4 ports.

Signal Flow of LQM (Regeneration of OTU1 Services)

Figure 10-92 is the functional block diagram of the LQM that implement the regeneration of one channel of OTU1 optical signal.

Figure 10-92 Functional block diagram of the LQM (regeneration of OTU1 services)



NOTE

The variable optical attenuators are only supported by the TNF2LQM.

In the signal flow of the LQM board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LQM to the WDM side of the LQM, and the receive direction is defined as the reverse direction.

- Transmit direction

  The client-side optical module receives one channel of OTU1 optical signal from client equipment through the RX1 port, and performs O/E conversion.

After O/E conversion, the electrical signal is sent to the service en/de-capsulation and processing module. The module performs processes such as overhead processing, reshaping, regenerating and retiming. Then, the module outputs a channel of OTU1 signals.

The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant 2.67 Gbit/s optical signals at DWDM standard wavelengths or the G.694.2-compliant 2.67 Gbit/s optical signals at CWDM standard wavelengths. The optical signals are output through the OUT1 optical port.

- Receive direction

  The WDM-side optical module receives the G.694.1-compliant OTU1 optical signal at DWDM standard wavelengths or the G.694.2-compliant OTU1 optical signal at CWDM standard wavelengths from the WDM side through the IN1 optical port. Then, the module performs O/E conversion.

  After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as overhead processing, reshaping, regenerating and retiming. Then, the module outputs one channel of OTU1 electrical signals.

  The client-side optical module performs E/O conversion of the signal, and then outputs one channel of OUT1 optical signal through the TX1 port.

NOTE

Figure 10-92 is a functional block diagram of the TNF1LQM board. The TNF2LQM board supports regeneration of two OTU1 services and both client-side TX1/RX1 and TX2/RX2 ports on the board can receive OTU1 services.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- Client-side electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE or FE electrical signals from client side devices, and performs the level conversion of the GE or FE electrical signals to internal electrical signals.
  - Client-side transmitter: Performs the level conversion of internal electrical signals to GE or FE electrical signals, and transmits the GE or FE electrical signals to client side devices.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of optical signals at 2.67 Gbit/s.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to optical signals at 2.67 Gbit/s.

  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module

  The module consists of the service en/de-capsulation module and the service processing module. It implements the en/de-capsulation of signals in any format and service convergence.
  - Service en/de-capsulation module: Processes the overheads of signals in any format, and reports the performance monitoring state of service signals.
  - Service processing module: Achieves the multiplexing from signals in any format to signals in OTU1 format and the demultiplexing from signals in OTU1 format to signals in any format, and performs processes such as encapsulation/decapsulation of FEC, encoding/decoding and scrambling/descrambling.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Variable optical attenuator (can be selected)
  - Adjust the transmission optical power or receive optical power.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

10.10.5 Front Panel

There are indicators and ports on the LQM front panel.

Appearance of the Front Panel

Figure 10-93 and Figure 10-94 show the front panel of the LQM.

Figure 10-93 Front panel of the TNF1LQM

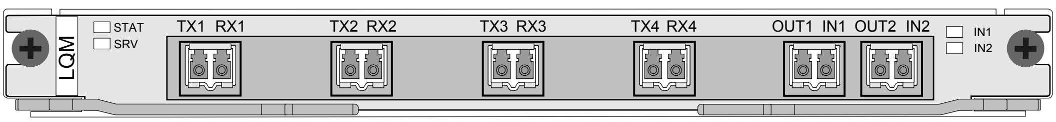
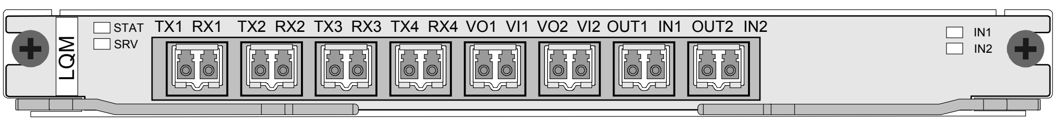


Figure 10-94 Front panel of the TNF2LQM



NOTE

Figure 10-93 shows the situation that optical SFP modules are used.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

- When the TNF1LQM board implements the convergence of four channels of Any services, **Table 10-152** lists the type and function of each port.

Table 10-152 Types and functions of the TNF1LQM ports (convergence of four channels of Any services)

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the standby channel.
TX1/RX1 to TX4/RX4	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives service signals to client-side equipment.

- When the TNF1LQM board implements the regeneration of one channel of OTU1 optical signal, **Table 10-153** lists the type and function of each port.

Table 10-153 Types and functions of the TNF1LQM ports (regeneration of one channel of OTU1 optical signals)

Port	Port Type	Function
OUT1/RX1	LC	Transmits/receives the regeneration OTU1 service signals of the east direction.
TX1/IN1	LC	Transmits/receives the regeneration OTU1 service signals of the west direction.

- When the TNF2LQM board adopts 1 x AP4 ODU1 mode and 1 x AP2 ODU0 mode, it can implement the convergence of Any optical signals. **Table 10-154** lists the type and function of each port.

Table 10-154 Types and functions of the TNF2LQM ports (convergence of Any services)

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the standby channel.
TX1/RX1 to TX4/RX4[a]	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives service signals to client-side equipment.
VI1 to VI2	LC	Receive the signal to be attenuated.
VO1 to VO2	LC	Transmit the attenuated signal.
a: When the board adopts 1 x AP2 ODU0 mode, it can implement the convergence of two channels of Any optical signals. At this time, only TX1/RX1 and TX2/RX2 optical ports are available.		

- When the TNF2LQM board adopts 1xAP2 regeneration mode, it can implement the regeneration of two OTU1 optical signals. **Table 10-155** lists the type and function of each port.

Table 10-155 Types and functions of the TNF2LQM ports (regeneration of two channels of OTU1 optical signals)

Port	Port Type	Function
OUT1/RX1, OUT2/RX2	LC	Transmits/receives the east optical signals of the OTU1 regeneration.
TX1/IN1, TX2/IN2	LC	Transmits/receives the west optical signals of the OTU1 regeneration.
VI1 to VI2	LC	Receive the signal to be attenuated.
VO1 to VO2	LC	Transmit the attenuated signal.

NOTE

- FE electrical ports can use only crossover cables.

NOTE

- The RX1/TX1-RX4/TX4 ports on the client side support the optical SFP module, single-fiber bidirectional GE SFP module, and electrical SFP module. The optical and electrical SFP modules can be used on the client side at the same time. The ports on the client side can receive Any optical signals, GE optical signals, or GE/FE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.10.6 Valid Slots

The LQM occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.10.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Display of Ports

Table 10-156 lists the sequence number displayed in an NMS system of the ports on the LQM board front panel.

Table 10-156 Display of the LQM ports

Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
TX1/RX1	3
TX2/RX2	4
TX3/RX3	5
TX4/RX4	6
VO1/VI1	7
VO2/VI2	8

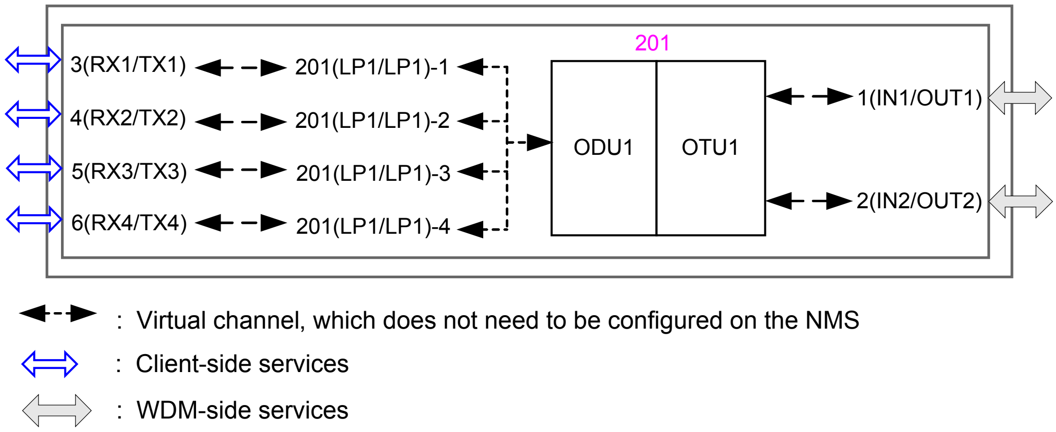
NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model of TNF1LQM

Figure 10-95 shows the port model of the TNF1LQM board.

Figure 10-95 Port model of the TNF1LQM board



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-6 (RX1/TX1 to RX4/TX4).
- Alarms and performance events related to OTN electrical-layer overheads are reported on channels 1 and 2 of logical port 201.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).
- Cross-connections are automatically generated and no configuration is required on the NMS.

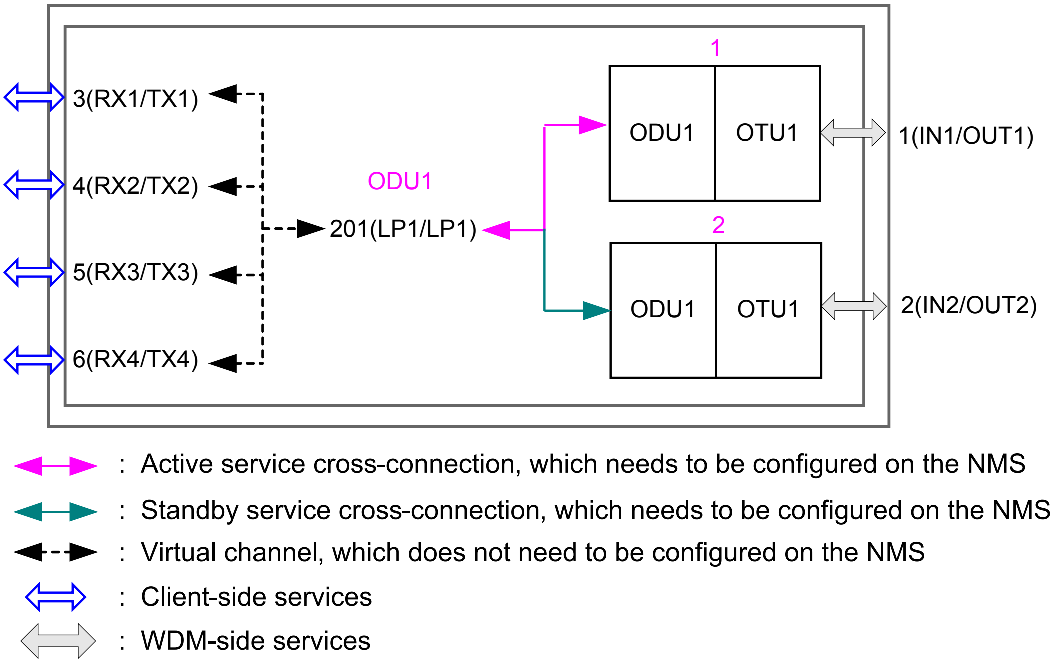
Port model of TNF2LQM

The TNF2LQM board can work in three different modes: 1 x AP4 ODU1 mode, 1 x AP2 ODU0 mode, 1 x AP2 regeneration mode.

- 1 x AP4 ODU1 mode

  Figure 10-96 shows the port model of the TNF2LQM board in 1 x AP4 ODU1 mode.

Figure 10-96 Port model of the TNF2LQM board (1 x AP4 ODU1 mode)

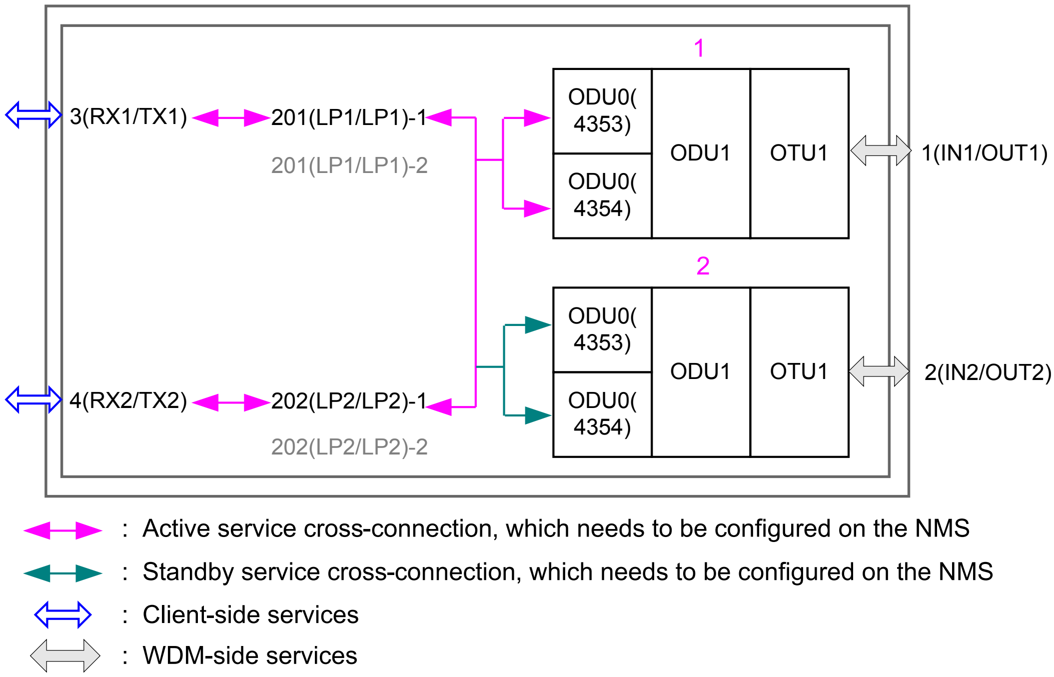


- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-6 (RX1/TX1 to RX4/TX4).
- Alarms, performance events, and configurations related to OTU1/ODU1 overheads are reported on channel 1 of optical ports 1 and 2.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).
- The 201 port supports ODU1 convergence mode and ODU1 non-convergence mode. It works in ODU1 convergence mode by default.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 1) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2. When ODUk SNCP (k = 1) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 1xAP2 ODU0 mode

  Figure 10-97 shows the port model of the TNF2LQM board in 1 x AP2 ODU0 mode.

Figure 10-97 Port model of the TNF2LQM board (1 x AP2 ODU0 mode)

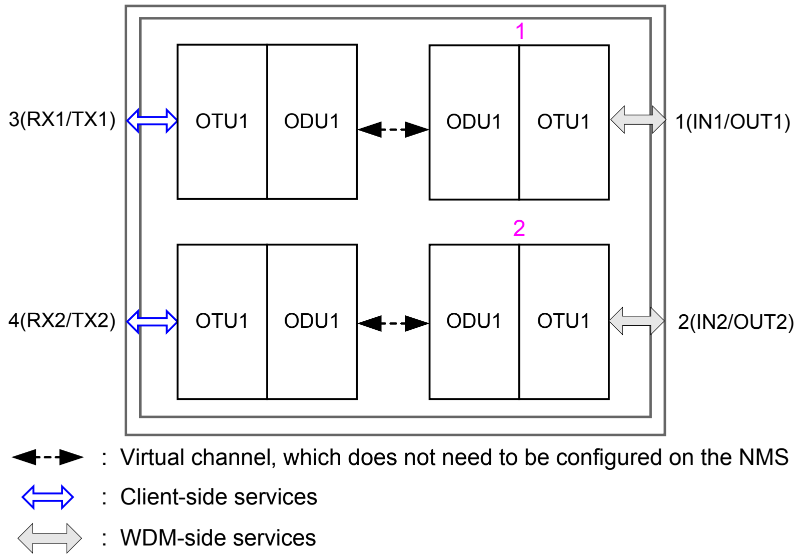


- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3 and 4 (RX1/TX1 and RX2/TX2).
- Alarms, performance events, and configurations related to ODU0 signal overheads are reported on channels 4353 and 4354 of WDM-side optical ports 1 and 2.
- Alarms, performance events, and configurations related to ODU1/OTU1 overheads are reported on channel 1 of optical ports 1 and 2.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).
- Cross-connections from optical ports 3 (RX1/TX1) and 4 (RX2/TX2) to channel 1 of ports 201 and 202 need to be configured. When the board is interconnected with a TN52TOM board for NG WDM products, you can configure the cross-connections from optical ports 3 (RX1/TX1) and 4 (RX2/TX2) to channel 2 of optical ports 201 and 202 to ensure channel ID consistency for the TN52TOM board.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 0) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to channel 4353 of optical port 1 and unidirectional cross-connections from port 201 to channel 4353 of optical port 2; bidirectional cross-connections from port 202 to channel 4354 of optical port 1 and unidirectional cross-connections from port 202 to channel 4354 of optical port 2. When ODUk SNCP (k = 0) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 1 x AP2 regeneration mode

  Figure 10-98 shows the port model of the TNF2LQM board in 1 x AP2 regeneration mode.

Figure 10-98 Port model of the TNF2LQM board (1 x AP2 regeneration mode)



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3 and 4 (RX1/TX1 and RX2/TX2).
- Alarms, performance events, and configurations related to client ODU1/OTU1 signal overheads are reported on channel 1 of optical ports 3 and 4 (RX1/TX1 and RX2/TX2).
- Alarms, performance events, and configurations related to ODU1/OTU1 overheads are reported on channel 1 of optical ports 1 and 2.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

10.10.8 Configuration of Cross-connection

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Service Package

The TNF1LQM board supports two types of service packages for the GE/STM-1 service, as shown in **Table 10-157**.

Table 10-157 Configuration for service packages of the TNF1LQM board

Service Package Mode	Port	Accessed Service	Configuration Method
GE service package	3(TX1/RX1)	GE	See Configuring Services in Service Package Mode.
	4(TX2/RX2)	GE	
	5(TX3/RX3)	Null	
	6(TX4/RX4)	Null	

Service Package Mode	Port	Accessed Service	Configuration Method
GE/SDH(STM-1) service package	3(TX1/RX1)	GE	
	4(TX2/RX2)	GE	
	5(TX3/RX3)	STM-1	
	6(TX4/RX4)	STM-1	

NOTE

Only TNF1LQM board supports service packages.

10.10.9 LQM Parameters on the NMS

Precautions

CAUTION

If you delete a logical LQM board and configure it again on the NMS, the original configuration of the board is deleted and the default configuration is restored.

Parameter Description

Field	Value	Description
Board Working Mode	1 x AP4 ODU1 mode, 1 x AP2 ODU0 mode, 1 x AP2 relay mode Default: 1 x AP4 ODU1 mode	• **1 x AP4 ODU1 mode**: Supports ODU1 service encapsulation . • **1 x AP2 ODU0 mode**: Supports ODU0 service encapsulation. • **1 x AP2 relay mode**: Supports regeneration of two OTU1 services. NOTE This parameter is only supported by the TNF2LQM.
Port Working Mode	ODU1 convergence mode (n*Any->ODU1), ODU1 non-convergence mode (OTU1/Any->ODU1) Default: ODU1 convergence mode (n*Any->ODU1)	• ODU1 convergence mode (n*Any->ODU1): client services are mapped into one ODU1 services. • ODU1 non-convergence mode (OTU1/Any->ODU1): client services are mapped into different ODU1 services. NOTE This parameter is only supported by the TNF2LQM.

Field	Value	Description
Cross-Connection Configuration Mode	• Automatic, Manual • Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**. **NOTE** This parameter is only supported by the TNF2LQM.
Service Type	TNF1LQM: • OTU-1, DVB-ASI, SDI, HDSDI, HDSDI14835, ESCON, FC-100, FC-100 (slice), FC-200, FC-200 (slice), FE, FICON, FICON express, FICON express (slice), FICON (slice), GE, GE(GFP-T), GE_SLICE, STM-1, STM-4, STM-16, None • Default: **OTU-1** (in the case of the TX1/RX1 port) or **None** (in the case of the other ports) TNF2LQM: • OTU-1, DVB-ASI, SDI, HDSDI, HDSDI14835, ESCON, FC-100, FC-200, FE, FICON, FICON express, GE(TTT-GMP), GE(GFP-T), CPRI2, CPRI3, STM-1, OC-3, STM-4, OC-12, STM-16, OC-48, None • Default: **OTU-1** (in the case of the TX1/RX1 port) or **None** (in the case of the other ports)	The **Service Type** parameter sets the type of the service accessed at the optical interface on the client side. **NOTE** For the TNF1LQM board, the encapsulation mode is GFP-F when **Service Type** is set to **GE**. The service type supported by the TNF2LQM board varies according to the value of Working Mode. For the TNF2LQM board, GE(TTT-GMP) is supported only when the board works in **1*AP2 ODU0 mode**. In case of GE services, select a proper service type according to the source of the GE services. • When a board is used to transmit synchronous Ethernet services, this parameter must be set to **GE (TTT-GMP)**. • When a board is used to transmit ordinary Ethernet services, this parameter must be set to **GE** or **GE (GFP_T)**. **CAUTION** • Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually received services. If no service type is configured on the client side, services cannot be connected normally.

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used. For example, when the TNF1LQM board is used for regenerating OTU1 signals, set **Channel Use Status** to **Unused** for the TX2/RX2, TX3/RX3, TX4/RX4, and IN2/OUT2 ports and to **Used** for the TX1/RX1 and IN1/OUT1 ports.
Automatic Laser Shutdown	TNF1LQM: ● Enabled, Disabled ● Default: **Disabled** in the case of TX1/RX1 ports, **Enabled** in the case of the other client-side optical ports. TNF2LQM: ● Enabled, Disabled ● Default: - 1*AP4 ODU1 mode: **Enabled** in the case of all the client-side optical ports. - 1*AP2 ODU0 mode: **Enabled** in the case of TX1/RX1 and TX2/RX2 ports, **Disabled** in the case of the other client-side optical ports. - 1*AP2 regeneration mode: The ALS function is disabled, that is, all lasers stay in enabled state.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.

Field	Value	Description
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

<table>
<tr><th>Field</th><th>Value</th><th>Description</th></tr>
<tr><td>Laser Status</td><td>ON, OFF
Default:
● WDM side: ON
● Client side: OFF</td><td>● Usually, this parameter is set to ON for every WDM-side optical port.
● In the case of client-side optical ports, retain the default value because Automatic Laser Shutdown is usually set to Enabled.
In practical application, set this parameter according to the scenario where the board is used. For example, when the TNF1LQM board is used for regenerating OTU1 signals, set Laser Status to ON for the TX1/RX1 and IN1/OUT1 port and to OFF for the TX2/RX2, TX3/RX3, TX4/RX4, and IN2/OUT2 optical ports.
CAUTION
If communication between NEs is achieved through only ESC provided by the LQM board, the following situations occur when neither a standby channel is available nor protection is configured:
● When the LQM board is used for converging four services at Any rate, the NE becomes unreachable after the WDM-side lasers on the LQM board are disabled.
● When the TNF1LQM board is used for regenerating OTU1 signals, the NE becomes unreachable after the lasers at the TX1/RX1 and IN1/OUT1 ports on the TNF1LQM board are disabled.</td></tr>
<tr><td>FEC Working State</td><td>Enabled, Disabled
Default: Enabled</td><td>● Enabled is recommended.
● FEC Working State of the two interconnected OTU boards must be consistent.</td></tr>
<tr><td>Optical Interface Attenuation Ratio (dB)</td><td>0 to 20
Default: 20</td><td>parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range.
NOTE
This parameter is only supported by the TNF2LQM.</td></tr>
<tr><td>Max. Attenuation Ratio (dB)</td><td>20
Default: 20</td><td>parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board.
NOTE
This parameter is only supported by the TNF2LQM.</td></tr>
<tr><td>Min. Attenuation Ratio (dB)</td><td>0
Default: 0</td><td>parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board.
NOTE
This parameter is only supported by the TNF2LQM.</td></tr>
</table>

Field	Value	Description
Guaranteed Bandwidth for Client-Side GE Service (M)	1-1000 Default: 1000	• Users determine the guaranteed bandwidth for GE services based on the needs. This parameter needs to be configured only for GE services. • The value of the **Guaranteed Bandwidth for Client-Side GE Service (M)** parameter must be greater than the actual service bandwidth of users. Only in this case, no packet loss can be ensured. • Retain the default value when timeslots are sufficient. • When timeslots are insufficient, decrease the committed information rate (CIR) of GE services to decrease the number of required timeslots. This is to ensure that the total number of timeslots is within the required range. For example, when the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports are used to receive GE services, the CIR can be set to 620 Mbit/s. In this case, each GE service uses four timeslots. Hence, the total number of timeslots required by the services received at the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports is not greater than 16. **NOTE** This parameter is only supported by the TNF1LQM.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Max. Packet Length	1518-9600 Default: 9600	• This parameter is valid only when **Service Type** is set to **GE** or **FE**. • The default value is recommended. **NOTE** This parameter is only supported by the TNF1LQM.

Field	Value	Description
SF Switching Trigger Condition	None, OTUK_BDI Default: None	Intra-board 1+1 protection switching is performed only at the affected end once a fault occurs if the parameter is set to **None**. Intra-board 1+1 protection switching is performed at both ends once an OTUK_BDI alarm is detected when the parameter is set to **OTUK_BDI**. **NOTE** This parameter is only supported by the TNF1LQM.
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group. **NOTE** This parameter is only supported by the TNF1LQM.
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled. **NOTE** This parameter is only supported by the TNF1LQM.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE** or **GE(GFP-T)**. ● The LPT function can work only with intra-board 1+1 protection or ODUk SNCP protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.

Field	Value	Description
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **NOTE** This parameter is only supported by the TNF2LQM. **CAUTION** The settings of **GCC Receive/Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

CAUTION

- If the LQM board is deleted on the U2000, configuration information will disappear and the board will restore to the default configuration after it is configured again on the U2000.

10.10.10 LQM Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LQM	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF2LQM	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2 EVOA	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-158 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-159 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-160 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-161 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	**1000BASE-BX-10km (SM1490)**
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-162 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	**1000BASE-BX-40km (SM1490)**
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-163 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-164 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-165 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Table 10-166 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Specifications for Client-Side Electrical Modules

Table 10-167 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100

Item	Unit	Value
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-168 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

NOTE

The GE electrical ports support 100/1000 Mbit/s self-adapting and 1000 Mbit/s.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight:
  - TNF1LQM: 0.6 kg (1.32 lb.)
  - TNF2LQM: 0.6 kg (1.32 lb.)

Power Consumption

Board	Typical Power Consumption at 25°C (77°F)	Maximum Power Consumption at 55°C (131°F)
TNF1LQM	17.4W	21.5W

Board	Typical Power Consumption at 25°C (77°F)	Maximum Power Consumption at 55°C (131°F)
TNF2LQM	11.7W	14.4W

10.11 LQM2

LQM2: Double 4 x Multi-rate Ports Wavelength Conversion Board

10.11.1 Version Description

The available hardware version for the LQM2 is TNF1 and TNF2.

Version

Table 10-169 describes the version mapping of the LQM2 board.

Table 10-169 Version description of the LQM2

Item	Description
Board hardware version	TNF1: The mapping version of the equipment is V100R001C01 or later. TNF2: The mapping version of the equipment is V100R003C01 or later.

Differences Between Versions

Table 10-170 lists differences between LQM2 board versions.

Table 10-170 Differences between LQM2 board versions

Item	TNF1LQM2	TNF2LQM2
Service type	Does not support CPRI option2, CPRI option3, OC-3, OC-12, OC-48.	Supports CPRI option2, CPRI option3, OC-3, OC-12, OC-48.
Regeneration function	Regenerates two channels of OTU1 signals.	Not supported
EVOA SFP module	Does not support EVOA ports.	Supports EVOA ports.
Synchronous Ethernet transparently transmitting	Does not support synchronous Ethernet services.	Supports synchronous Ethernet services.

Item	TNF1LQM2	TNF2LQM2
Protection schemes	Does not support ODUk SNCP protection. Supports SW SNCP protection.	Supports ODUk (k = 0, 1) SNCP protection. Does not support SW SNCP protection.
Mapping path	Supports ODU1-level mapping.	Supports ODU0-level and ODU1-level mapping.
Encapsulation mode	Supports encapsulation of GE services in GFP_F and GFP_T modes.	Supports encapsulation of GE services in GFP_T and GE (TTT-GMP) modes.

Substitution Relationship

Table 10-171 lists the substitution relationship for LQM2 boards.

Table 10-171 Substitution relationship for LQM2 boards

Original Board	Substitute Board	Substitution Rules
TNF1LQM2	TNF2LQM2	The TNF2LQM2 board can be created as TNF1LQM2 on the NMS to function as a TNF1LQM2 board. In this scenario, the TNF2LQM2 board only provides the functions of the TNF1LQM2 board. **NOTE** If the NE software version is V100R003C01 or later, the NE software does not need to be upgraded during the substitution. If the NE software version is earlier than V100R003C01, the NE software needs to be upgraded to V100R003C01 or a later version. **NOTE** OTU1 services cannot be received on the client side of the TNF2LQM2 board; therefore, the TNF2LQM2 board cannot replace the TNF1LQM2 board that works in regeneration mode. The TNF2LQM2 board does not support GE (GFP-F) services. When it is used to substitute for a TNF1LQM2 board provisioned with GE (GFP-F) services, change the service type to GE (GFP-T) after the substitution.
TNF2LQM2	None	-

10.11.2 Application

The LQM2 board can be mainly used in two different application scenarios: convergence of Any services and regeneration of OTU1 optical signals. Only the TNF1LQM2 board supports regeneration of OTU1 optical signals.

Service Access Description

Table 10-172 and **Table 10-173** describes the principle for configuring the ports on the LQM2 board.

Table 10-172 Principle for configuring the ports on the TNF1LQM2 board

Work Mode of the Board	Application Scenario of the Board	Available Ports	Service Access	Remarks
2LQM mode	Convergence of dual four signals at any rate	TX2/RX2 to TX4/RX4, TX6/RX6 to TX8/RX8	125 Mbit/s to 1.25 Gbit/s	● The overall bandwidth of the services received at 201(LP1/LP1)-1 to 201(LP1/LP1)-4 should not exceed 2.5 Gbit/s. ● The overall bandwidth of the services received at 202(LP2/LP2)-1 to 202(LP2/LP2)-4 should not exceed 2.5 Gbit/s. ● The client-side port group (TX1/RX1 to TX4/RX4) corresponds to the WDM-side port IN1/OUT1, and the client-side port group (TX5/RX5 to TX8/RX8) corresponds to the WDM-side port IN2/OUT2. Both the WDM-side port groups support the single feeding and single receiving function.
		TX1/RX1, TX5/RX5	125 Mbit/s to 2.5 Gbit/s	
	Regeneration of two channels of OTU1 optical signals	TX1/RX1, TX5/RX5	OTU1	
AP8 mode	Convergence of eight signals at any rate	TX2/RX2 to TX8/RX8	125 Mbit/s to 1.25 Gbit/s	● The overall bandwidth of the services received at 201(LP1/LP1)-1 to 201(LP1/LP1)-8 should not exceed 2.5 Gbit/s. ● WDM-side optical ports provide the
		TX1/RX1	125 Mbit/s to 2.5 Gbit/s	

Work Mode of the Board	Application Scenario of the Board	Available Ports	Service Access	Remarks
	Regeneration of one channel of OTU1 optical signals	OUT1/RX1 and TX1/IN1	OTU1	dual fed and selective receiving function.

Table 10-173 Port configuration rule for the TNF2LQM2 board

Working Mode of the Board	Application Scenario	Working Mode of the Port	Available Port	Service Access	Remarks
1 x AP8 ODU1 mode	Convergence of eight Any services and ODU1-level mapping	ODU1 convergence mode	TX1/RX1–TX8/RX8	125 Mbit/s–2.5 Gbit/s	• The overall bandwidth of the services received at 201 (LP1/LP1)-1 to 201(LP1/LP1)-8 should not exceed 2.5 Gbit/s. • WDM-side optical ports provide the dual fed and selective receiving function.
		ODU1 non-convergence mode	TX1/RX1	1.25 Gbit/s–2.5 Gbit/s	
2 x AP4 ODU1 mode	Convergence of two groups of four Any services and ODU1-level mapping	ODU1 convergence mode	TX1/RX1–TX8/RX8	125 Mbit/s–2.5 Gbit/s	• The overall bandwidth of the services received at 201 (LP1/LP1)-1 to 201(LP1/LP1)-4 should not exceed 2.5 Gbit/s. • The overall bandwidth of the services received at 202 (LP2/LP2)-1 to 202(LP2/LP2)-4 should not

Working Mode of the Board	Application Scenario	Working Mode of the Port	Available Port	Service Access	Remarks
		ODU1 non-convergence mode	TX1/RX1, TX5/RX5	1.25 Gbit/s–2.5 Gbit/s	exceed 2.5 Gbit/s.
2 x AP2 ODU0 mode	Convergence of two groups of two Any services and ODU0-level mapping	-	TX1/RX1, TX2/RX2, TX5/RX5, TX6/RX6	125 Mbit/s–1.25 Gbit/s	Both the two channels of WDM-side signals support dual fed and selective receiving.
2 x AP3 ODU1 mode	Convergence of two groups of three Any services and ODU1-level mapping	ODU1 convergence mode	TX1/RX1–TX6/RX6	125 Mbit/s–2.5 Gbit/s	• The overall bandwidth of the services received at 201 (LP1/LP1) should not exceed 2.5 Gbit/s. • The overall bandwidth of the services received at 202 (LP2/LP2) should not exceed 2.5 Gbit/s. • Both the two channels of WDM-side signals support dual fed and selective receiving.
		ODU1 non-convergence mode	TX1/RX1, TX5/RX5	1.25 Gbit/s–2.5 Gbit/s	

Application Scenario 1: Implements the Convergence of Any Services

The LQM2 board mainly used to converge a maximum of eight channels of Any (at a rate of 125 Mbit/s to 2.5 Gbit/s) signals to one channel or two channels of OTU1 signals and convert the converged OTU1 signals into signals borne on a standard DWDM wavelength compliant with ITU-T G.694.1 or signals borne on a standard CWDM wavelength compliant with ITU-T G. 694.2. At the same time, the board completes the reverse process.

Figure 10-99 Application 1: convergence of Any services implemented by the LQM2 board

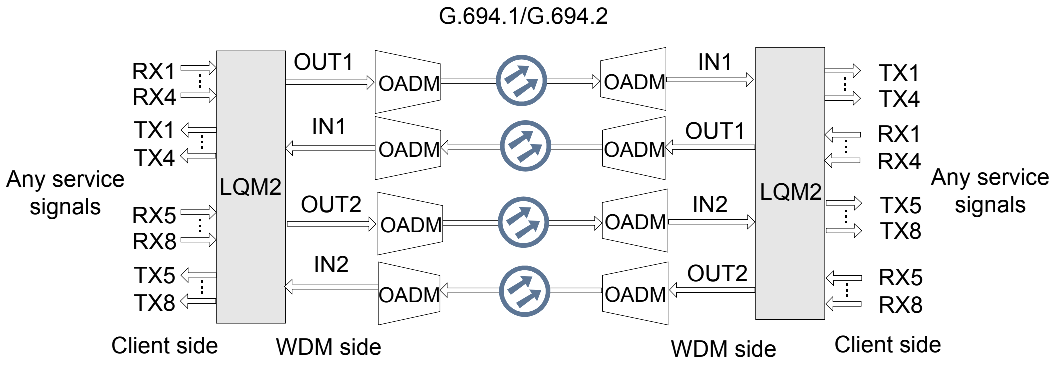


Figure 10-100 Application 2: convergence of Any services implemented by the LQM2 board

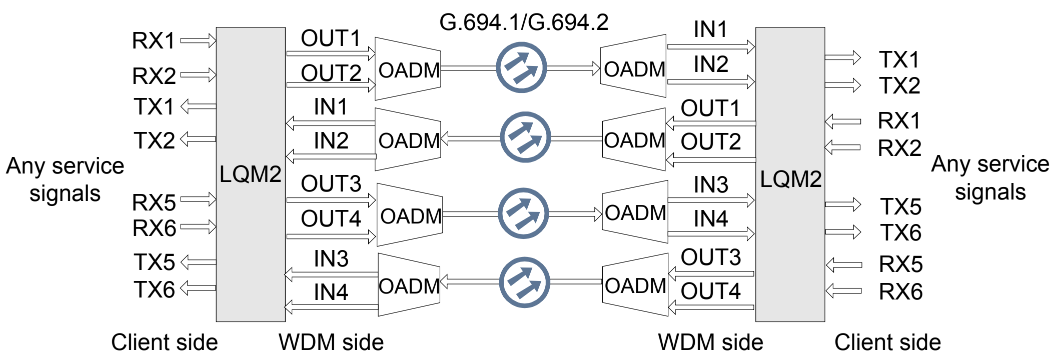
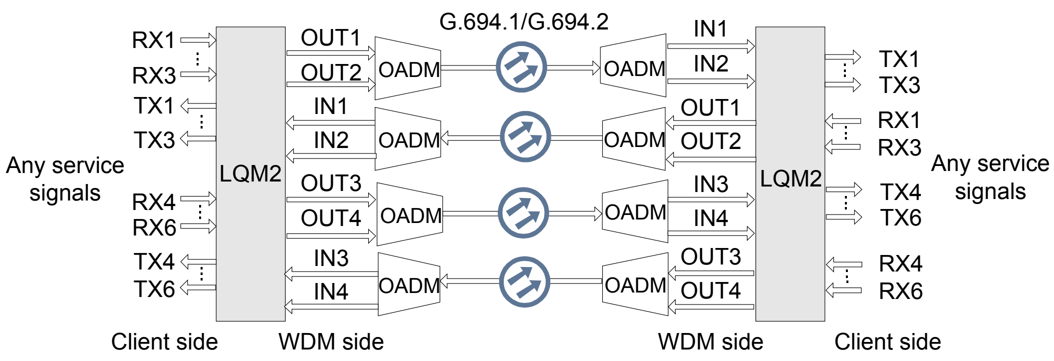


Figure 10-101 Application 3: convergence of Any services implemented by the LQM2 board



The TNF1LQM2 board can work in four different modes: AP8 mode, 2LQM mode.

- When the TNF1LQM2 board adopts AP8 mode, see **Figure 10-99**.
  - Converges eight channels of Any signals to a channel of OTU1 optical signals.
  - WDM-side optical ports provide the dual fed and selective receiving function.
- When the TNF1LQM2 board adopts 2LQM mode, see **Figure 10-99**.
  - Functions as two single fed and single receiving LQM boards and converges two groups of four Any services to two OTU1 services.
  - The client-side ports (TX1/RX1-TX4/RX4) work with the WDM-side port (IN1/OUT1), the client-side ports (TX5/RX5-TX8/RX8) work with the WDM-side port (IN2/OUT2). Both the two port groups support single fed and single receiving.

The TNF2LQM2 board can work in four different modes: 1 x AP8 ODU1 mode, 2 x AP4 ODU1 mode, 2 x AP2 ODU0 mode, 2 x AP3 ODU1 mode.

- When the TNF2LQM2 board adopts 1 x AP8 ODU1 mode, see **Figure 10-99**.
  - Converges eight channels of Any signals to a channel of OTU1 optical signals.
  - Supports ODU1-level mapping.
  - WDM-side optical ports provide the dual fed and selective receiving function.
- When the TNF2LQM2 board adopts 2 x AP4 ODU1 mode, see **Figure 10-99**.
  - Functions as two single fed and single receiving LQM boards and converges two groups of four Any services to two OTU1 services.
  - Supports ODU1-level mapping.
  - The client-side ports (TX1/RX1-TX4/RX4) work with the WDM-side port IN1/OUT1; the client-side ports (TX5/RX5-TX8/RX8) work with the WDM-side port (IN2/OUT2). Both the two port groups support single fed and single receiving.
- When the TNF2LQM2 board adopts 2 x AP2 ODU0 mode, see **Figure 10-100**.
  - Converges two groups of two Any services to two OTU1 services.
  - Supports ODU0-level mapping.
  - In this scenario, client-side services can only be transmitted through ports TX1/RX1, TX2/RX2, TX5/RX5, TX6/RX6.
  - The client-side ports (TX1/RX1-TX2/RX2) work with the WDM-side ports (IN1/OUT1 and IN2/OUT2); the client-side ports (TX5/RX5-TX6/RX6) work with the WDM-side ports (IN3/OUT3 and IN4/OUT4). Both the two port groups support dual fed and selective receiving.
- When the TNF2LQM2 board adopts 2 x AP3 ODU1 mode, see **Figure 10-101**.
  - Converges two groups of three Any services to two OTU1 services.
  - Supports ODU1-level mapping.
  - In this scenario, client-side services can only be transmitted through ports TX1/RX1-TX6/RX6.
  - The client-side ports (TX1/RX1-TX3/RX3) work with the WDM-side ports (IN1/OUT1 and IN2/OUT2), the client-side ports (TX4/RX4-TX6/RX6) work with the WDM-side ports (IN3/OUT3 and IN4/OUT4). Both the two port groups support dual fed and selective receiving.

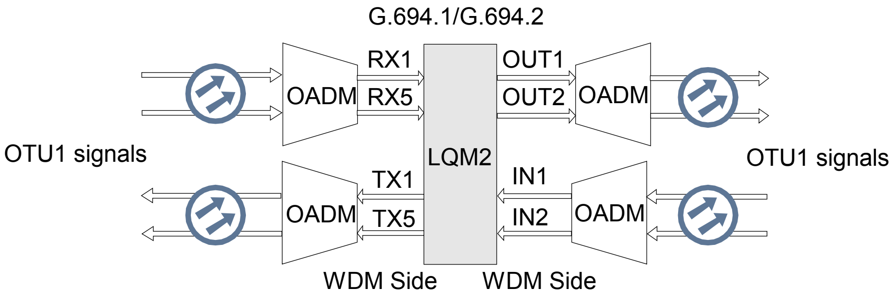
Application Scenario 2: Implements the Regeneration of OTU1 Optical Signals

Only the TNF1LQM2 board can implement the regeneration of OTU1 optical signals.

- When the TNF1LQM2 board adopts 2LQM mode, it can implement the regeneration of two OTU1 optical signals.
- When the TNF1LQM2 board adopts AP8 mode, it can implement the regeneration of one OTU1 optical signal. In this case, only the TX1/RX1 port is available among other client-side optical ports. WDM-side optical ports provide the dual fed and selective receiving function.

The application where the TNF1LQM2 board implements the regeneration of OTU1 optical signals is shown in **Figure 10-102**.

Figure 10-102 TNF1LQM2 as a regeneration board of OTU1 optical signals



CAUTION

- When the LQM2 board is used as a regeneration board of two OTU1 optical signals, only OTU1 services can be received at the RX1/TX1 and RX5/TX5 ports, otherwise, the ESC communication on the client side will be interrupted.
- When FE services are received on the client side, the TNF1LQM2 board cannot be interconnected with the TNF2LQM2 board.

Background Information

The LQM2 board has two service processing chips, each of which provides 16 timeslots for receiving services. Different types of services require different number of timeslots. The total number of timeslots for the services received at the LQM2 board must be smaller than the maximum number of timeslots that the service processing chip can provide.

- When the TNF1LQM2 works in AP8 mode, or the TNF2LQM2 works in 1 x AP8 ODU1 mode, the total number of timeslots for the services configured at all client-side ports must be not greater than 16.
- When the TNF1LQM2 works in 2LQM mode, or the TNF2LQM2 works in 2 x AP4 ODU1 mode or 2 x AP3 ODU1 mode, the total number of timeslots for the services configured at the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports must be not greater than 16 and

the total number of timeslots for the services configured at the TX5/RX5, TX6/RX6, TX7/RX7, and TX8/RX8 ports must be not greater than 16.

Table 10-174 lists the number of timeslots required by common services.

Table 10-174 Number of timeslots required by common services

Service Type	Number of Timeslots Required	Service Type	Number of Timeslots Required
GE/GE(GFP_T)/GE (TTT-GMP)	7	FICON	6
STM-1	1	FICON EXPRESS	12
STM-4	4	ESCON	2
STM-16	16	DVB-ASI	2
FC200	12	SDI	3
FC100	6	HDSDI	12
FE	1	HDSDI14835	12
FC100_SLICE	8	OTU1	16
FC200_SLICE	16	FICON_SLICE	8
FICON_EXPRESS_SLICE	16	GE_SLICE	12

In case of GE services, the committed information rate can be configured to change the number of timeslots required. **Table 10-175** lists the number of timeslots required by GE services at different bandwidths.

Table 10-175 Number of timeslots required by GE services

Bandwidth (Mbit/s)	Number of Timeslots Required	Bandwidth (Mbit/s)	Number of Timeslots Required
931-1000	7	311-465	3
776-930	6	156-310	2
621-775	5	1-155	1
466-620	4	-	-

The TNF1LQM2 board supports slice services, such as GE_SLICE, FC100_SLICE, FC200_SLICE, FICON_SLICE, and FICON_EXPRESS_SLICE. Compared with common services, slice services feature better performance in transparent transmission of clock but require more timeslots. In practical application, select a proper service type according to the actual conditions. For example, when the LQM2 board is used to receive FC100 services, select FC100_SLICE if better performance in transparent transmission of clock is required and timeslots are sufficient. Otherwise, select FC100 so that more timeslots can be used to receive other types of services.

10.11.3 Functions and Features

The LQM2 board supports the following functions and features: wavelength conversion, service convergence, ALS, and the regeneration of the OTU1 optical signals.

For detailed functions and features, see **Table 10-176**.

Table 10-176 Functions and features of the LQM2 board

<table>
<tr><th>Function and Feature</th><th>Description</th></tr>
<tr><td>Basic Function</td><td>The TNF1LQM2 board supports the following working modes:
In AP8 mode:
8 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 1 x OTU1
The TNF1LQM2 board implements bidirectional regeneration of one channel of OTU1 optical signals.
The WDM-side ports on the board support the dual feeding and selective receiving function.
In 2LQM mode:
Dual 4 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 2 x OTU1
The board implements bidirectional regeneration of two channels of OTU1 optical signals.
The TNF2LQM2 board supports the following working modes:
In 1 x AP8 ODU1 mode:
8 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 1 x OTU1
The WDM-side ports on the board support the dual feeding and selective receiving function.
Supports ODU1-level mapping.
In 2 x AP4 ODU1 mode:
Dual 4 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 2 x OTU1
Supports ODU1-level mapping.
In 2 x AP2 ODU0 mode:
Dual 2 x Any (125 Mbit/s – 1.25 Gbit/s) <-> 2 x OTU1
The WDM-side ports on the TNF2LQM2 board support the dual feeding and selective receiving function.
Supports ODU0-level mapping.
In 2 x AP3 ODU1 mode:
Dual 3 x Any (125 Mbit/s – 2.5 Gbit/s) <-> 2 x OTU1
The WDM-side ports on the TNF2LQM2 board support the dual feeding and selective receiving function.
Supports ODU1-level mapping.</td></tr>
</table>

Function and Feature	Description
Service type	● Convergence services: – STM-1: SDH services, the rate is 155.52 Mbit/s. – STM-4: SDH services, the rate is 622.08 Mbit/s. – STM-16: SDH services, the rate is 2.488 Gbit/s. – OC-3: SONET services, the rate is 155.52 Mbit/s. (Only TNF2LQM2 supports) – OC-12: SONET services, the rate is 622.08 Mbit/s. (Only TNF2LQM2 supports) – OC-48: SONET services, the rate is 2.488 Gbit/s. (Only TNF2LQM2 supports) – FE: Fast Ethernet services, the rate is 125 Mbit/s. Supports FE optical signals and FE electrical signals. – GE: Gigabit Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. – ESCON: Enterprise system connection services, the rate is 200 Mbit/s. – FC100: Fiber channel services, the rate is 1.06 Gbit/s. – FC200: Fiber channel services, the rate is 2.12 Gbit/s. – FICON: Fiber channel services, the rate is 1.06 Gbit/s. – FICON EXPRESS: Fiber channel services, the rate is 2.12 Gbit/s. – DVB-ASI (Digital Video Broadcasting -Asynchronous Serial Interface): Digital TV services with the rate being 270 Mbit/s. – SDI (Digital Video Broadcasting - Serial Digital Interface): Digital TV services with the rate being 270 Mbit/s. – HD-SDI: High-definition digital TV services, the rate is 1.485 Gbit/s. – CPRI option2: The rate is 1.2288 Gbit/s. (Only TNF2LQM2 supports) – CPRI option3: The rate is 2.4576 Gbit/s. (Only TNF2LQM2 supports) ● Regeneration services: – OTU1: OTN services, the rate is 2.67 Gbit/s. (Only TNF1LQM2 supports) **NOTE** FC100, FC200, FICON, and FICON EXPRESS services that the TNF1LQM2 accessed can be configured as cut service. The "SDI" is also called the "SD-SDI" according to SMPTE 259M standard.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.

Function and Feature	Description
Ethernet service mapping mode	TNF1LQM2: ● Supports encapsulation of GE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) and GFP_T (ITU-T G.7041) modes. ● Supports encapsulation of FE services in GFP_F (ITU-T G.7041) (displayed as GE on the NMS) mode. TNF2LQM2: ● Supports encapsulation of GE services in GFP_T (ITU-T G.7041) and TTT-GMP (ITU-T G.709) (displayed as GE(TTT-AGMP) on the NMS) modes. ● Supports encapsulation of FE services in GFP_T (ITU-T G.7041) modes.
Alarms and performance events monitoring	Monitors B1, SM_BIP8, PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. LQM2 monitors the RMON performance of GE/FE services.
OTN function	● Provides the OTU1 interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM functions for ODU1 and ODU0. ● Supports SM functions for OTU1. **NOTE** When the TNF1LQM2 board is used as a regeneration board, it does not support the PM overhead configuration.
Variable optical attenuator	The TNF2LQM2 board can adjust the optical power of the WDM-side signals using the SFP EVOA module housed at the VO/VI port. The allowable attenuation range is from 0 dB to 20 dB.
Intelligent Fiber (IF) function	The TNF1LQM2 board can automatically insert maintenance code streams to the client-side optical ports on the downstream board in the case of an input fault on the client or WDM side of the upstream board. Then the fault information can transfer to the client side of the downstream board. TNF2LQM2: Not supported.
Regeneration board	The WDM-side signals of the LQM2 board can be regenerated by the LWX2, LQM, or TNF1LQM2 board.
Synchronous Ethernet services	The TNF2LQM2 board supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.

Function and Feature	Description
Protection schemes	TNF1LQM2: ● Supports intra-board 1+1 protection ● Supports client 1+1 protection ● Supports SW SNCP protection TNF2LQM2: ● Supports intra-board 1+1 protection ● Supports client 1+1 protection ● Supports ODUk (k = 0, 1) SNCP protection. **NOTE** ● In the case that the TNF1LQM2 board is used in 2LQM mode, if it is configured with intra-board 1+1 protection, the OLP board must be used to achieve the protection. ● Only the RX1/TX1, RX2/TX2, RX5/TX5, and RX6/TX6 ports on the LQM2 board support the SW SNCP protection.
Loopback	● Supports WDM side inloop ● Supports WDM side outloop ● Supports client side inloop ● Supports client side outloop
ALS function	Supports the ALS function on the client side. **CAUTION** ● When the client side receives OTU1 services, the ALS function is disabled. That is, the laser stays in enabling state.
ESC function	Supported

<table>
<tr><th>Function and Feature</th><th>Description</th></tr>
<tr><td>Cross-connect function</td><td>TNF1LQM2:
Intra-board cross-connect:
Achieves the cross-connect function of optical services with rate lower than 1.25 Gbit/s.
Inter-board cross-connect:
Achieves the cross-connect function of optical services with rate lower than 1.25 Gbit/s.
TNF2LQM2:
Intra-board cross-connect:
When the board works in 1*AP8 ODU1 mode or 2*AP4 ODU1 mode, it achieves the cross-connect function of optical services with rate lower than 1.25 Gbit/s.
Inter-board cross-connect:
When the board works in 1*AP8 ODU1 mode or 2*AP4 ODU1 mode, it achieves the cross-connect function of optical services with rate lower than 1.25 Gbit/s.
CAUTION
The LQM2 board can receive GE and FE electrical services on the client side. These electrical services cannot be cross-connected. They can be configured only as pass-through services.</td></tr>
<tr><td>LPT function</td><td>The board supports the LPT function only when the client-side service type is GE or FE services.</td></tr>
<tr><td>PRBS test</td><td>Supports the PRBS function on the client side.
NOTE
The PRBS function on the client side is supported only when the client-side service type is GE/STM-1/OC-3/STM-4/OC-12/STM-16/OC-48/OTU1.</td></tr>
<tr><td>Ethernet port working mode</td><td>TNF1LQM2:
GE optical port: 1000M full-duplex or auto-negotiation
GE electrical port: auto-negotiation
FE optical port: 100M full-duplex
FE electrical port: 100M full-duplex
TNF2LQM2:
GE optical port: 1000M full-duplex
GE electrical port: 1000M full-duplex
FE optical port: 100M full-duplex
FE electrical port: 100M full-duplex</td></tr>
<tr><td>WDM specifications</td><td>Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.</td></tr>
</table>

Function and Feature	Description	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	IEEE 802.3u IEEE 802.3z ITU-T G.707 ITU-T G.782 ITU-T G.783 NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI) NCITS FIBRE CHANNEL LINK SERVICES (FC-LS) NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2) NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3) NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3) NCITS FIBRE CHANNEL - PHYSICAL AND SIGNALING INTERFACE (FC-PH) NCITS FIBRE CHANNEL SINGLE-BYTE COMMAND CODE SETS-2 MAPPING PROTOCOL (FC-SB-2) SMPTE 292M Bit-Serial Digital Interface for High-Definition Television Systems ETSI TR 101 891 Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI) SMPTE 259M 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals - Serial Digital Interface NCITS SBCON Single-Byte Command Code Sets CONnection architecture (SBCON) CPRI Specification V4.1 **NOTE** Only the TNF2LQM2 board supports CPRI Specification V4.1.

Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2 **NOTE** Only the TNF2LQM2 board supports ITU-T G.873.1.

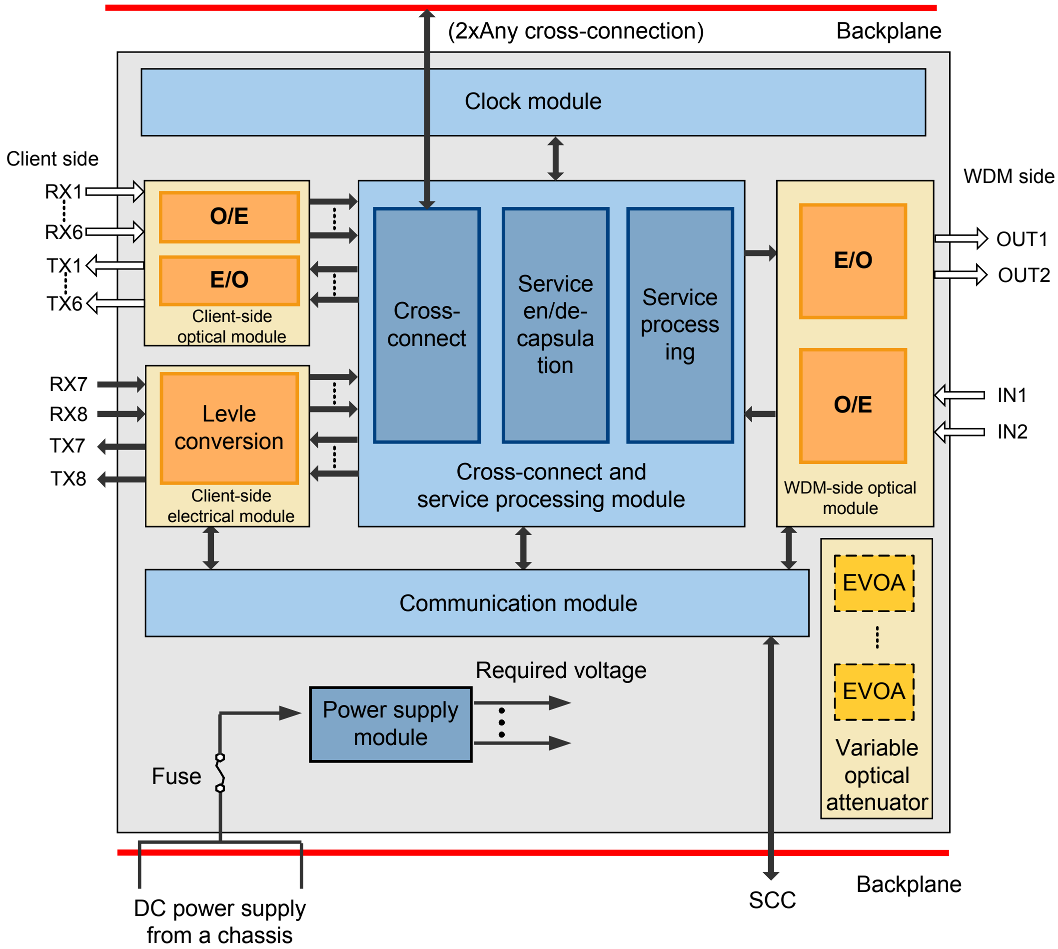
10.11.4 Working Principle and Signal Flow

The LQM2 board consists of the client-side optical module or the client-side electrical module, the WDM-side optical module, the cross-connect and service processing module, the clock module, the variable optical attenuator, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Signal Flow of LQM2 (Convergence of Any Services)

Figure 10-103 is the functional block diagram of the LQM2 board that implements the convergence of eight channels of signals at any rate. The diagram shows that the optical SFP module is used in the RX1/TX1-RX6/TX6 ports and the electrical SFP module is used in the RX7/TX7-RX8/TX8 ports.

Figure 10-103 Functional block diagram of the LQM2 board (convergence of Any services)



NOTE

The variable optical attenuators are only supported by the TNF2LQM2.

In the signal flow of the LQM2 board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LQM2 to the WDM side of the LQM2, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives optical signals from client equipment through the RX1-RX8 ports, and performs O/E conversion.
  - The client-side electrical module receives electrical signals from client equipment through the RX1-RX8 ports, and performs level conversion.

  After conversion, the eight channels of electrical signals are sent to the service en/de-capsulation and processing module. The module performs processes such as multiplexing, clock generating and frame processing. Then, the module outputs one or two channels of OTU1 signals.

  The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the OTU1 optical signals at DWDM or CWDM standard wavelengths. The optical signals are output through the OUT1 and OUT2 optical ports.

- Receive direction

  The WDM-side optical module receives the OTU1 optical signals at DWDM or CWDM standard wavelengths from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

  After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as decapsulation, clock recovery and demultiplexing. Then, the module outputs eight channels of electrical signals at any rate.

  The client-side optical module performs E/O conversion and the client-side electrical module performs level conversion of the eight channels of electrical signals, and then outputs eight channels of client-side optical signals and electrical signals through the TX1 - TX8 ports.

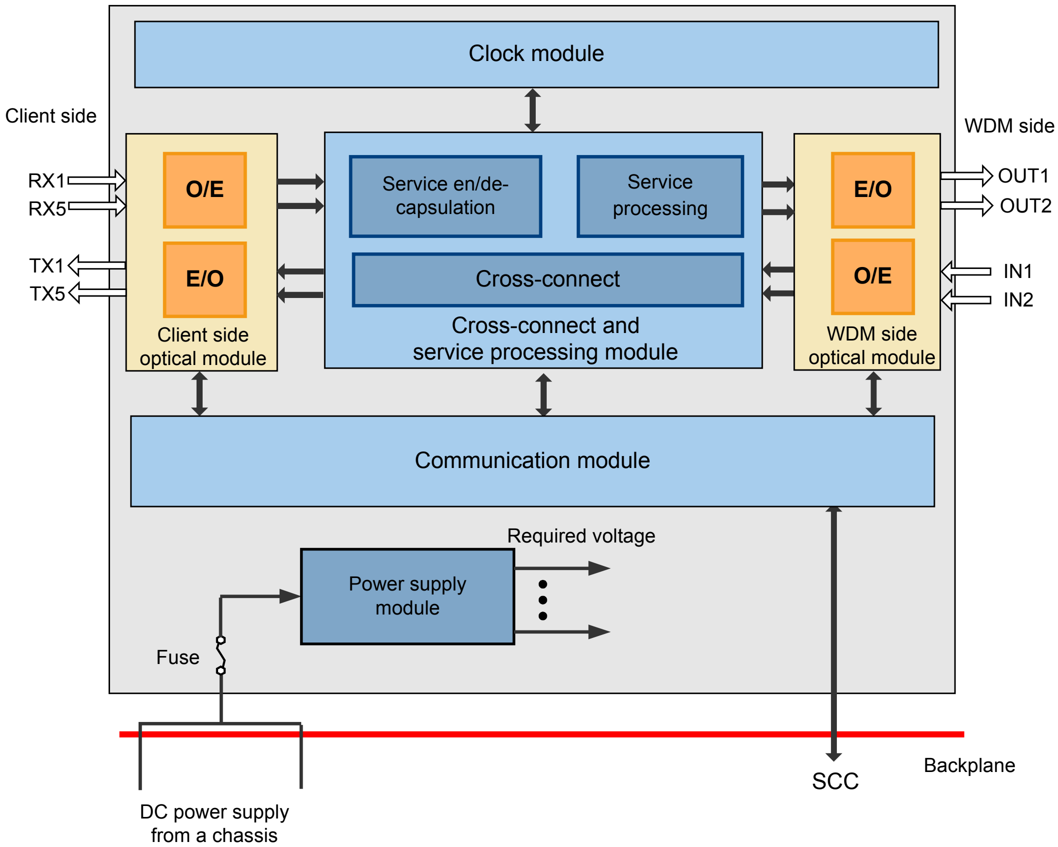
NOTE

When the TNF2LQM board works in 2 x AP2 ODU0 mode, ports TX1/RX1–TX2/RX2 and TX5/RX5–TX6/RX6 can be used to receive client-side services. When the TNF2LQM board works in 2 x AP3 ODU1 mode, ports TX1/RX1–TX6/RX6 can be used to receive client-side services.

Signal Flow of LQM2 (Regeneration of OTU1 Services)

Figure 10-104 is the functional block diagram of the LQM2 board that implements the regeneration of two channels of OTU1 optical signals.

Figure 10-104 Functional block diagram of the LQM2 board (regeneration of OTU1 services)



In the signal flow of the LQM2 board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LQM2 to the WDM side of the LQM2, and the receive direction is defined as the reverse direction.

- Transmit direction

  The client-side optical module receives two channels of OTU1 optical signals from client equipment through the RX1 and RX5 ports, and performs O/E conversion.

  After O/E conversion, the electrical signals are sent to the service en/de-capsulation and processing module. The module performs processes such as overhead processing, reshaping, regenerating and retiming. Then, the module outputs two channels of OTU1 signals.

  The OTU1 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the OTU1 optical signals at DWDM or CWDM standard wavelengths. The optical signals are output through the OUT1 and OUT2 optical ports.

- Receive direction

  The WDM-side optical module receives the OTU1 optical signals at DWDM or CWDM standard wavelengths from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

  After O/E conversion, the signals are sent to the service en/de-capsulation and processing module. The module performs processes such as overhead processing, reshaping, regenerating and retiming. Then, the module outputs two channels of electrical signals.

  The client-side optical module performs E/O conversion of the signals, and then outputs two channels of optical signals through the TX1 and TX5 ports.

NOTE

Only the TNF1LQM2 board supports regeneration of OTU1 services.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- Client-side electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives GE or FE electrical signals from client side devices, and performs the level conversion of the GE or FE electrical signals to internal electrical signals.
  - Client-side transmitter: Performs the level conversion of internal electrical signals to GE or FE electrical signals, and transmits the GE or FE electrical signals to client side devices.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of optical signals at 2.67 Gbit/s.

  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to optical signals at 2.67 Gbit/s.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Cross-connect and service processing module

  The module consists of the service en/de-capsulation module and the service processing module. It implements the en/de-capsulation of signals in any format and service convergence.

  - Service en/de-capsulation module: Processes the overheads of signals in any format, and reports the performance monitoring state of service signals.
  - Service processing module: Achieves the multiplexing from signals in any format to signals in OTU1 format and the demultiplexing from signals in OTU1 format to signals in any format, and performs processes such as encapsulation/decapsulation of FEC, encoding/decoding and scrambling/descrambling.
  - Cross-connect module: Cross-connects the client-side accessed signals with each other and passes them through, or cross-connects the client-side accessed signals with the service signals from the backplane.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Variable optical attenuator (can be selected)
  - Adjust the transmission optical power or receive optical power.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

10.11.5 Front Panel

There are indicators and ports on the LQM2 front panel.

Appearance of the Front Panel

Figure 10-105 and **Figure 10-106** show the front panel of the LQM2. It shows the situation that the ports are inserted with optical SFP modules.

Figure 10-105 Front panel of the TNF1LQM2

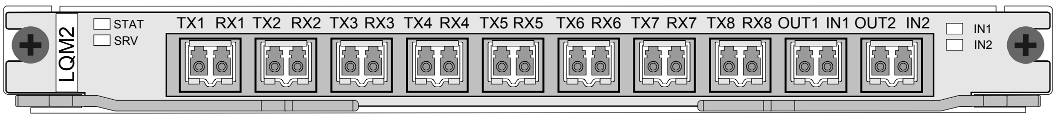
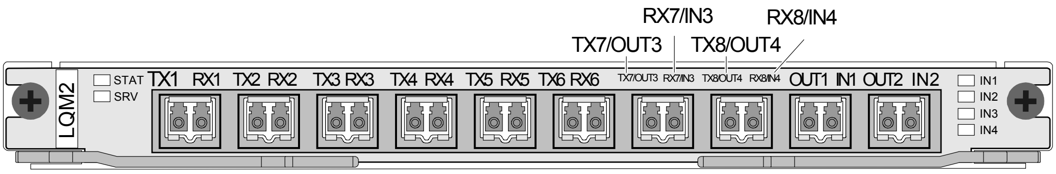


Figure 10-106 Front panel of the TNF2LQM2



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

- When the TNF1LQM2 board implements the convergence of signals at any rate, **Table 10-177** lists the type and function of each port.

Table 10-177 Types and functions of the TNF1LQM2 ports (convergence of eight channels of signals at any rate)

Port	Port Type	Function	Remarks
IN1/OUT1 to IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals.	When the LQM2 board adopts 2LQM mode: ● The client-side ports TX1/RX1-TX4/RX4 work with the WDM-side port IN1/OUT1. ● The client-side ports TX5/RX5-TX8/RX8 work with the WDM-side port IN2/OUT2. ● Both the two port groups support single fed and single receiving. When the LQM2 board adopts AP8 mode: ● WDM-side optical ports provide the dual fed and selective receiving function. ● The signals received and transmitted through the IN1/OUT1 port are active signals, while the signals received and transmitted through the IN2/OUT2 port are standby signals.
TX1/RX1 to TX8/RX8	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives service signals to client-side equipment.	

- When the TNF1LQM2 board implements the regeneration of two channels of OTU1 optical signals, **Table 10-178** lists the type and function of each port.

Table 10-178 Types and functions of the TNF1LQM2 ports (regeneration of two channels of OTU1 optical signals)

Port	Port Type	Function	Remarks
OUT1/RX1, OUT2/RX5	LC	Transmits/receives the east optical signals of the OTU1 regeneration.	When the LQM2 board adopts 2LQM mode: ● Implement the regeneration of two channels of OTU1 optical signals. ● Both the two port groups support single fed and single receiving. When the LQM2 board adopts AP8 mode: ● Implement the regeneration of one channel of OTU1 optical signals. ● For client-side optical ports, only port TX1/RX1 is available. ● WDM-side optical ports provide the dual fed and selective receiving function. ● The signals received and transmitted through the IN1/OUT1 port are active signals, while the signals received and transmitted through the IN2/OUT2 port are standby signals.
TX1/IN1, TX5/IN2	LC	Transmits/receives the west optical signals of the OTU1 regeneration.	

RX1/TX1 to TX6/RX6 are client-side ports, while IN1/OUT1 and IN2/OUT2 are WDM-side ports. TX7/OUT3/RX7/IN3 and TX8/OUT4/RX8/IN4 can work as client-side ports or WDM-side ports based on the working mode of the board.

- When the TNF2LQM2 board adopts 1 x AP8 ODU1 mode:

Table 10-179 Types and functions of the TNF2LQM2 ports (1 x AP8 ODU1 mode)

Port	Port Type	Function	Remarks
TX1/RX1 to TX8/RX8	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the first group service signals from client-side equipment.	● TX7/OUT3/RX7/IN3 and TX8/OUT4/RX8/IN4 work as the client-side ports TX7/RX7 and TX8/RX8. ● WDM-side optical ports provide the dual fed and

Port	Port Type	Function	Remarks
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.	selective receiving function.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the standby channel.	

- When the TNF2LQM2 board adopts 2 x AP4 ODU1 mode:

Table 10-180 Types and functions of the TNF2LQM2 ports (2 x AP4 ODU1 mode)

Port	Port Type	Function	Remarks
TX1/RX1 to TX8/RX8	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the first group service signals from client-side equipment.	• TX7/OUT3/RX7/IN3 and TX8/OUT4/RX8/IN4 work as the client-side ports TX7/RX7 and TX8/RX8. • The client-side ports TX1/RX1-TX4/RX4 work with the WDM-side port IN1/OUT1. • The client-side ports TX5/RX5-TX8/RX8 work with the WDM-side port IN2/OUT2. • Both the two port groups support single fed and single receiving.
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the first group WDM signals.	
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the second group WDM signals.	

- When the TNF2LQM2 board adopts 2 x AP2 ODU0 mode:

Table 10-181 Types and functions of the TNF2LQM2 ports (2 x AP2 ODU0 mode)

Port	Port Type	Function	Remarks
TX1/RX1, TX2/RX2, TX5/RX5, TX6/RX6	LC	Transmits/receives the first group service signals from client-side equipment.	• TX7/OUT3/RX7/IN3 and TX8/OUT4/RX8/IN4 work as the WDM-side IN3/OUT3 and IN4/OUT4 ports. • The client-side ports TX1/RX1-TX2/RX2 work with the WDM-side ports IN1/OUT1 and IN2/OUT2. • The client-side ports TX5/RX5-TX6/RX6 work with the WDM-side ports IN3/OUT3 and IN4/OUT4. • Both the two port groups support dual fed and selective receiving.
IN1/OUT1, IN2/OUT2	LC	Connected to the OADM board to receive/transmit the first group WDM signals coming from the active channel and standby channel.	
IN3/OUT3, IN4/OUT4	LC	Connected to the OADM board to receive/transmit the second group WDM signals coming from the active channel and standby channel.	

- When the TNF2LQM2 board adopts 2 x AP3 ODU1 mode:

Table 10-182 Types and functions of the TNF2LQM2 ports (2 x AP3 ODU1 mode)

Port	Port Type	Function	Remarks
TX1/RX1 to TX6/RX6	LC	Transmits/receives the first group service signals from client-side equipment.	• TX7/OUT3/RX7/IN3 and TX8/OUT4/RX8/IN4 work as the WDM-side IN3/OUT3 and IN4/OUT4 ports. • The client-side ports TX1/RX1-TX3/RX3 work with the WDM-side ports IN1/OUT1 and IN2/OUT2. • The client-side ports TX4/RX4-TX6/RX6 work with the WDM-side ports IN3/OUT3 and IN4/OUT4. • Both the two port groups support dual fed and selective receiving.
IN1/OUT1, IN2/OUT2	LC	Connected to the OADM board to receive/transmit the first group WDM signals coming from the active channel and standby channel.	

Port	Port Type	Function	Remarks
IN3/OUT3, IN4/OUT4	LC	Connected to the OADM board to receive/transmit the second group WDM signals coming from the active channel and standby channel.	

CAUTION

- FE electrical ports can use only crossover cables.

NOTE

- The RX1/TX1-RX8/TX8 ports on the client side support the optical SFP module, single-fiber bidirectional GE SFP module, and electrical SFP module. The preceding SFP modules can be used on the client side at the same time. The ports on the client side can receive Any optical signals, GE optical signals, or GE/FE electrical signals through the replacement of the SFP modules.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.11.6 Valid Slots

The LQM2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT 1, SLOT 3, and SLOT 4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT 1 to SLOT 6.

To ensure board performance, it is recommended that the F2LQM2 board be inserted into SLOT1, SLOT3 or SLOT5.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

Slots for Cross-Connect Boards

The LQM2 board supports intra-board and inter-board cross-connection of the services with rate lower than 1.25 Gbit/s and supports the cross-connection of a maximum of two services between paired slots.

- In the OptiX OSN 1800 I chassis,
  - SLOT3 and SLOT4 are paired slots that support the cross-connection of a maximum of two services.
  - In addition to the cross-connection between paired slots, the cross-connection of one service is also supported between SLOT3 and SLOT1, and between SLOT4 and SLOT1.
- In the OptiX OSN 1800 II chassis,
  - SLOT1 and SLOT2 are paired slots, SLOT3 and SLOT5 are paired slots, and SLOT4 and SLOT6 are paired slots. Each pair of slots supports the cross-connection of a maximum of two services.
  - In addition to the cross-connection between paired slots, the cross-connection of one service is also supported between SLOT3 and SLOT4, between SLOT3 and SLOT6, between SLOT4 and LOT5, and between SLOT5 and SLOT6.

NOTE

For F2LQM2:

A DC-powered OptiX OSN 1800 II chassis can accommodate at most five F2LQM2 boards when it is equipped with ODUk SNCP protection. It can accommodate up to six F2LQM2 boards when it is unequipped with ODUk SNCP protection.

An AC-powered OptiX OSN 1800 II chassis can accommodate at most three F2LQM2 boards.

10.11.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Display of Ports

Table 10-183 lists the sequence number displayed on the U2000 of the port on the LQM2 board front panel.

Table 10-183 Display of the LQM2 ports

Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
TX1/RX1	3
TX2/RX2	4
TX3/RX3	5
TX4/RX4	6
TX5/RX5	7
TX6/RX6	8
TX7/RX7	9
TX8/RX8	10

NOTE

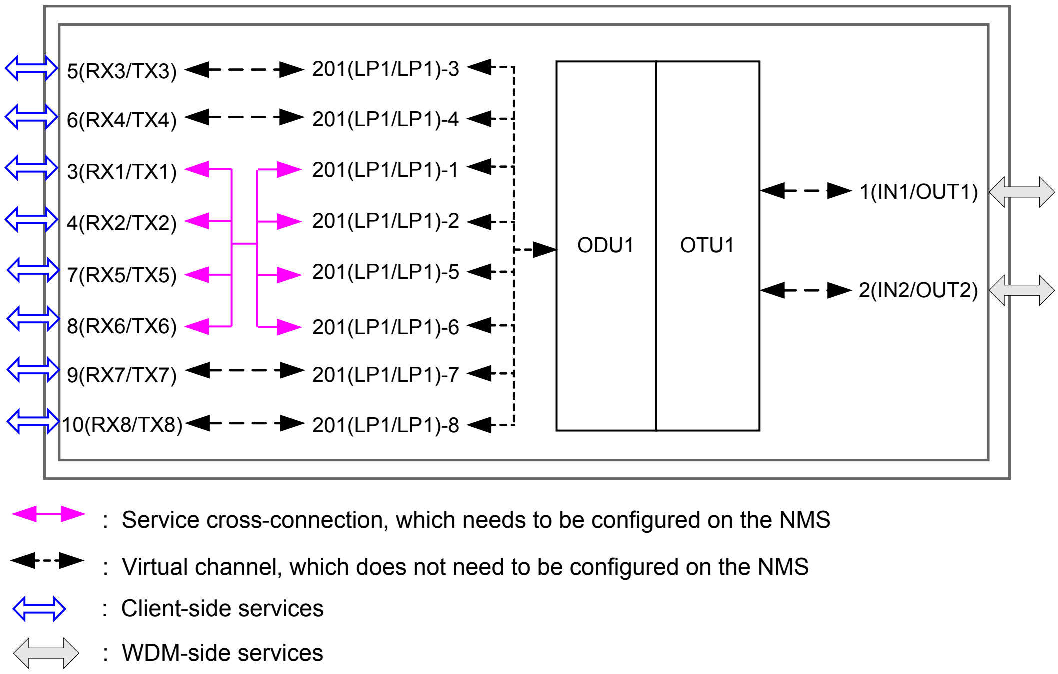
- An EVOA optical module can be installed at any client-side port on the TNF2LQM2 board. When an EVOA module is installed at a client-side port, the attenuation of the EVOA optical module is configured at the client-side port, and the related alarms are also reported at the client-side port.
- An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model of TNF1LQM2 board

- AP8 mode

  Figure 10-107 shows the port model of the LQM2 board in AP8 mode.

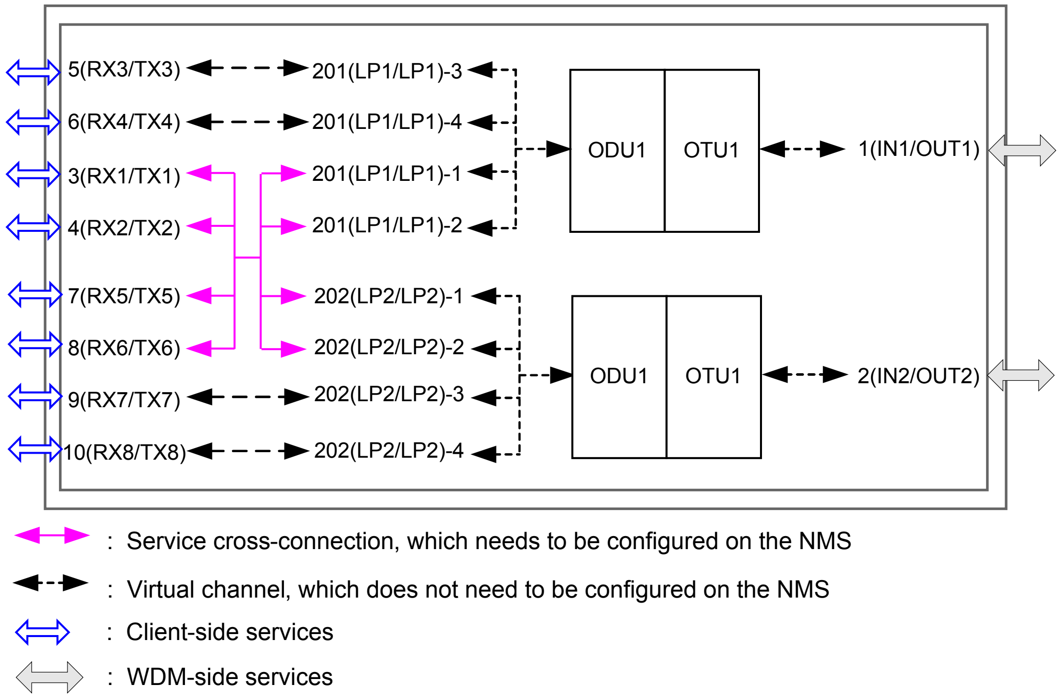
Figure 10-107 Port model of the LQM2 board (AP8 mode)



  - Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-10 (RX1/TX1 to RX8/TX8).
  - Alarms and performance events related to OTN electrical-layer overheads are reported on channels 1 and 2 of logical port 201.
  - Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).
- 2LQM mode

  Figure 10-108 shows the port model of the LQM2 board in 2LQM mode.

Figure 10-108 Port model of the LQM2 board (2LQM mode)



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-10 (RX1/TX1 to RX8/TX8).
- Alarms and performance events related to OTN electrical-layer overheads are reported on channel 1 of logical ports 201 and 202.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

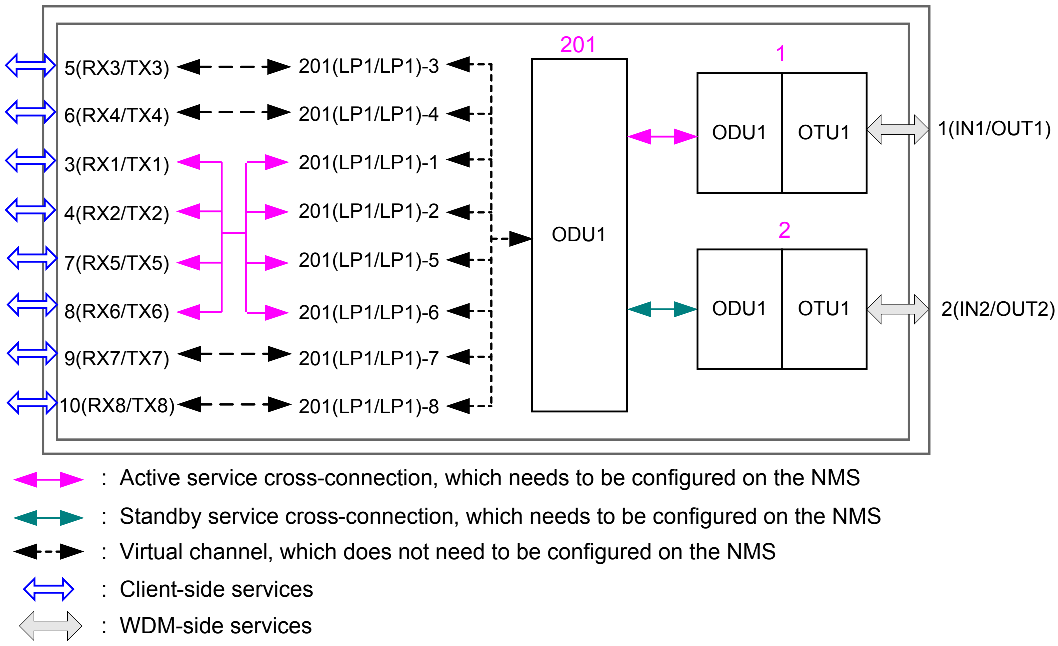
Port model of TNF2LQM2 board

The TNF2LQM2 board can work in four different modes: 1 x AP8 ODU1 mode, 2 x AP4 ODU1 mode, 2 x AP2 ODU0 mode, 2 x AP3 ODU1 mode.

- 1 x AP8 ODU1 mode

  Figure 10-109 shows the port model of the TNF2LQM2 board in 1 x AP8 ODU1 mode.

Figure 10-109 Port model of the TNF2LQM2 board (1 x AP8 ODU1 mode)

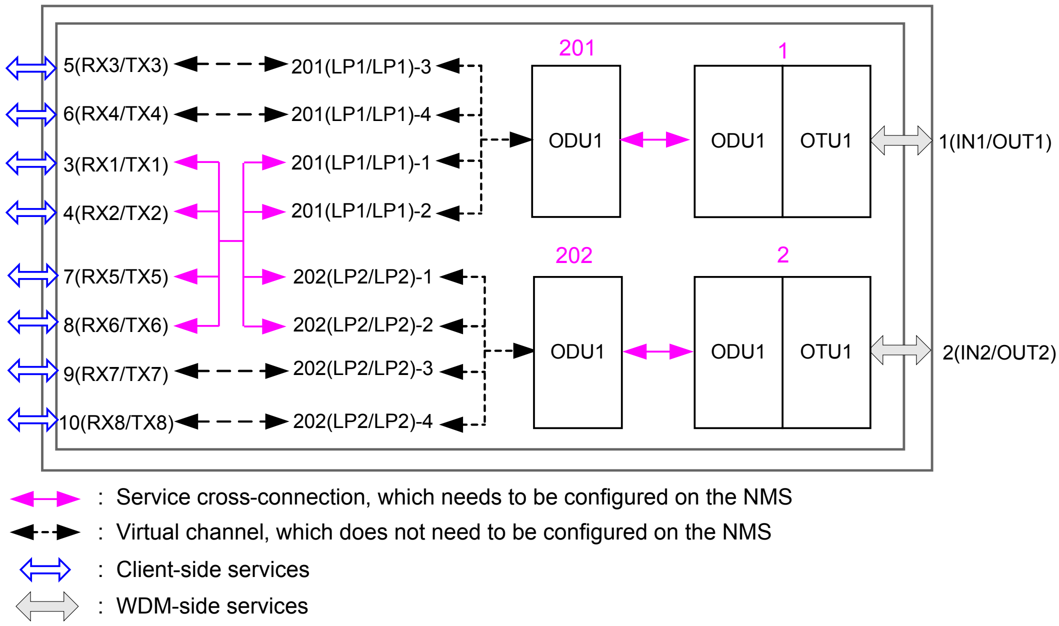


- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-10 (RX1/TX1 to RX8/TX8).
- Alarms, performance events, and configurations related to OTU1/ODU1 overheads are reported on channel 1 of optical ports 1 and 2.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- Port 201 supports ODU1 convergence mode and ODU1 non-convergence mode. It works in ODU1 convergence mode by default.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 1) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2. When ODUk SNCP (k = 1) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 2 x AP4 ODU1 mode

  Figure 10-110 shows the port model of the TNF2LQM2 board in 2 x AP4 ODU1 mode.

Figure 10-110 Port model of the TNF2LQM2 board (2 x AP4 ODU1 mode)

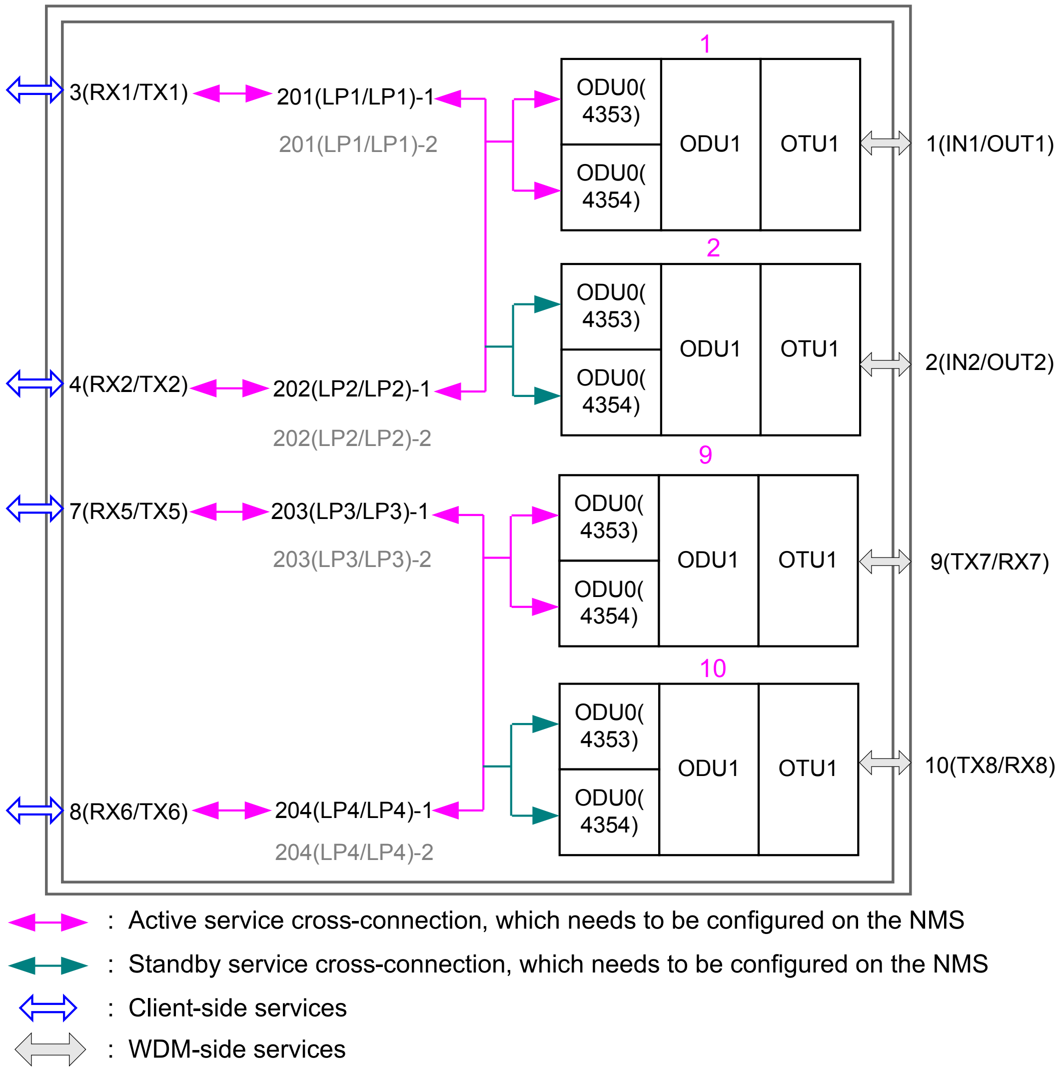


  - Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-10 (RX1/TX1 to RX8/TX8).
  - Alarms, performance events, and configurations related to OTU1/ODU1 overheads are reported on channel 1 of optical ports 1 and 2.
  - Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).
  - The 201 and 202 ports support ODU1 convergence mode and ODU1 non-convergence mode. They work in ODU1 convergence mode by default.

- 2 x AP2 ODU0 mode

  Figure 10-111 shows the port model of the TNF2LQM2 board in 2 x AP2 ODU0 mode.

Figure 10-111 Port model of the TNF2LQM2 board (2 x AP2 ODU0 mode)



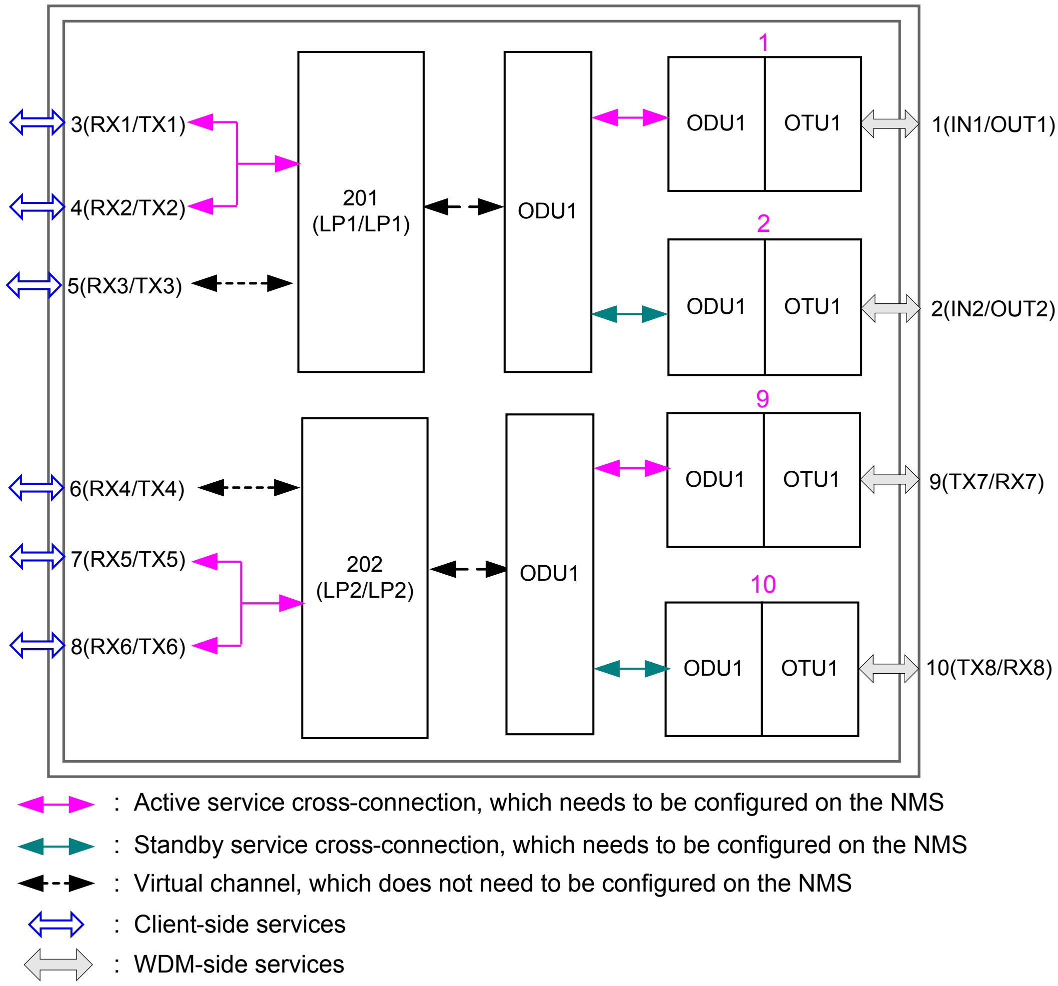
- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3(RX1/TX1), 4(RX2/TX2), 7(RX5/TX5), 8(RX6/TX6).
- Alarms, performance events, and configurations related to ODU0 signal overheads are reported on channels 4353 and 4354 of WDM-side optical ports.
- Alarms, performance events, and configurations related to ODU1/OTU1 signal overheads are reported on channel 1 of optical ports 1, 2, 9, and 10.
- Alarms, performance events, and configurations related to WDM-side optical modules and the optical layer are reported on channel 1 of WDM-side optical ports 1, 2, 9, and 10.
- Cross-connections from ports 3(RX1/TX1), 4(RX2/TX2), 7(RX5/TX5), 8(RX6/TX6) to channel 1 of ports 201–204 need to be configured. When the board is interconnected with a TN52TOM board for NG WDM products, you can configure the cross-connections from optical ports 3(RX1/TX1), 4(RX2/TX2), 7(RX5/TX5), 8(RX6/TX6) to channel 2 of ports 201–204 to ensure channel ID consistency for the TN52TOM board.

- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 0) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to channel 4353 of optical port 1 and unidirectional cross-connections from port 201 to channel 4353 of optical port 2; bidirectional cross-connections from port 202 to channel 4354 of optical port 1 and unidirectional cross-connections from port 202 to channel 4354 of optical port 2; bidirectional cross-connections from port 203 to channel 4353 of optical port 9 and unidirectional cross-connections from port 203 to channel 4353 of optical port 10; bidirectional cross-connections from port 204 to channel 4354 of optical port 9 and unidirectional cross-connections from port 204 to channel 4354 of optical port 10. When ODUk SNCP (k = 0) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

- 2 x AP3 ODU1 mode

  Figure 10-112 shows the port model of the TNF2LQM2 board in 2 x AP3 ODU1 mode.

Figure 10-112 Port model of the TNF2LQM2 board (2 x AP3 ODU1 mode)



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical ports 3-8 (RX1/TX1 to RX6/TX6).
- Alarms, performance events, and configurations related to OTU1/ODU1 signal overheads are reported on channel 1 of optical ports 1, 2, 9, and 10.
- Alarms, performance events, and configurations related to WDM-side optical modules and the optical layer are reported on channel 1 of WDM-side optical ports 1, 2, 9, and 10.
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1), 2 (IN2/OUT2), 9 (IN9/OUT9), 10 (IN10/OUT10).
- The 201 and 202 ports support ODU1 convergence mode and ODU1 non-convergence mode. They work in ODU1 convergence mode by default.
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 1) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2; bidirectional cross-connections from port 202 to optical port 9 and unidirectional cross-connections from port 202 to optical port 10. When ODUk SNCP (k = 0) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

10.11.8 Configuration of Cross-connection

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Service Package

The TNF1LQM2 board supports two types of service packages, as shown in **Table 10-184**.

Table 10-184 Configuration of the service packages of the TNF1LQM2 board

Service Package Mode	Port	Accessed Service	Configuration Method
GE service package	3 (TX1/RX1)	GE	See Configuring Services in Service Package Mode.
	4 (TX2/RX2)	GE	
	5 (TX3/RX3)	Null	
	6 (TX4/RX4)	Null	
	7 (TX5/RX5)	Null	
	8 (TX6/RX6)	Null	
	9 (TX7/RX7)	Null	
	10 (TX8/RX8)	Null	
GE/SDH(STM-1) service package	3 (TX1/RX1)	GE	

Service Package Mode	Port	Accessed Service	Configuration Method
	4 (TX2/RX2)	GE	
	5 (TX3/RX3)	STM-1	
	6 (TX4/RX4)	STM-1	
	7 (TX5/RX5)	Null	
	8 (TX6/RX6)	Null	
	9 (TX7/RX7)	Null	
	10 (TX8/RX8)	Null	

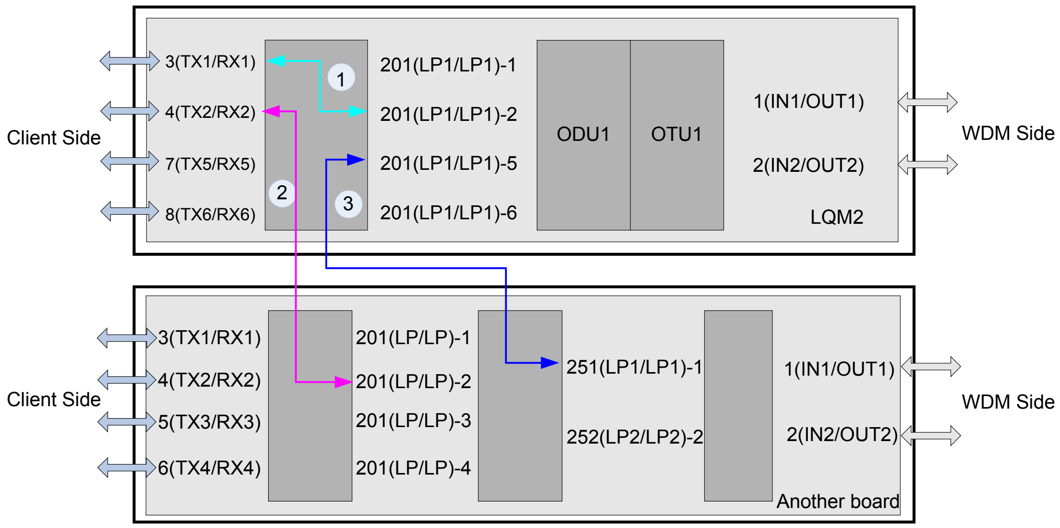
NOTE

Only TNF1LQM2 board supports service packages.

Cross-Connect Ports

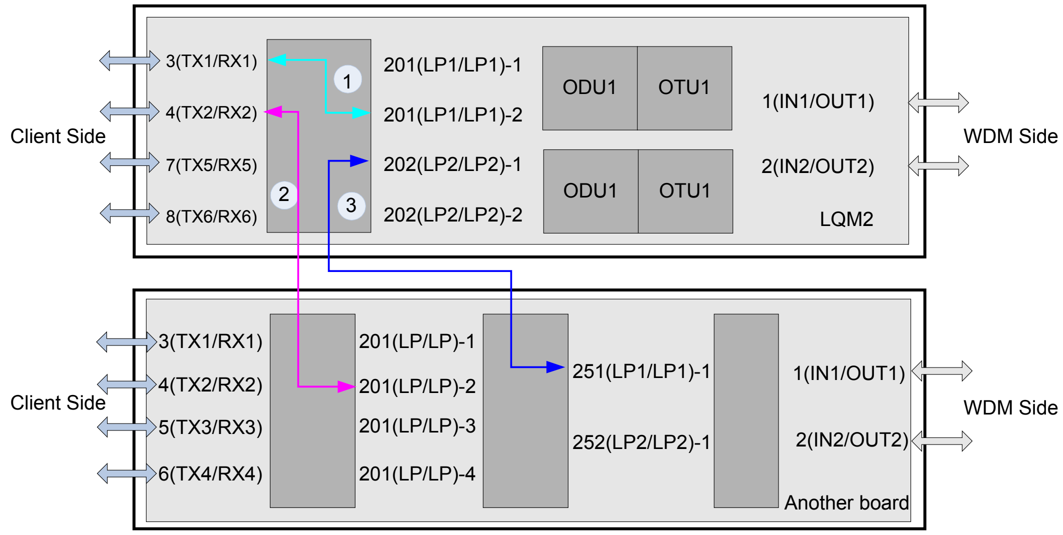
The LQM2 board supports inter-board cross-connections and intra-board cross-connections of optical services with rate lower than 1.25 Gbit/s. This board implements service cross-connections through its cross-connect module. **Figure 10-113** and **Figure 10-114** show the cross-connections implemented on the LQM2 board.

Figure 10-113 Example of cross-connections of the LQM2 board (AP8 mode of TNF1LQM2, 1 x AP8 ODU1 mode of TNF2LQM2)



Another board: LQG, LQM2, or TSP. The 201 ports uses the LQG board as an example and the 251 ports uses the TSP board as an example.

Figure 10-114 Example of cross-connections of the LQM2 board (2LQM mode of TNF1LQM2, 2 x AP4 ODU1 mode of TNF2LQM2)



Another board: LQG, LQM2, or TSP. The 201 ports uses the LQG board as an example and the 251 ports uses the TSP board as an example.

- Intra-board cross-connection
  - The client-side optical services with rate lower than 1.25 Gbit/s are cross-connected to the WDM-side ports 201 of the LQM2 board. For details, see 1 in **Figure 10-113** and **Figure 10-114**.
- Inter-board cross-connection
  - The GE signals on the client side of the LQM2 board are cross-connected to the WDM-side ports 201 of the LQG board, or the optical services with rate lower than 1.25 Gbit/s on the client side of the LQM2 board are cross-connected to the WDM-side ports 201 of another LQM2 board. For details, see 2 in **Figure 10-113** and **Figure 10-114**.
  - The STM-4/STM-1 signals on the WDM-side ports 201 or 202 of the LQM2 board are cross-connected to the WDM-side ports 251 and 252 of the TSP board. For details, see 3 in **Figure 10-113** and **Figure 10-114**.

NOTE

Only the client-side optical ports 3 (RX1/TX1), 4 (RX2/TX2), 7 (RX5/TX5), and 8 (RX6/TX6) on the LQM2 board support the cross-connection function.

10.11.9 LQM2 Parameters on the NMS

Precautions

CAUTION

If you delete a logical LQM2 board and configure it again on the NMS, the original configuration of the board is deleted and the default configuration is restored.

Parameter Description

<table>
<tr><th>Field</th><th>Value</th><th>Description</th></tr>
<tr><td>Board Working Mode</td><td>TNF1LQM2:
AP8 Mode, 2LQM Mode
Default: 2LQM Mode
TNF2LQM2:
1*AP8 ODU1 mode, 2*AP4 ODU1 mode, 2*AP2 ODU0 mode, 2*AP3 ODU1 mode
Default: 2*AP4 ODU1 mode</td><td>TNF1LQM2:
2LQM Mode: the LQM2 board is used for converging double four services at Any rate or regenerating two channels of OTU1 signals. In this mode, two channels of signals are sent on the WDM side in a single-fed and single receiving manner.
AP8 Mode: the LQM2 board is used for converging eight services at Any rate or regenerating one channel of OTU1 signals. In this mode, signals are sent by optical ports on the WDM side in a dual fed and selective receiving manner.
TNF2LQM2:
1 x AP8 ODU1 mode: the LQM2 board is used for converging eight services at Any rate and ODUk (k=1) SNCP/intra-board 1+1 protection is supported. In this mode, signals are sent by optical ports on the WDM side in a dual fed and selective receiving manner.
2 x AP4 ODU1 mode: the LQM2 board is used for converging double four services at Any rate. In this mode, two channels of signals are sent on the WDM side in a single-fed and single receiving manner.
2 x AP2 ODU0 mode: the LQM2 board is used for converging double two services at Any rate and ODUk (k=0) SNCP/intra-board 1+1 protection is supported. In this mode, signals are sent by optical ports on the WDM side in a dual fed and selective receiving manner.
2 x AP3 ODU1 mode: the LQM2 board is used for converging double three services at Any rate and ODUk (k=1) SNCP/intra-board 1+1 protection is supported. In this mode, signals are sent by optical ports on the WDM side in a dual fed and selective receiving manner.
NOTE
Before changing the working mode of the LQM2 board, ensure that no cross-connection or service is configured on the board. If a cross-connection or service is configured on the board, delete the cross-connection or service and set Service Type to None before you change the working mode of the board.</td></tr>
</table>

Field	Value	Description
		CAUTION Switching between different working modes on a board interrupts the existing services.
Port Working Mode	ODU1 convergence mode (n*Any->ODU1), ODU1 non-convergence mode (OTU1/Any->ODU1) Default: ODU1 convergence mode (n*Any->ODU1)	• ODU1 convergence mode (n*Any->ODU1): client services are mapped into ODU1 services. • ODU1 non-convergence mode (OTU1/Any->ODU1): client services are mapped into ODU1 services. **NOTE** This parameter is valid when **Board Working Mode** is set to **1*AP8 ODU1 mode**, **2*AP4 ODU1 mode** or **2*AP3 ODU1 mode**. **NOTE** This parameter is only supported by the TNF2LQM2.
Cross-Connection Configuration Mode	• Automatic, Manual • Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**. **NOTE** This parameter is only supported by the TNF2LQM2.

Field	Value	Description
Service Type	TNF1LQM2: • OTU-1, DVB-ASI, SDI, HDSDI, HDSDI14835, ESCON, FC-100, FC-100 (slice), FC-200, FC-200 (slice), FE, FICON, FICON express, FICON express (slice), FICON (slice), GE, GE(GFP-T), GE_SLICE, STM-1, STM-4, STM-16, None • Default: **OTU-1** (in the case of the TX1/RX1 port) or **None** (in the case of the other ports) TNF2LQM2: • DVB-ASI, SDI, HDSDI, HDSDI14835, ESCON, FC-100, FC-200, FE, FICON, FICON express, GE (TTT-GMP), GE (GFP-T), CPRI2, CPRI3, STM-1, OC-3, STM-4, OC-12, STM-16, OC-48, None • Default: None	The **Service Type** parameter sets the type of the service accessed at the optical interface on the client side. NOTE • After you configure a cross-connection for the board, setting the **Service Type** field fails if the service type selected during cross-connection configuration is different from the value you set for **Service Type**. In this case, you need to delete the cross-connection and set the **Service Type** field again. • For the TNF1LQM2 board, the encapsulation mode is GFP-F when **Service Type** is set to **GE**. • The service type supported by the LQM2 board varies according to the value of Working Mode. • For the TNF2LQM2 board, GE(TTT-GMP) is supported only when the board works in **2*AP2 ODU0 mode**. In case of GE services, select a proper service type according to the source of the GE services. • When a board is used to transmit synchronous Ethernet services, this parameter must be set to **GE(TTT-GMP)**. • When a board is used to transmit ordinary Ethernet services, this parameter must be set to **GE** or **GE(GFP_T)**. CAUTION • Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually received services. Otherwise, services cannot be connected normally.

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used. Examples are as follows: • When the LQM2 board is used for converging services at Any rate, set **Channel Use Status** to **Used** for all WDM-side optical ports and set this parameter for all client-side optical ports according to the actual network design. • When the TNF1LQM2 board is used for regenerating two OTU1 services (2LQM mode), set **Channel Use Status** to **Used** for the TX1/RX1, IN1/OUT1, TX5/RX5, and IN2/OUT2 optical ports and to **Unused** for the other optical ports. • When the TNF1LQM2 board is used for regenerating one OTU1 service (AP8 mode), set **Channel Use Status** to **Used** for the TX1/RX1, and IN1/OUT1 optical ports and to **Unused** for the other optical ports.

Field	Value	Description
Automatic Laser Shutdown	Enabled, Disabled Default: **Disabled** (in the case of TX1/RX1, and TX5/RX5 ports), **Enabled** (in the case of the other client-side optical ports), or **Disabled** (in the case of WDM-side optical ports) TNF1LQM2: ● Enabled, Disabled ● Default: – 2LQM mode: **Disabled** in the case of TX1/RX1 and TX5/RX5 ports, **Enabled** in the case of the other client-side optical ports. – AP8 mode: **Disabled** in the case of TX1/RX1 ports, **Enabled** in the case of the other client-side optical ports. TNF2LQM2: ● Enabled, Disabled ● Default: – 1*AP8 ODU1 mode: **Enabled** in the case of all the client-side optical ports. – 2*AP4 ODU1 mode: **Enabled** in the case of all the client-side optical ports. – 2*AP2 ODU0 mode: **Enabled** in the case of TX1/RX1, TX2/RX2, TX5/RX5 and TX6/RX6 ports,	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.

Field	Value	Description
	Disabled in the case of the other client-side optical ports. - 2*AP3 ODU1 mode: **Enabled** in the case of TX1/RX1 to TX6/RX6 ports, **Disabled** in the case of the other client-side optical ports.	
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. ● If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. ● If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. ● If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect. **NOTE** This parameter is only supported by the TNF2LQM2.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

<table>
<tr><th>Field</th><th>Value</th><th>Description</th></tr>
<tr><td>Laser Status</td><td>ON, OFF
Default:
WDM side: ON
Client side: OFF</td><td>The default value is recommended. In practical application, set this parameter according to the scenario where the board is used. Examples are as follows:
When the LQM2 board is used for converging services at Any rate, set Laser Status to On for all WDM-side optical ports. Automatic Laser Shutdown of client-side optical ports is set to Enabled. Hence, lasers on client-side optical ports is enabled or disabled automatically according to the signal receiving conditions at the WDM-side optical ports on the local board and the signal receiving conditions at the client-side optical ports on the opposite board. That is, you do not need to set this parameter manually.
When the TNF1LQM2 board is used for regenerating two OTU1 services (2LQM mode), set Laser Status to On for the TX1/RX1, IN1/OUT1, TX5/RX5, and IN2/OUT2 optical ports and to Off for the other optical ports.
When the TNF1LQM2 board is used for regenerating one OTU1 service (AP8 mode), set Laser Status to On for the TX1/RX1, and IN1/OUT1 optical ports and to Off for the other optical ports.
CAUTION
If the communication between NEs is achieved through only the ESC provided by the LQM2 board, the following situations occur when neither a standby channel is available nor protection is configured:
The NE becomes unreachable after the WDM-side lasers on the LQM2 board are disabled when the LQM2 board is used for converging services at Any rate.
The NE becomes unreachable after the lasers at the TX1/RX1, IN1/OUT1, TX5/RX5, and IN2/OUT2 optical ports on the TNF1LQM2 board are disabled when the TNF1LQM2 board is used for regenerating two OTU1 services (2LQM mode).
The NE becomes unreachable after the lasers at the TX1/RX1, and IN1/OUT1 optical ports on the TNF1LQM2 board are disabled when the TNF1LQM2 board is used for regenerating one OTU1 service (AP8 mode).</td></tr>
<tr><td>FEC Working State</td><td>Enabled, Disabled
Default: Enabled</td><td>Enabled is recommended.
FEC Working State of the two interconnected OTU boards must be consistent.</td></tr>
</table>

Field	Value	Description
Optical Interface Attenuation Ratio (dB)	0 to 20 Default: 20	parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range. **NOTE** This parameter is only supported by the TNF2LQM2.
Max. Attenuation Ratio (dB)	20 Default: 20	parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board. **NOTE** This parameter is only supported by the TNF2LQM2.
Min. Attenuation Ratio (dB)	0 Default: 0	parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board. **NOTE** This parameter is only supported by the TNF2LQM2.
Guaranteed Bandwidth for Client-Side GE Service (M)	1-1000 Default: 1000	• Users determine the guaranteed bandwidth for GE services based on the needs. This parameter needs to be configured only for GE services. • The value of the **Guaranteed Bandwidth for Client-Side GE Service (M)** parameter must be greater than the actual service bandwidth of users. Only in this case, no packet loss can be ensured. • Retain the default value when timeslots are sufficient. • When timeslots are insufficient, decrease the committed information rate of GE services to decrease the number of timeslots required. This is to ensure that the total number of timeslots is within the required range. For example, when the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports are used to receive GE services, the CIR can be set to 620 Mbit/s. In this case, each GE service uses four timeslots. Hence, the total number of timeslots required by the services received at the TX1/RX1, TX2/RX2, TX3/RX3, and TX4/RX4 ports is not greater than 16. **NOTE** This parameter is only supported by the TNF1LQM2.

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Max. Packet Length	1518-9600 Default: 9600	● This parameter is valid only when **Service Type** is set to **GE** or **FE**. ● The default value is recommended. **NOTE** This parameter is only supported by the TNF1LQM2.
SF Switching Trigger Condition	None, OTUK_BDI Default: None	Intra-board 1+1 protection switching is performed only at the affected end once a fault occurs if the parameter is set to **None**. Intra-board 1+1 protection switching is performed at both ends once an OTUK_BDI alarm is detected when the parameter is set to **OTUK_BDI**. **NOTE** This parameter is only supported by the TNF1LQM2.
Auto-Negotiation of GE	Enabled, Disabled Default: Disabled	The Auto Negotiation parameter is available only when the **Service Type** parameter is set to **GE**. ● It is recommended to set this parameter to Disabled. ● If the equipment of the customer adopts the auto negotiation, the value of the Auto Negotiation parameter must be consistent with the value of the Auto Negotiation parameter of the equipment of the customer. ● The Auto Negotiation parameter must be consistent for the OTUs in the same protection group. **NOTE** This parameter is only supported by the TNF1LQM2.

Field	Value	Description
Intelligent Fiber Status	Enabled, Disabled Default: Enabled	When a link is faulty, and the fault state must be transparently transmitted to the interconnected client-side equipment, the IF function needs to be enabled. ● This parameter is valid only when **Service Type** of the optical port is set to **GE**. ● This parameter is invalid after the LPT function of the board is enabled. **NOTE** This parameter is only supported by the TNF1LQM2.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **GE** or **GE(GFP-T)**. ● The LPT function can work only with intra-board 1+1 protection or ODUk SNCP protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.

Field	Value	Description
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **NOTE** This parameter is only supported by the TNF2LQM2. **CAUTION** The settings of **GCC Receive/Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/ Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/ wavelength No./optical port wavelength/ frequency, for example, C/11/1471.00/208.170. Default: /	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.11.10 LQM2 Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications, and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LQM2	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF2LQM2	1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2 EVOA	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-185 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-186 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	**800ps/nm-fixed-PIN-eSFP**
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-187 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	**1000BASE-LX-10km**	**1000BASE-LX-40km**	**1000BASE-ZX-80km**
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-188 Specifications of 1000BASE-BX-10km optical module

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	10	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	-3	-3
Minimum mean launched power	dBm	-9	-9
Minimum extinction ratio	dB	6	6

Item	Unit	Value	
		1000BASE-BX-10km (SM1310)	1000BASE-BX-10km (SM1490)
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: FP Receive: PIN	Transmit: PIN Receive: FP
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-19.5	-19.5
Minimum receiver overload	dBm	-3	-3

Table 10-189 Specifications of 1000BASE-BX-40km optical module

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Line code format	-	NRZ	NRZ
Target distance	km	40	40
Transmitter parameter specifications at point S			
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	3	3
Minimum mean launched power	dBm	-2	-2
Minimum extinction ratio	dB	6	6
Eye pattern mask	-	IEEE802.3ah-compliant	
Receiver parameter specifications at point R			
Receiver type	-	Transmit: DFB Receive: PIN	Transmit: PIN Receive: DFB
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500	Transmit: 1480 to 1500 Receive: 1260 to 1360

Item	Unit	Value	
		1000BASE-BX-40km (SM1310)	1000BASE-BX-40km (SM1490)
Receiver sensitivity	dBm	-23	-23
Minimum receiver overload	dBm	-3	-3

Table 10-190 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-191 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-192 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Table 10-193 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Specifications for Client-Side Electrical Modules

Table 10-194 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600

Item	Unit	Value
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-195 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

NOTE

The GE electrical ports support 100/1000 Mbit/s self-adapting and the rate of 1000 Mbit/s.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight:
  - TNF1LQM2: 0.7 kg (1.59 lb.)
  - TNF2LQM2: 0.7 kg (1.59 lb.)

Power Consumption

Board	Typical Power Consumption at 25°C (77°F)	Maximum Power Consumption at 55°C (131°F)
TNF1LQM2	29.4W	36.8W
TNF2LQM2	16.5W	21.0W

10.12 LQPL

LQPL: OLT Side 4 Port GPON/STM-16/OTU1 Access Wavelength Conversion Board

10.12.1 Version Description

The available hardware version for the LQPL is TNF1.

Version

Table 10-196 describes the version mapping of the LQPL board. The mapping version of the equipment is V100R002C00 or later.

Table 10-196 Version description of the LQPL

Item	Description
Board hardware version	TNF1

10.12.2 Application

The LQPL can be used in three different application scenarios: convergence of four channels of GPON optical signals, convergence of four channels of STM-16/OTU1 optical signals, and hybrid transmission of STM-16/OTU1/GPON optical signals.

Service Access Description

Table 10-197 describes the service access of the ports on the LQPL board.

Table 10-197 Service access description of the LQPL board

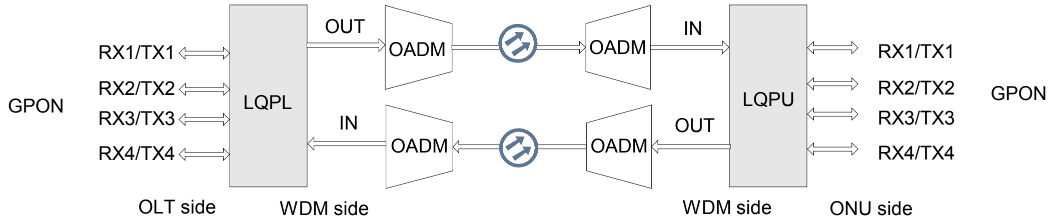
Application Scenario of the Board	Available Service	Number of Available Ports	Names of Available Ports
Hybrid Transmission of four channels of GPON/STM-16/OTU1 services	GPON, OTU1, STM-16	4	TX1/RX1 to TX4/RX4

Application Scenario 1: Implements the Convergence of Four Channels of GPON Optical Signals

The LQPL board can be connected to the OLT-side equipment to access four channels of GPON services, which are converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access four channels of GPON services, see **Figure 10-115**.

Figure 10-115 Application of the LQPL to access four channels of GPON services

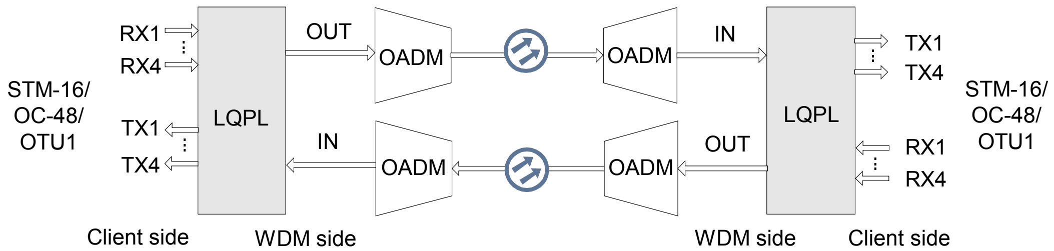


Application Scenario 2: Implements the Convergence of Four Channels of STM-16/OTU1 Optical Signals

The LQPL board can access four channels of STM-16/OTU1 services, which are converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access four channels of STM-16/OTU1 services, see **Figure 10-116**.

Figure 10-116 Application of the LQPL to access four channels of STM-16/OTU1 services

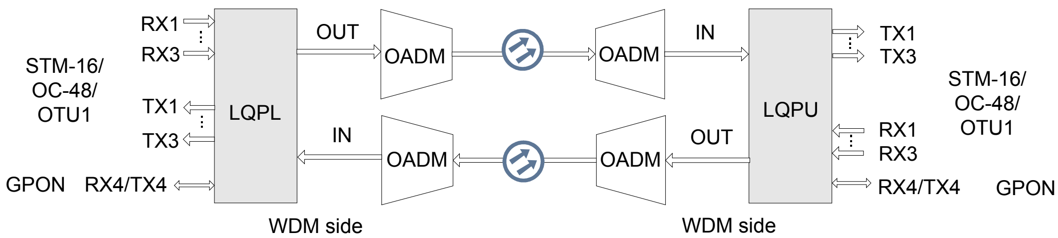


Application Scenario 3: Hybrid Transmission of STM-16/OTU1/GPON Services

The LQPL board can access STM-16/OTU1/GPON services at the same time. The services are converged into OTU2 signals, which are then converted into standard WDM wavelengths for transmission.

Figure 10-117 shows the hybrid transmission of STM-16/OTU1/GPON services.

Figure 10-117 Hybrid transmission of STM-16/OTU1/GPON services



NOTE

When the LQPL board accesses GPON services, the board must be used in pairs with the LQPU board. **Figure 10-117** shows the scenario that RX1/TX1-RX3/TX3 ports access STM-16/OTU1 services and RX4/TX4 ports access GPON services. The uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The maximum transmission distance for signals on the LQPL board is 240 km.
- The maximum distance between the LQPL board and an OLT is 20 km; the maximum distance between an ONU and an OLT is 50 km.

NOTE

- LQPL boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

NOTE

- When the LQPL board accesses GPON services, the board must be used in pairs with the LQPU board.

NOTE

- When the LQPL accesses GPON services, the ONU optical module must be selected, on which the "GPON ONU SFP" tag is labeled.

10.12.3 Functions and Features

The LQPL board can implement hybrid transmission of four channels of STM-16/OTU1/GPON services and convergence of the services into OTU2 optical signals.

For detailed functions and features, see **Table 10-198**.

Table 10-198 Functions and features of the LQPL

Function and Feature	Description
Basic Function	4 x STM-16/OTU1/GPON <—> 1 x OTU2
Service type	● Convergence services: – OTU1: OTN services, the rate is 2.67 Gbit/s. – STM-16: SDH services, the rate is 2.488 Gbit/s. – GPON: The service rate is 1.244 Gbit/s in the uplink direction and is 2.488 Gbit/s in the downlink direction.
FEC function	● Supports forward error correction (FEC) that complies with ITU-T G.709. ● Supports AFEC-2 that complies with ITU-T G.975.1. **NOTE** Boards that use different FEC modes cannot interoperate with each other.

<table>
<tr><th>Function and Feature</th><th>Description</th></tr>
<tr><td>Alarms and performance events monitoring</td><td>Monitors B1, SM_BIP8 and PM_BIP8 bytes to help locate faults.
Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.</td></tr>
<tr><td>OTN function</td><td>● Provides the OTU2 interface on WDM-side.
● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709.
● Supports PM functions for ODU2.
● Supports SM functions for OTU2.</td></tr>
<tr><td>Regeneration board</td><td>When the LQPL board accesses OTU1/STM-16 signals on the client side, the WDM-side signals of the LQPL board can be regenerated by the TNF1LSX board.</td></tr>
<tr><td>Non-Intrusive Monitoring Function</td><td>Monitors WDM-side SDH signals and reports R_LOF, MS_AIS, J0_MM, B1_SD, and B1_EXC alarms and performance events related to B1 errors.
NOTE
This function is available only when SDH signals are accessed on the client side of the board. This function has no impact on reporting of alarms and performance events related to the client-side signals.</td></tr>
<tr><td>Protection schemes</td><td>When the LQPL board accesses STM-16/OTU1 services:
● Supports client 1+1 protection
● Supports intra-board 1+1 protection
When the LQPL board accesses GPON services:
● Supports client 1+1 protection
● Supports intra-board 1+1 protection
NOTE
● In the case that GPON services are accessed and the client 1+1 protection is configured, switching cannot be performed if a fiber cut occurs on the ONU side of the LQPU board.
● If the LQPL board is configured with the intra-board 1+1 protection, the OLP board must be used to achieve the protection.</td></tr>
<tr><td>Loopback</td><td>When the LQPL board accesses only STM-16/OTU1 services:
● Supports WDM side inloop
● Supports WDM side outloop
● Supports client side inloop
● Supports client side outloop
When the LQPL board accesses both STM-16/OTU1 and GPON services at the same time, the ports for receiving STM-16/OTU1 services are as follows:
● Supports client side inloop
● Supports client side outloop</td></tr>
</table>

Function and Feature	Description	
ALS function	Supports the ALS function on the client side. **NOTE** ● When the client side accesses OTU1 services, the ALS function is disabled. That is, the laser stays in enabling state.	
ESC function	Supported	
Cross-connect function	Not supported	
LPT function	Not supported	
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is STM-16/OTU1.	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G. 694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.707 ITU-T G.782 ITU-T G.783 ITU-T G.984

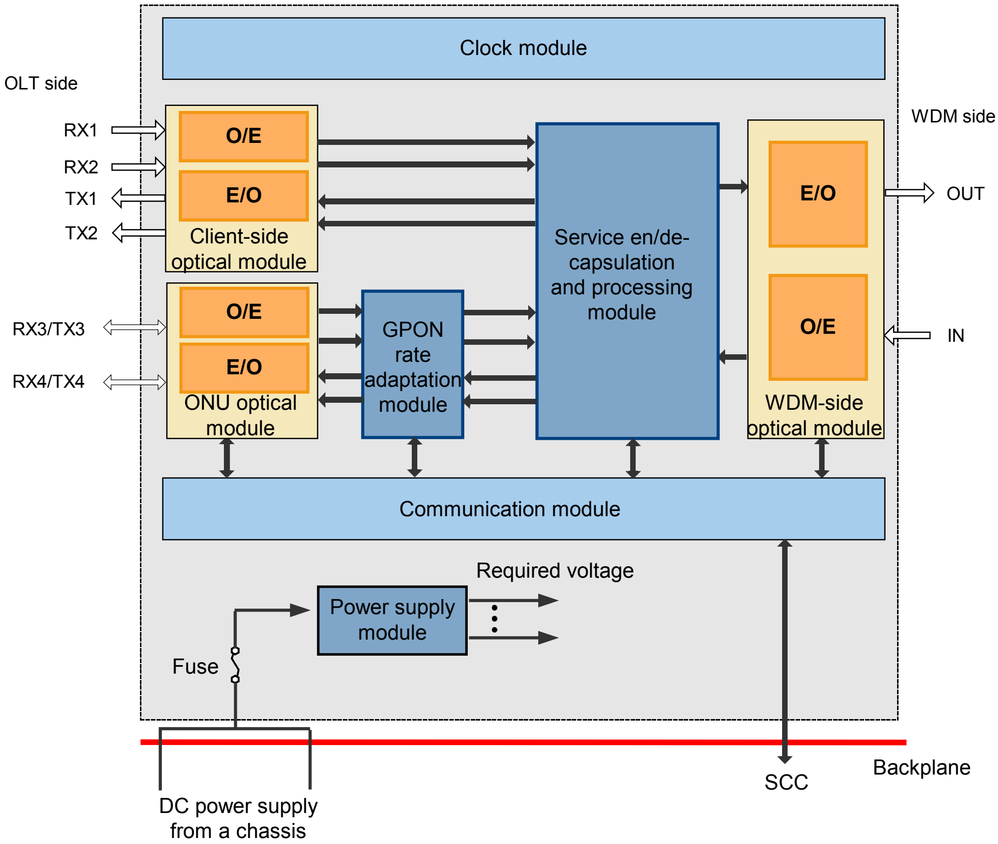
Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.12.4 Working Principle and Signal Flow

The LQPL board consists of: the client-side optical module or the ONU optical module, the WDM-side optical module, the GPON rate adaptation module, the service en/de-capsulation and processing module, the clock module, the communication module, and the power supply module.

Figure 10-118 shows the functional block diagram of the LQPL board. The figure shows the scenario that RX1/TX1 and RX2/TX2 ports access STM-16/OTU1 services and RX3/TX3 and RX4/TX4 ports access GPON services.

Figure 10-118 Functional block diagram of the LQPL board



In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

- In the downlink direction
  - The client-side optical module receives STM-16/OTU1 optical signals through RX1-RX4 ports, and performs the O/E conversion.
  - The ONU optical module receives GPON optical signals through RX1-RX4 ports, and performs the O/E conversion.

  The converted GPON electrical signals are sent to the GPON rate adaptation module for rate conversion. The module performs operations such as multiplexing, clock generating, and frame processing. Then, the module outputs one channel of OTU2 signals.

  The OTU2 signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the G.694.1-compliant OTU2 optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths. The optical signals are output through the OUT optical ports.
- In the uplink direction

  The WDM-side optical module receives one channel of OTU2 signals through the IN optical port, and then performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service en/de-capsulation and processing module. The module performs operations such as decapsulation, clock recovery, and demultiplexing. The GPON signals are converted into 2.488 Gbit/s data stream through the service en/de-capsulation and processing module. Then, the GPON services are converted into 1.244 Gbit/s uplink data in the GPON rate adaptation module and are output together with other electrical signals.

The client-side optical module and ONU optical module perform the E/O conversion of four channels of GPON/STM-16/OTU1 electrical signals, and then output four channels of GPON/STM-16/OTU1 optical signals through TX1-TX4 optical ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- ONU optical module
  - OLT-side receiver: Receives GPON optical signals from the OLT devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - OLT-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to OLT devices.
  - Reports the performance of the OLT-side optical port.
  - Reports the working state of the OLT-side laser.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of OTU2 optical signals, and extracts clock from the electrical signals.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to OTU2 optical signals, and multiplexes the clock signals with the electrical services signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module

  It implements the en/de-capsulation of STM-16/OTU1/GPON signals and service convergence.

  - Processes the overheads of signals, and reports the performance monitoring state of service signals.
  - Achieves the multiplexing from STM-16/OTU1/GPON signals to OTU2 signals and the demultiplexing from OTU2 signals to STM-16/OTU1/GPON signals.
- GPON rate adaptation module
  - Receives signals at the rate of 2.488 Gbit/s from the service en/de-capsulation and processing module, and convert the signals into uplink GPON services at the rate of 1.244 Gbit/s.
  - Monitors the performance of the GPON downlink frames.

- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

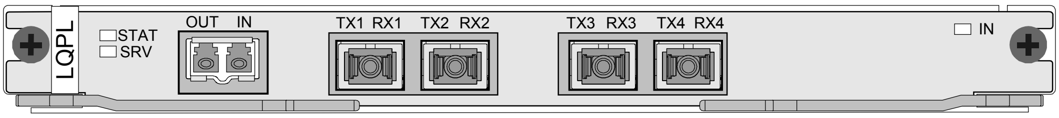
10.12.5 Front Panel

There are indicators and ports on the LQPL front panel.

Appearance of the Front Panel

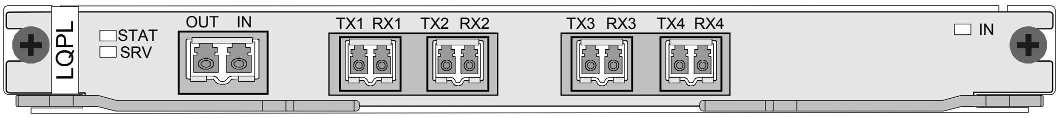
When the LQPL board is used to access four channels of GPON signals, the front panel of the board is shown in **Figure 10-119**.

Figure 10-119 Front panel of the LQPL (used to access four channels of GPON signals)



When the LQPL board is used to access four channels of STM-16/OTU1 signals, the front panel of the board is shown in **Figure 10-120**.

Figure 10-120 Front panel of the LQPL (used to access four channels of STM-16/OTU1 signals)



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-199 lists the type and function of each port.

Table 10-199 Types and functions of the LQPL ports

Optical Port	Port Type	Function
IN/OUT	LC	Connected to the OADM board to receive/transmit OTU2 signals.
TX1/RX1 to TX4/RX4	LC	Connected to the OADM board to transmits/receives STM-16/OTU1 signals.
	SC	Transmits/receives GPON service signals from OLT-side equipment.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.12.6 Valid Slots

The LQPL occupies one slot.

Valid Slot in Subrack

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.12.7 Physical and Logical Ports

This section describes the display of optical ports on the board.

Display of Ports

Table 10-200 lists the sequence number displayed in an NMS system of the port on the LQPL board front panel.

Table 10-200 Display of the LQPL ports

Ports on the Front Panel	Port Displayed on the U2000
IN/OUT	1
TX1/RX1	3
TX2/RX2	4
TX3/RX3	5

Ports on the Front Panel	Port Displayed on the U2000
TX4/RX4	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.12.8 LQPU Parameters on the NMS

Parameter Description

Field	Value	Description
Service Type	GPON, OTU1, STM-16 Default: OTU1	Select a value according to the actual type of service that is carried. **NOTE** ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

<table>
<tr><th>Field</th><th>Value</th><th>Description</th></tr>
<tr><td>Laser Status</td><td>ON, OFF
Default:
- WDM side: ON
- Client side: OFF</td><td>- Usually, this parameter is set to ON for every WDM-side optical port.
- In the case of client-side optical ports, retain the default value because Automatic Laser Shutdown is usually set to Enabled.
CAUTION
If the communication between NEs is achieved through only the ESC provided by the LQPL/LQPU board, the following situation occurs when neither a standby channel is available nor protection is configured: the NEs are unreachable after the lasers on the WDM side of the LQPL/LQPU board are disabled.</td></tr>
<tr><td>FEC Working State</td><td>Enabled, Disabled
Default: Enabled</td><td>- Enabled is recommended.
- FEC Working State of the two interconnected OTU boards must be consistent.</td></tr>
<tr><td>FEC Mode</td><td>FEC, AFEC
Default: FEC</td><td>This parameter is available only when you set FEC Working State to Enabled.
- The default value is recommended. To improve the error correction capability, set this parameter to AFEC.
- FEC Mode of the two boards that are interconnected on the WDM side must be consistent. Otherwise, services are interrupted.
NOTE
When the client-side optical port on the board receives GPON services, FEC Mode cannot be set to AFEC.
The actual value is AFEC-2, but AFEC is displayed on the NMS.</td></tr>
<tr><td>Non-Intrusive Monitoring Status</td><td>Enabled, Disabled
Default: Disabled</td><td>You can set this parameter when the SDH service is transmitted. It is recommended to retain the default value.</td></tr>
</table>

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	You can set this parameter to **Inloop** or **Outloop** for an optical port only when you set **Service Type** to **STM-16** or **OTU1** for the optical port. Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
PRBS Test Status	Enabled, Disabled Default: /	• Retain the default value when a network works normally. • Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./ optical port wavelength/ frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.

Field	Value	Description
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

NOTE

- If the LQPL/LQPU board is deleted on the U2000 the configuration information will disappear and the board will recover to default configuration after it is configured again on the U2000 The default service at TX1/ RX1 to TX4/RX4 ports of LQPL board is OTU1.

10.12.9 LQPL Specifications

The technical specifications cover the optical port specifications, mechanical specifications, and power consumption.

Board Name	Optical Module on Client Side	Optical Module on OLT Side	Optical Module on WDM Side
TNF1LQPL	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP I-16 S-16.1 L-16.2	GPON-ONU	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-201 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-202 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	**1600ps/nm-fixed-APD-XFP**
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-203 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-204 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-205 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-206 Specifications of GPON-ONU optical module

Item	Unit	Value
		GPON-ONU
Transmission rate	Gbit/s	Transmit: 1.25 Receive: 2.50
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	0.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Receiver sensitivity	dBm	-27
Minimum receiver overload	dBm	-8

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.50 kg (1.10 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 32.8 W
- Maximum Power Consumption at 55°C (131°F): 41.0 W

10.13 LQPU

LQPU: ONU Side 4 Port GPON/STM-16/OTU1 Access Wavelength Conversion Board

10.13.1 Version Description

The available hardware version for the LQPU is TNF1.

Version

Table 10-207 describes the version mapping of the LQPU board. The mapping version of the equipment is V100R002C00 or later.

Table 10-207 Version description of the LQPU

Item	Description
Board hardware version	TNF1

10.13.2 Application

The LQPU can be used in three different application scenarios: convergence of four channels of GPON optical signals, convergence of four channels of STM-16/OTU1 optical signals, and hybrid transmission of GPON/STM-16/OTU1 optical signals.

Service Access Description

Table 10-208 describes the service access of the ports on the LQPU board.

Table 10-208 Service access description of the LQPU board

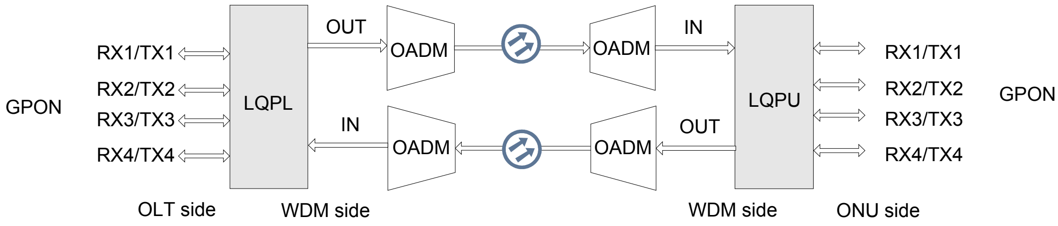
Application Scenario of the Board	Available Service	Number of Available Ports	Names of Available Ports
Hybrid Transmission of four channels of GPON/STM-16/OTU1 services	GPON, OTU1, STM-16	4	TX1/RX1 to TX4/RX4

Application Scenario 1: Implements the Convergence of Four Channels of GPON Optical Signals

The LQPU board can be connected to the ONU-side equipment to access four channels of GPON service, which is converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access four channels of GPON services, see **Figure 10-121**.

Figure 10-121 Application of the LQPU to access four channels of GPON services

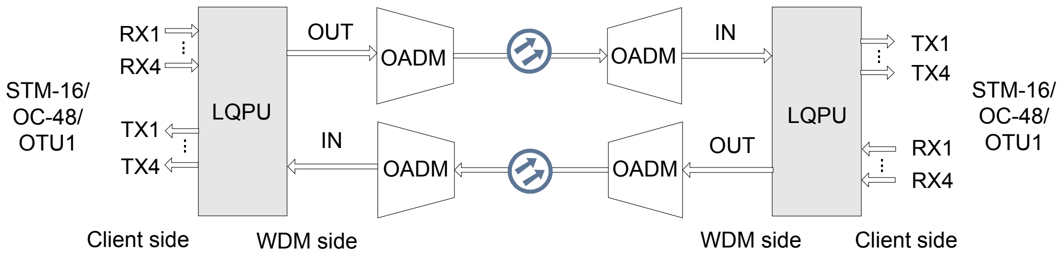


Application Scenario 2: Implements the Convergence of Four Channels of STM-16/OTU1 Optical Signals

The LQPU board can access four channels of STM-16/OTU1 services, which are converged into one channel of OTU2 signals. The OTU2 signals are then converted into standard WDM wavelength for further transmission.

For the application of the board to access four channels of STM-16/OTU1 services, see **Figure 10-122**.

Figure 10-122 Application of the LQPU to access four channels of STM-16/OTU1 services

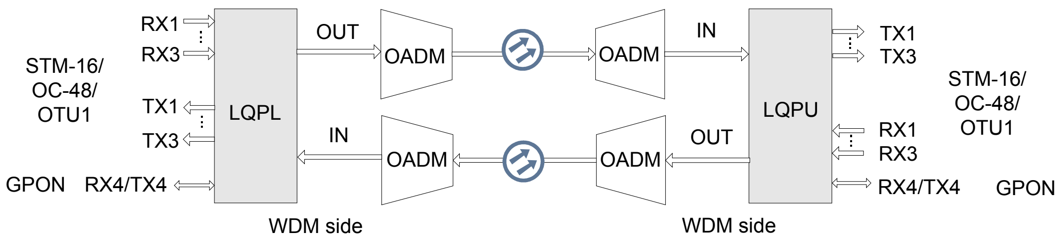


Application Scenario 3: Hybrid Transmission of GPON/STM-16/OTU1 Services

The LQPU board can access GPON/STM-16/OTU1 services at the same time. The services are converged into OTU2 signals, which are then converted into standard WDM wavelengths for transmission.

Figure 10-123 shows the hybrid transmission of GPON/STM-16/OTU1 services.

Figure 10-123 Hybrid transmission of GPON/STM-16/OTU1 services



NOTE

When the LQPU board accesses GPON services, the board must be used in pairs with the LQPL board. **Figure 10-123** shows the scenario that RX1/TX1-RX3/TX3 ports access STM-16/OTU1 services and RX4/TX4 ports access GPON services. The uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The maximum transmission distance for signals on the LQPU board is 240 km.
- The maximum distance between the LQPU board and an ONU is 20 km; the maximum distance between an ONU and an OLT is 50 km.

NOTE

- When the LQPU board accesses GPON services, the board must be used in pairs with the LQPL board.

NOTE

- LQPU boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

NOTE

- When the LQPU accesses GPON services, the OLT optical module must be selected, on which the "GPON OLT SFP" tag is labeled.

10.13.3 Functions and Features

The LQPU board can implement hybrid transmission of four channels of GPON/STM-16/OTU1 services and convergence of the services into OTU2 optical signals.

For detailed functions and features, see **Table 10-209**.

Table 10-209 Functions and features of the LQPU

Function and Feature	Description
Basic Function	4 x STM-16/OTU1/GPON <—> 1 x OTU2
Service type	● Convergence services: – OTU1: OTN services, the rate is 2.67 Gbit/s. – STM-16: SDH services, the rate is 2.488 Gbit/s. – GPON: The service rate is 1.244 Gbit/s in the uplink direction and is 2.488 Gbit/s in the downlink direction.
FEC function	● Supports forward error correction (FEC) that complies with ITU-T G.709. ● Supports AFEC-2 that complies with ITU-T G.975.1. **NOTE** Boards that use different FEC modes cannot interoperate with each other.

<table>
<tr><th>Function and Feature</th><th>Description</th></tr>
<tr><td>Alarms and performance events monitoring</td><td>Monitors B1, SM_BIP8 and PM_BIP8 bytes to help locate faults.
Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.</td></tr>
<tr><td>OTN function</td><td>Provides the OTU2 interface on WDM-side.
Supports the OTN frame format and overhead processing by referring to the ITU-T G.709.
Supports PM functions for ODU2.
Supports SM functions for OTU2.</td></tr>
<tr><td>Regeneration board</td><td>When the LQPU board accesses OTU1/STM-16 signals on the client side, the WDM-side signals of the LQPU board can be regenerated by the TNF1LSX board.</td></tr>
<tr><td>Non-Intrusive Monitoring Function</td><td>Monitors WDM-side SDH signals and reports R_LOF, MS_AIS, J0_MM, B1_SD, and B1_EXC alarms and performance events related to B1 errors.
NOTE
This function is available only when SDH signals are accessed on the client side of the board. This function has no impact on reporting of alarms and performance events related to the client-side signals.</td></tr>
<tr><td>Protection schemes</td><td>When the LQPU board accesses STM-16/OTU1 services:
Supports client 1+1 protection
Supports intra-board 1+1 protection
When the LQPU board accesses GPON services:
Supports client 1+1 protection
Supports intra-board 1+1 protection
NOTE
In the case that GPON services are accessed and the client 1+1 protection is configured, switching cannot be performed if a fiber cut occurs on the ONU side of the LQPU board.
If the LQPU board is configured with the intra-board 1+1 protection, the OLP board must be used to achieve the protection.</td></tr>
<tr><td>Loopback</td><td>When the LQPU board accesses only STM-16/OTU1 services:
Supports WDM side inloop
Supports WDM side outloop
Supports client side inloop
Supports client side outloop
When the LQPU board accesses both STM-16/OTU1 and GPON services at the same time, the ports for receiving STM-16/OTU1 services are as follows:
Supports client side inloop
Supports client side outloop</td></tr>
</table>

Function and Feature	Description	
ALS function	Supports the ALS function on the client side. **NOTE** ● When the client side accesses OTU1 services, the ALS function is disabled. That is, the laser stays in enabling state.	
ESC function	Supported	
Cross-connect function	Not supported	
LPT function	Not supported	
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is STM-16/OTU1.	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G. 694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.707 ITU-T G.782 ITU-T G.783 ITU-T G.984

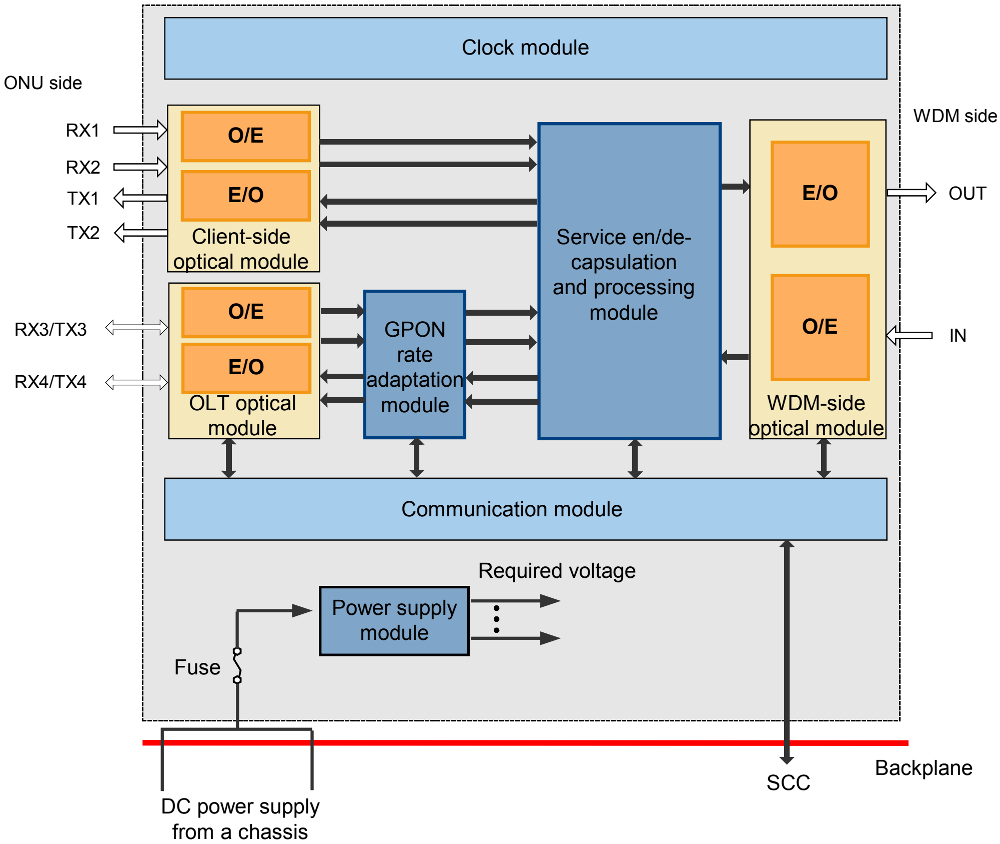
Function and Feature	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.13.4 Working Principle and Signal Flow

The LQPU board consists of: the client-side optical module or the OLT optical module, the WDM-side optical module, the GPON rate adaptation module, the service en/de-capsulation and processing module, the clock module, the communication module, and the power supply module.

Figure 10-124 shows the functional block diagram of the LQPU board. The figure shows the scenario that RX1/TX1 and RX2/TX2 ports access STM-16/OTU1 services and RX3/TX3 and RX4/TX4 ports access GPON services.

Figure 10-124 Functional block diagram of the LQPU board



In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

- In the uplink direction
  - The client-side optical module receives STM-16/OTU1 optical signals through RX1-RX4 ports, and performs the O/E conversion.
  - The OLT optical module receives GPON optical signals through RX1-RX4 ports, and performs the O/E conversion.

  The converted four electrical signals are sent to the service en/de-capsulation and processing module. The module performs processes such as multiplexing, clock generating, and frame processing. Then, the module outputs one channel of OTU2 signals. Then, the GPON services are sent to the GPON rate adaptation module to complete the rate conversion from 1.244 Gbit/s to 2.488 Gbit/s and then sent to the service en/de-capsulation and processing module.

  The OTU2 signals are sent to the WDM-side optical module. After performing E/O conversion, the module sends out the G.694.1-compliant OTU2 optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths. The optical signals are output through the OUT optical ports.

- In the downlink direction

  The WDM-side optical module receives one channel of OTU2 signals through the IN optical port, and then performs the O/E conversion.

After the O/E conversion, the electrical signals are sent to the service en/de-capsulation and processing module. The module performs operations such as decapsulation, clock recovery, and demultiplexing. Then, the GPON services are output together with other electrical signals.

The client-side optical module and OLT optical module perform the E/O conversion of four channels of GPON/STM-16/OTU1 electrical signals, and then output four channels of GPON/STM-16/OTU1 optical signals through TX1-TX4 optical ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives optical signals in any format from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to optical signals in any format, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- OLT optical module
  - ONU-side receiver: Receives GPON optical signals from the ONU devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - ONU-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to ONU devices.
  - Reports the performance of the ONU-side optical port.
  - Reports the working state of the ONU-side laser.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of OTU2 optical signals, and extracts clock from the electrical signals.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to OTU2 optical signals, and multiplexes the clock signals with the electrical services signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- GPON rate adaptation module
  - Completes the rate conversion of GPON services from the downlink rate of 2.488 Gbit/s to the uplink rate of 1.244 Gbit/s, and then sends the services to the service en/de-capsulation and processing module.
  - In the uplink direction, the module convert the signals at the rate of 1.244 Gbit/s into the signals at the rate of 2.488 Gbit/s, and then send the signals to the service en/de-capsulation and processing module to be processed. In the downlink direction, the module send the signals at the rate of 2.488 Gbit/s from the service en/de-capsulation and processing module to the OLT optical module.
  - Monitors the performance of the GPON uplink and downlink frames.
- Service en/de-capsulation and processing module

It implements the en/de-capsulation of STM-16/OTU1/GPON signals and service convergence.

 - Processes the overheads of signals, and reports the performance monitoring state of service signals.
 - Achieves the multiplexing from STM-16/OTU1/GPON signals to OTU2 signals and the demultiplexing from OTU2 signals to STM-16/OTU1/GPON signals.

- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

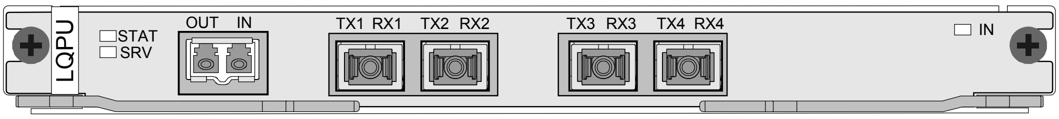
10.13.5 Front Panel

There are indicators and ports on the LQPU front panel.

Appearance of the Front Panel

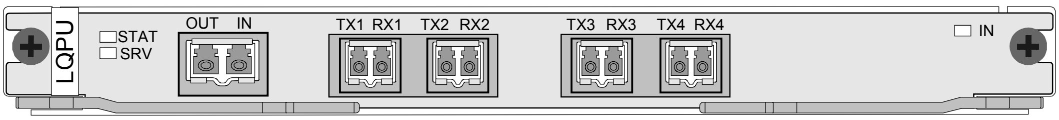
When the LQPU board is used to access four channels of GPON signals, the front panel of the board is shown in **Figure 10-125**.

Figure 10-125 Front panel of the LQPU (used to access four channels of GPON signals)



When the LQPU board is used to access four channels of STM-16/OTU1 signals, the front panel of the board is shown in **Figure 10-126**.

Figure 10-126 Front panel of the LQPU (used to access four channels of STM-16/OTU1 signals)



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange

- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-210 lists the type and function of each port.

Table 10-210 Types and functions of the LQPU ports

Optical Port	Port Type	Function
IN/OUT	LC	Connected to the OADM board to receive/transmit OTU2 signals.
TX1/RX1 to TX4/RX4	LC	Connected to the OADM board to transmits/receives STM-16/OTU1 signals.
	SC	Transmits/receives GPON service signals from ONU-side equipment.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.13.6 Valid Slots

The LQPU occupies one slot.

Valid Slot in Subrack

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.13.7 Physical and Logical Ports

This section describes the display of optical ports on the board.

Display of Ports

Table 10-211 lists the sequence number displayed in an NMS system of the port on the LQPU board front panel.

Table 10-211 Display of the LQPU ports

Ports on the Front Panel	Port Displayed on the U2000
IN/OUT	1
TX1/RX1	3
TX2/RX2	4
TX3/RX3	5
TX4/RX4	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.13.8 LQPU Parameters on the NMS

Parameter Description

Field	Value	Description
Service Type	GPON, OTU1, STM-16 Default: OTU1	Select a value according to the actual type of service that is carried. **NOTE** ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.

Field	Value	Description
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LQPL/LQPU board, the following situation occurs when neither a standby channel is available nor protection is configured: the NEs are unreachable after the lasers on the WDM side of the LQPL/LQPU board are disabled.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
FEC Mode	FEC, AFEC Default: FEC	This parameter is available only when you set **FEC Working State** to **Enabled**. ● The default value is recommended. To improve the error correction capability, set this parameter to **AFEC**. ● **FEC Mode** of the two boards that are interconnected on the WDM side must be consistent. Otherwise, services are interrupted. **NOTE** When the client-side optical port on the board receives GPON services, **FEC Mode** cannot be set to **AFEC**. The actual value is **AFEC-2**, but **AFEC** is displayed on the NMS.
Non-Intrusive Monitoring Status	Enabled, Disabled Default: Disabled	You can set this parameter when the SDH service is transmitted. It is recommended to retain the default value.

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	You can set this parameter to **Inloop** or **Outloop** for an optical port only when you set **Service Type** to **STM-16** or **OTU1** for the optical port. Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./ optical port wavelength/ frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.

Field	Value	Description
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

NOTE

- If the LQPL/LQPU board is deleted on the U2000 the configuration information will disappear and the board will recover to default configuration after it is configured again on the U2000 The default service at TX1/ RX1 to TX4/RX4 ports of LQPL board is OTU1.

10.13.9 LQPU Specifications

The technical specifications cover the optical port specifications, mechanical specifications, and power consumption.

Board Name	Optical Module on Client Side	Optical Module on ONU Side	Optical Module on WDM Side
TNF1LQPU	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP I-16 S-16.1 L-16.2	GPON-OLT	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-212 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-213 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	1600ps/nm-fixed-APD-XFP
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/ G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-214 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-215 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-216 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-217 Specifications of GPON-OLT optical module

Item	Unit	Value
		GPON-OLT
Transmission rate	Gbit/s	Transmit: 2.50 Receive: 1.25
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	1.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.53 kg (1.17 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 45.4 W
- Maximum Power Consumption at 55°C (131°F): 54.0 W

10.14 LSPL

LSPL: OLT Side Single Port GPON Access Wavelength Conversion Board

10.14.1 Version Description

The available hardware version for the LSPL is TNF1.

Version

Table 10-218 describes the version mapping of the LSPL board. The mapping version of the equipment is V100R001C01 or later.

Table 10-218 Version description of the LSPL

Item	Description
Board hardware version	TNF1

10.14.2 Application

The LSPL board is connected to the OLT-side equipment to access one GPON service, which is converged into one OTU1 signal. The OTU1 signal is then converted into standard WDM wavelength for further transmission.

Service Access Description

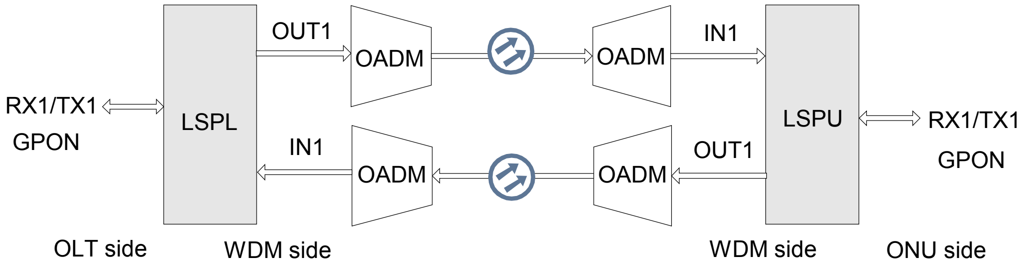
Table 10-219 describes the principle for configuring the ports of the LSPL board.

Table 10-219 Principle for configuring the ports of the LSPL board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Connected to the OLT-side equipment to access one GPON service	GPON service: the service rate is 1.244 Gbit/s in the uplink and 2.488 Gbit/s in the downlink	1	TX1/RX1

For the application of the board in WDM systems, see **Figure 10-127**.

Figure 10-127 Application of the LSPL in WDM system



NOTE

The LSPL board must work with the LSPU board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The LSPL board must work with the LSPU board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The maximum distance between the LSPL board and an OLT is 20 km; the maximum distance between an ONU and an OLT is 50 km.

NOTE

- LSPL boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

10.14.3 Functions and Features

The LSPL board accesses one channel of GPON services and then transmit the services transparently.

For detailed description of the functions and features, see **Table 10-220**.

Table 10-220 Functions and features of the LSPL board

Functions and Features	Description
Basic Function	The LSPL board accesses one channel of GPON services and then transmit the services transparently. The optical port on the WDM side provides the dual fed and selective receiving function.
Service type	GPON: The service rate is 1.244 Gbit/s in the uplink and 2.488 Gbit/s in the downlink.

Functions and Features	Description
Alarms and performance events monitoring	Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.
OTN function	• Provides the OTU1 interface on WDM-side. • Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. • Supports PM functions for ODU1. • Supports SM functions for OTU1.
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.
Regeneration board	-
Protection schemes	• Supports client 1+1 protection • Supports intra-board 1+1 protection **NOTE** • In the case of the client 1+1 protection, if a fiber on the ONU side of the LSPU board is broken, the protection switching cannot be performed.
Loopback	Not supported
ALS function	Supports the ALS function on the client side.
ESC function	Supported
Cross-connect function	Not supported
LPT function	Not supported

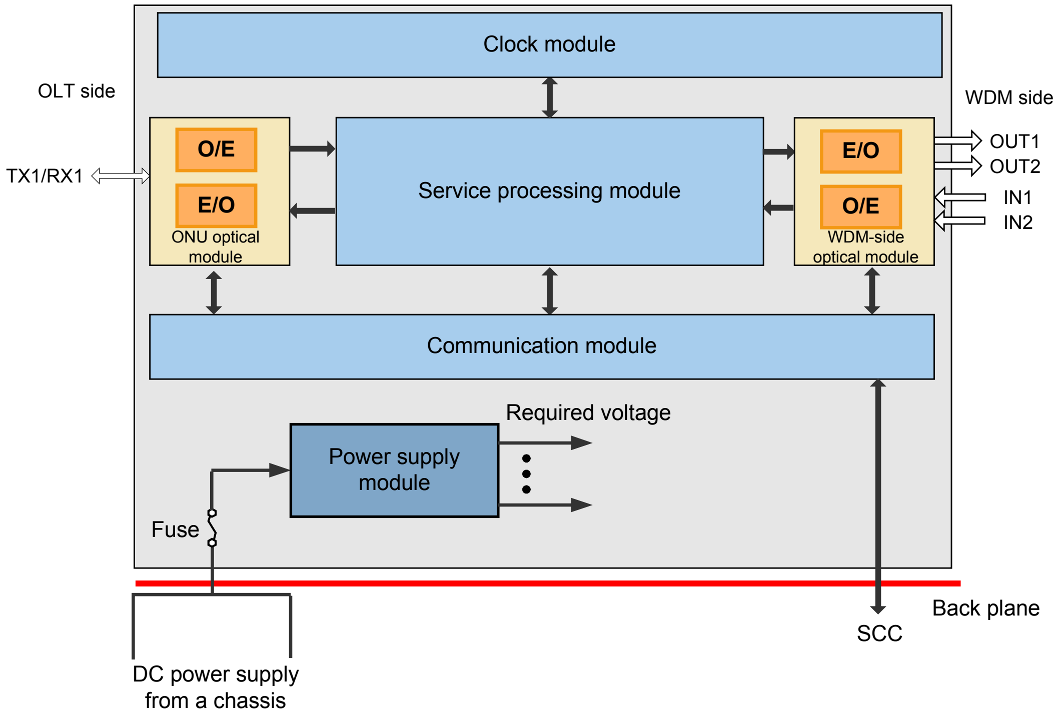
Functions and Features	Description	
PRBS test	Not supported	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.984
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.14.4 Working Principle and Signal Flow

The LSPL board consists of the ONU optical module, WDM-side module, service processing module, clock module, communication module, detection module and power supply module.

Figure 10-128 shows the functional block diagram of the LSPL.

Figure 10-128 Functional block diagram of the LSPL



Signal Flow

The LSPL board must work with the LSPU board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

- In the downlink direction

  The ONU optical module receives one channel of GPON signals from the OLT equipment through the RX1 optical port, and then performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

- In the uplink direction

  The WDM-side optical module receives two channels of OTU1 signals through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs one channel of GPON signals.

The GPON signals are sent to the ONU optical module and are then output through the TX1 optical port after the E/O conversion.

Module Function

- ONU optical module
  - OLT-side receiver: Receives GPON optical signals from the OLT devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - OLT-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to OLT devices.
  - Reports the working state of the OLT-side laser.
- WDM-side optical module
  - WDM-side receiver: Performs the O/E conversion of the OTU1 signals.
  - WDM-side transmitter: Performs the E/O conversion from internal electrical signals to OTU1 optical signal.
  - Reports performance events of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service processing module
  - Performs a series of operations for the signals, such as mapping/demapping, and clock transparent transmission.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

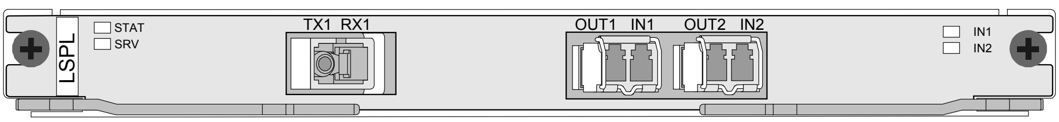
10.14.5 Front Panel

There are indicators and ports on the LSPL front panel.

Appearance of the Front Panel

Figure 10-129 shows the front panel of the LSPL.

Figure 10-129 Front panel of the LSPL



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-221 lists the type and function of each port.

Table 10-221 Types and functions of the LSPL ports

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the WDM signals coming from the standby channel.
RX1/TX1	SC	Transmits/receives the service signals to OLT-side equipment.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.14.6 Valid Slots

The LSPL occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.14.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-222 lists the sequence number displayed on an NMS system of the optical port on the LSPL board front panel.

Table 10-222 Display of the LSPL optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX1/TX1	3

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.14.8 LSPU Parameters on the NMS

Parameter Description

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	• The default value is recommended. • On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: • WDM side: ON • Client side: OFF	• Usually, this parameter is set to **ON** for every WDM-side optical port. • In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LSPL/LSPU board, do not disable the WDM-side lasers on the LSPL/LSPU board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	• **Enabled** is recommended. • **FEC Working State** of the two interconnected OTU boards must be consistent.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.14.9 LSPL Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on OLT Side	Optical Module on WDM Side
TNF1LSPL	GPON-ONU	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-223 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Maximum reflectance	dB	-27

Table 10-224 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-225 Specifications of GPON-ONU optical module

Item	Unit	Value
		GPON-ONU
Transmission rate	Gbit/s	Transmit: 1.25 Receive: 2.50
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	0.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Receiver sensitivity	dBm	-27
Minimum receiver overload	dBm	-8

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.68 kg (1.50 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 25.8 W
- Maximum Power Consumption at 55°C (131°F): 30.9 W

10.15 LSPR

LSPR: Single Port GPON Extension REG Board

10.15.1 Version Description

The available hardware version for the LSPR is TNF1.

Version

Table 10-226 describes the version mapping of the LSPR board. The mapping version of the equipment is V100R001C01 or later.

Table 10-226 Version description of the LSPR

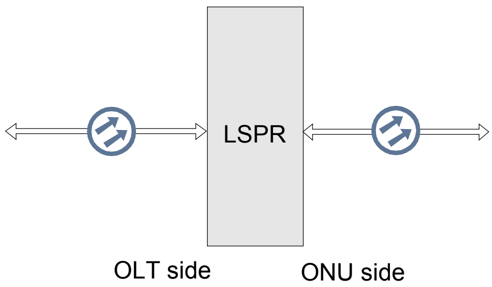
Item	Description
Board hardware version	TNF1

10.15.2 Application

The LSPR board is connected to ONU-side and OLT-side equipment and performs regeneration, reshaping, and retiming of one channel of GPON services and therefore extends the transmission distance of the GPON services.

For the application of the board, see **Figure 10-130**.

Figure 10-130 Application of the LSPR board



NOTE

- The maximum distance between the LSPR board and an ONU or an OLT is 20 km; the maximum distance between an ONU and an OLT is 55 km.
- LSPR boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

10.15.3 Functions and Features

The LSPR board performs regeneration, reshaping, and retiming of one channel of GPON services and therefore extends the transmission distance of the GPON services.

For detailed description of the functions and features, see **Table 10-227**.

Table 10-227 Functions and features of the LSPR board

Functions and Features	Description	
Basic Function	The board performs regeneration, reshaping, and retiming of one channel of GPON services and therefore extends the transmission distance of the GPON services.	
Alarms and performance events monitoring	Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.	
FEC function	Not supported	
Loopback	Not supported	
ALS function	Not supported	
ESC function	Not supported	
Cross-connect function	Not supported	
LPT function	Not supported	
PRBS test	Not supported	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.984

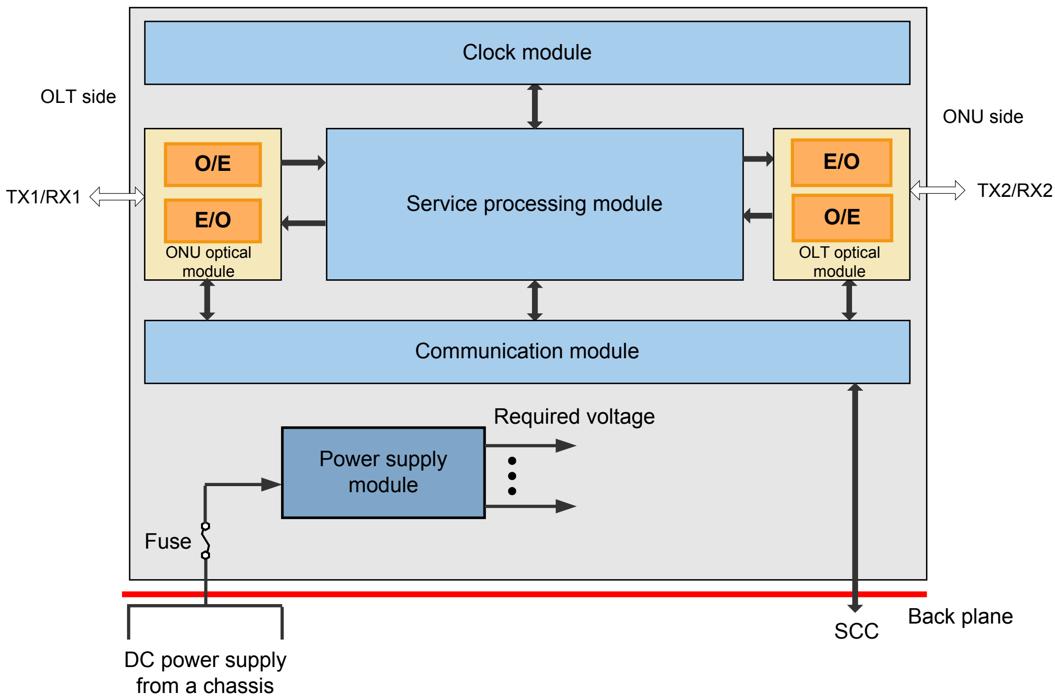
Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	–

10.15.4 Working Principle and Signal Flow

The LSPR board consists of OLT optical module, ONU optical module, service processing module, clock module, communication module, detection module and power supply module.

Figure 10-131 shows the functional block diagram of the LSPR.

Figure 10-131 Functional block diagram of the LSPR



Signal Flow

In the signal flow of the LSPR board, the uplink and the downlink directions are defined. The direction from the ONU side to the OLT side is defined as the uplink direction, and the reverse direction is defined as the downlink direction.

The ONU optical module receives one channel of GPON signals from the OLT equipment through the RX1 optical port, and then performs the O/E conversion.

After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of reshaping, regeneration, and retiming.

The signals are sent to the optical transmit module and are then output through the TX2 optical port after the E/O conversion.

Module Function

- ONU optical module
  - OLT-side receiver: Receives GPON optical signals from the OLT devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - OLT-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to OLT devices.
  - Reports the working state of the OLT-side laser.
- OLT optical module
  - ONU-side receiver: Receives GPON optical signals from the ONU devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - ONU-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to ONU devices.
  - Reports the performance of the ONU-side optical port.
  - Reports the working state of the ONU-side laser.
- Service processing module
  - Performs the reshaping, regeneration, and retiming of the signals.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

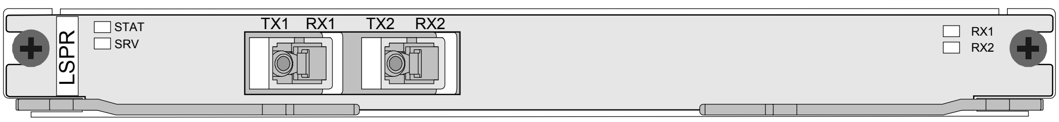
10.15.5 Front Panel

There are indicators and ports on the LSPR front panel.

Appearance of the Front Panel

Figure 10-132 shows the front panel of the LSPR.

Figure 10-132 Front panel of the LSPR



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- OLT-side receive optical power status indicator (RX1)——red, green, orange
- ONU-side receive optical power status indicator (RX2)——red, green, orange

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-228 lists the type and function of each port.

Table 10-228 Types and functions of the LSPR ports

Optical Port	Port Type	Function
RX1/TX1	SC	Connected to the OADM board to receive/transmit OLT-side signals.
RX2/TX2	SC	Connected to the OADM board to receive/transmit ONU-side signals.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.15.6 Valid Slots

The LSPR occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.15.7 Physical and Logical Ports

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 10-229 lists the sequence number displayed on an NMS system of the optical port on the LSPR board front panel.

Table 10-229 Display of the LSPR optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
RX1/TX1	1
RX2/TX2	2

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.15.8 LSPR Parameters on the NMS

Parameter Description

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LSPR board, do not disable the WDM-side lasers on the LSPR board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.15.9 LSPR Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on ONU Side	Optical Module on OLT Side
TNF1LSPR	GPON-OLT	GPON-ONU

Specifications of optical modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-230 Specifications of GPON-ONU optical module

Item	Unit	Value
		GPON-ONU
Transmission rate	Gbit/s	Transmit: 1.25 Receive: 2.50
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	0.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1260 to 1360 Receive: 1480 to 1500
Receiver sensitivity	dBm	-27
Minimum receiver overload	dBm	-8

Table 10-231 Specifications of GPON-OLT optical module

Item	Unit	Value
		GPON-OLT
Transmission rate	Gbit/s	Transmit: 2.50 Receive: 1.25
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		

Item	Unit	Value
		GPON-OLT
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	1.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.66 kg (1.45 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 12.0 W
- Maximum Power Consumption at 55°C (131°F): 14.4 W

10.16 LSPU

LSPU: ONU Side Single Port GPON Access Wavelength Conversion Board

10.16.1 Version Description

The available hardware version for the LSPU is TNF1.

Version

Table 10-232 describes the version mapping of the LSPU board. The mapping version of the equipment is V100R001C01 or later.

Table 10-232 Version description of the LSPU

Item	Description
Board hardware version	TNF1

10.16.2 Application

The LSPU board is connected to the ONU-side equipment to access one GPON service, which is converged into one OTU1 signal. The OTU1 signal is then converted into standard WDM wavelength for further transmission.

Service Access Description

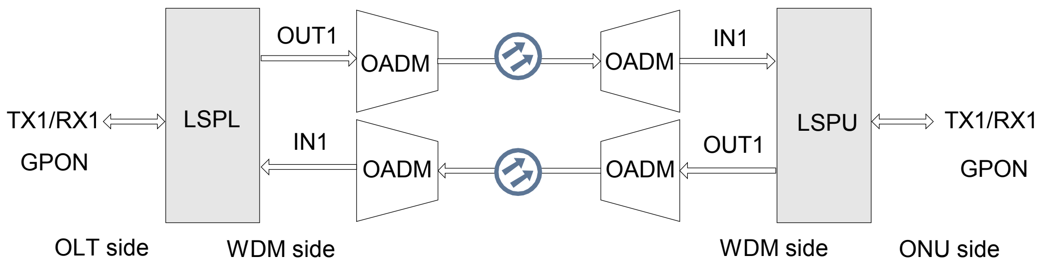
Table 10-233 describes the principle for configuring the ports of the LSPU board.

Table 10-233 Principle for configuring the ports of the LSPU board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports
Connected to the ONU-side equipment to access one GPON service	GPON service: the service rate is 1.244 Gbit/s in the uplink and 2.488 Gbit/s in the downlink	1	TX1/RX1

For the application of the board in WDM systems, see Figure 10-133.

Figure 10-133 Application of the LSPU in WDM system



NOTE

The LSPU board must work with the LSPL board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The LSPU board must work with the LSPL board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

NOTE

- The maximum distance between the LSPU board and an ONU is 20 km; the maximum distance between an ONU and an OLT is 50 km.

NOTE

- LSPU boards can be connected to Huawei-developed PON devices instead of PON devices provided by a third party.

10.16.3 Functions and Features

The LSPU board accesses one channel of GPON services and then transmit the services transparently.

For detailed description of the functions and features, see **Table 10-234**.

Table 10-234 Functions and features of the LSPU board

Functions and Features	Description
Basic Function	The board accesses one channel of GPON services and then transmit the services transparently. The optical port on the WDM side provides the dual fed and selective receiving function.
Service type	GPON: The service rate is 1.244 Gbit/s in the uplink and 2.488 Gbit/s in the downlink.
Alarms and performance events monitoring	Monitors SM_BIP8 and PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.
OTN function	- Provides the OTU1 interface on WDM-side. - Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. - Supports PM functions for ODU1. - Supports SM functions for OTU1.

Functions and Features	Description	
FEC function	Supports forward error correction (FEC) that complies with ITU-T G.709.	
Regeneration board	-	
Protection schemes	• Supports client 1+1 protection • Supports intra-board 1+1 protection **NOTE** • In the case of the client 1+1 protection, if a fiber on the ONU side of the LSPU board is broken, the protection switching cannot be performed.	
Loopback	Not supported	
ALS function	Supports the ALS function on the client side.	
ESC function	Supported	
Cross-connect function	Not supported	
LPT function	Not supported	
PRBS test	Not supported	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.984

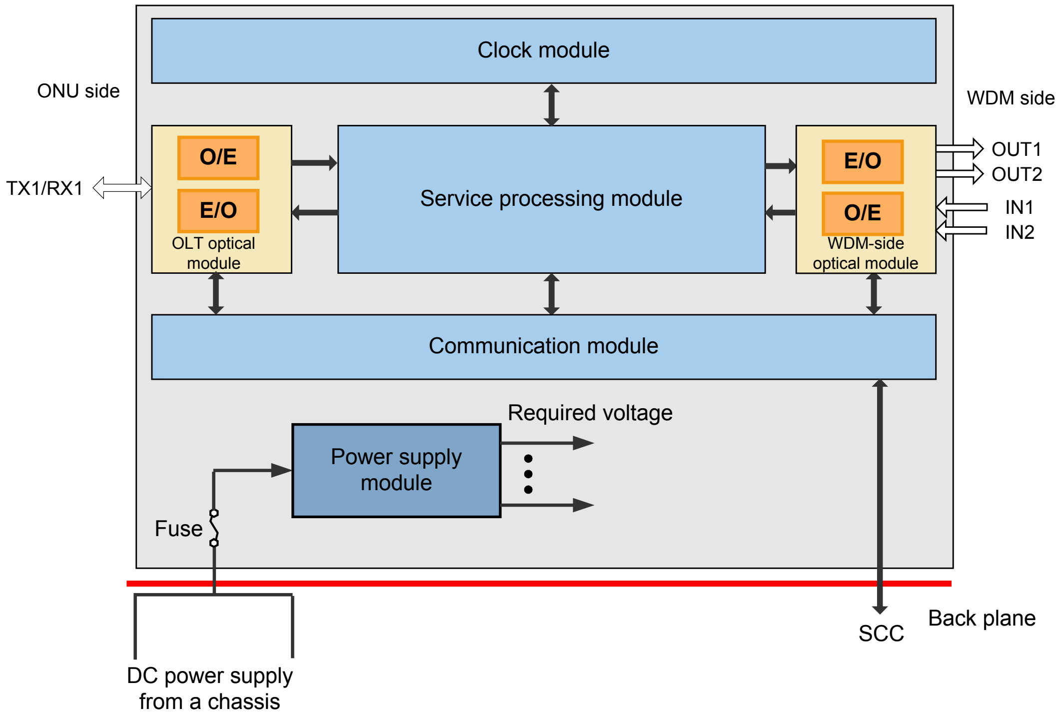
Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2

10.16.4 Working Principle and Signal Flow

The LSPU board consists of the OLT optical module, WDM-side module, service processing module, clock module, communication module, detection module and power supply module.

Figure 10-134 shows the functional block diagram of the LSPU.

Figure 10-134 Functional block diagram of the LSPU



Signal Flow

The LSPU board must work with the LSPL board. In the signal flow of the system, the uplink and the downlink directions are defined. The direction from the OLT side to the ONU side is defined as the downlink direction, and the reverse direction is defined as the uplink direction.

- In the uplink direction

  The OLT optical module receives one channel of GPON signals from the ONU through the RX1 optical port, and then performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module, where the signals are processed through a series of operations, such as mapping, clock transparent transmission, and frame processing. Then, the service processing module outputs one channel of OTU1 signals.

  The OTU1 signals are sent to the WDM-side module and are then output through the OUT1 and OUT2 optical ports after the E/O conversion.

- In the downlink direction

  The WDM-side optical module receives two channels of OTU1 signals through the IN1 and IN2 optical ports, and then performs the O/E conversion.

  After the O/E conversion, the signals are sent to the service processing module, where the signals are demapped. Then, the service processing module outputs one channel of GPON optical signals.

  The GPON optical signals are sent to the OLT optical module and are then output through the TX1 optical port after the E/O conversion.

Module Function

- OLT optical module
  - ONU-side receiver: Receives GPON optical signals from the ONU devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - ONU-side transmitter: Performs E/O conversion from internal electrical signals to GPON optical signals, and transmits the optical signals to ONU devices.
  - Reports the performance of the ONU-side optical port.
  - Reports the working state of the ONU-side laser.
- WDM-side optical module
  - WDM-side receiver: Performs the O/E conversion of the OTU1 signals.
  - WDM-side transmitter: Performs the E/O conversion from internal electrical signals to OTU1 optical signals.
  - Reports performance events of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service processing module
  - Performs a series of operations for the signals, such as mapping/demapping, and clock transparent transmission.
- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

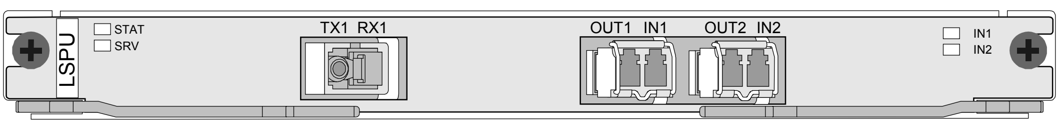
10.16.5 Front Panel

There are indicators and ports on the LSPU front panel.

Appearance of the Front Panel

Figure 10-135 shows the front panel of the LSPU.

Figure 10-135 Front panel of the LSPU



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-235 lists the type and function of each port.

Table 10-235 Types and functions of the LSPU ports

Port	Port Type	Function
IN1/OUT1	LC	Connected to the OADM board to receive/ transmit the WDM signals coming from the active channel.
IN2/OUT2	LC	Connected to the OADM board to receive/ transmit the WDM signals coming from the standby channel.
RX1/TX1	SC	Transmits/receives the service signals to ONU-side equipment.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.16.6 Valid Slots

The LSPU occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.16.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-236 lists the sequence number displayed on an NMS system of the optical port on the LSPU board front panel.

Table 10-236 Display of the LSPU optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX1/TX1	3

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

10.16.8 LSPU Parameters on the NMS

Parameter Description

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LSPL/LSPU board, do not disable the WDM-side lasers on the LSPL/LSPU board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.16.9 LSPU Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on ONU Side	Optical Module on WDM Side
TNF1LSPU	GPON-OLT	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-237 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Maximum reflectance	dB	-27

Table 10-238 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

Table 10-239 Specifications of GPON-OLT optical module

Item	Unit	Value
		GPON-OLT
Transmission rate	Gbit/s	Transmit: 2.50 Receive: 1.25
Line code format	-	NRZ
Target distance	km	20
Transmitter parameter specifications at point S		
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Maximum mean launched power	dBm	5.0
Minimum mean launched power	dBm	1.5
Minimum extinction ratio	dB	10
Eye pattern mask	-	G.984.2-compliant
Receiver parameter specifications at point R		
Receiver type	-	Transmit: DFB Receive: APD
Operating wavelength range	nm	Transmit: 1480 to 1500 Receive: 1260 to 1360
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.71 kg (1.56 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 24.6 W
- Maximum Power Consumption at 55°C (131°F): 29.5 W

10.17 LSX

LSX: 10 Gbit/s Wavelength Conversion Board

10.17.1 Version Description

The available hardware version for the LSX is TNF1 and TNF2.

Version

Table 10-240 describes the version mapping of the LSX board.

Table 10-240 Version description of the LSX

Item	Description
Board hardware version	TNF1: The mapping version of the TNF1LSX is V100R001C02 or later. TNF2: The mapping version of the TNF2LSX is V100R003C01 or later.

Differences Between Versions

Table 10-241 lists the differences between the LSX board versions.

Table 10-241 Differences between the LSX board versions

Item	TNF1LSX	TNF2LSX
Service Type	FC800, FICON 8G, FC1200, FICON 10G: not supported	FC800, FICON 8G, FC1200, FICON 10G: supported
Regeneration	Supported	Not supported
Protection	ODU2 SNCP: not supported	ODU2 SNCP: supported
Non-Intrusive Monitoring Function	Supported	Not supported
Dual-fed selective receiving on the WDM side	Not supported	Supported
Optical module type	XFP and TXFP optical modules: supported on the client side SFP+ optical modules: not supported on the client side	XFP and TXFP optical modules: not supported on the client side SFP+ optical modules: supported on the client side

Substitution Relationship

Table 10-242 lists the substitution relationship for LSX boards.

Table 10-242 Substitution relationship for LSX board versions

Original Board	Substitute Board	Substitution Rules
TNF1LSX	TNF2LSX	The TNF2LSX board can be created as TNF1LSX on the NMS to function as a TNF1LSX board. In this scenario, the TNF2LSX board only provides the functions of the TNF1LSX board. **NOTE** If the NE software version is V100R003C01 or later, the NE software does not need to be upgraded during the substitution. If the NE software version is earlier than V100R003C01, the NE software needs to be upgraded to V100R003C01 or a later version. **NOTE** OTU2 services cannot be received on the client side of the TNF2LSX board; therefore, the TNF2LSX board cannot replace the TNF1LSX board that works in regeneration mode.
TNF2LSX	None	-

10.17.2 Application

The LSX can be used in two different application scenarios: transmission of one channel of 10 Gbit/s optical signals, and regeneration of one channel of OTU2 or OTU2e optical signals.

Service Access Description

Table 10-243 describes the principle for configuring the ports of the LSX board.

Table 10-243 Principle for configuring the ports of the LSX board

Application Scenario of the Board	Service Access	Names of Available Ports	Remarks
Access one channel of optical signals	Any optical signals at the rate of 10 Gbit/s	TX/RX	Null

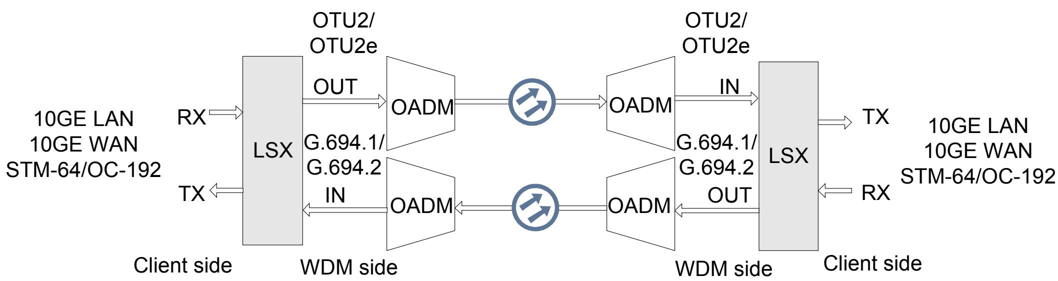
Application Scenario of the Board	Service Access	Names of Available Ports	Remarks
Access one channel of OTU2 or OTU2e optical signals	OTU2 or OTU2e signals	OUT/RX and TX/IN	• RX port receives the regeneration wavelength of east direction, OUT port transmits the regeneration wavelength of east direction. • IN port receives the regeneration wavelength of west direction, TX port transmits the regeneration wavelength of west direction. **NOTE** Only the TNF1LSX board supports regeneration function.

Application Scenario 1: Implements the Transparent Transmission of One Channel of 10 Gbit/s Optical Signals

The LSX is mainly used to map one channel of 10 Gbit/s service signals into OTU2 or OTU2e signals and implement the conversion between the 10 Gbit/s service signals and the ITU-T Recommendation-compliant signals.

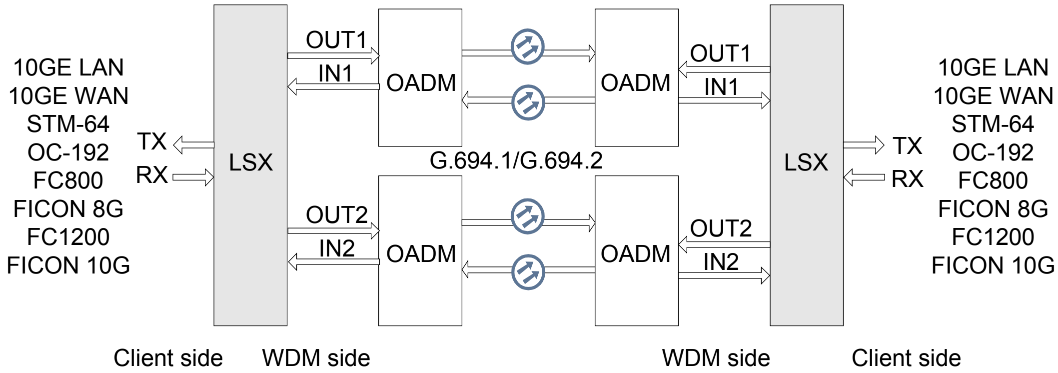
For the application of the TNF1LSX board to implement the transparent transmission of one channel of optical signals, see **Figure 10-136**.

Figure 10-136 Application of the TNF1LSX board (access one channel of optical signals)



For the application of the TNF2LSX board to implement the transparent transmission of one channel of optical signals, and dually feeds and selectively receives signals on the WDM side. see **Figure 10-137**.

Figure 10-137 Application of the TNF2LSX board (access one channel of optical signals)



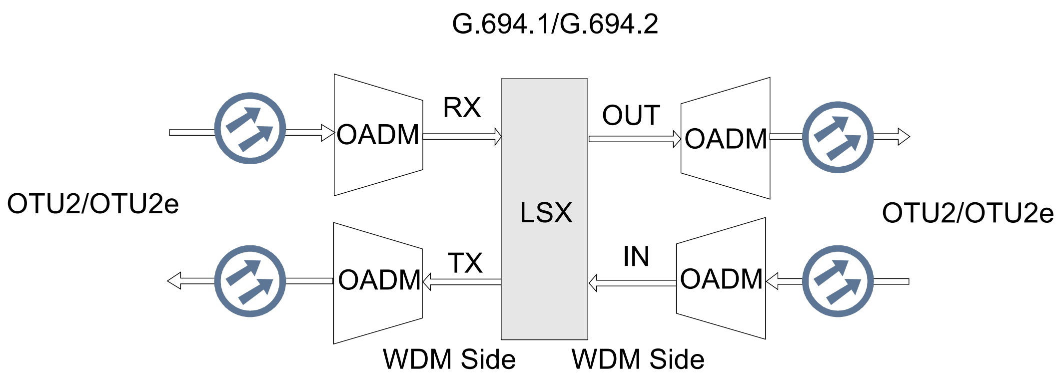
NOTE

In the above-mentioned applications, the board supports dual-fed selective receiving on the WDM side. For dual-fed selective receiving, the OUT1/IN1 port functions as the working channel and the OUT2/IN2 port functions as the protection channel.

Application Scenario 2: Implements the Regeneration of One Channel of OTU2 or OTU2e Optical Signals

For the application of the TNF1LSX board as a regeneration board of one channel of OTU2 or OTU2e optical signals, see **Figure 10-138**.

Figure 10-138 Application of the TNF1LSX (access one channel of OTU2 or OTU2e optical signals)



NOTE

- The maximum transmission distance for signals on the LSX board is 240 km.

10.17.3 Functions and Features

The LSX is a fixed wavelength OTU board and supports OTN ports and ESC.

For detailed information about the functions and features, see **Table 10-244**.

Table 10-244 Functions and features of the LSX

Functions and Features	Description
Basic function	• 1 x 10Gbit/s service signals<—> 1 x OTU2/OTU2e • The TNF1LSX board supports the bidirectional regeneration of one channel of OTU2 or OTU2e optical signals on the client side.
Services type	• 10GE LAN: Ethernet services, the rate is 10.31 Gbit/s. • 10GE WAN: Ethernet services, the rate is 9.95 Gbit/s. • STM-64: SDH services, the rate is 9.95 Gbit/s. • OC-192: SONET services, the rate is 9.95 Gbit/s. • FC800: Fiber channel services with the rate being 8.5 Gbit/s. (Only TNF2LSX supports) • FICON 8G: Fiber channel services with the rate being 8.5 Gbit/s. (Only TNF2LSX supports) • FC1200: Fiber channel services with the rate being 10.51 Gbit/s. (Only TNF2LSX supports) • FICON 10G: Fiber channel services with the rate being 10.51 Gbit/s. (Only TNF2LSX supports) • OTU2: OTN services, the rate is 10.71 Gbit/s. • OTU2e: OTN services, the rate is 11.1 Gbit/s. **NOTE** The 10GE LAN services can be mapped in two modes: Bit Transparent Mapping (11.1 G) and MAC Transparent Mapping (10.7 G). TNF1LSX: The processing of the 10GE WAN service and the STM-64/OC-192 service is the same. Therefore, when the 10GE WAN service is transmitted, you can configure it as the STM-64/OC-192 service on the U2000.

Functions and Features	Description
OTN function	TNF1LSX: ● Provides the OTU2 and OTU2e interface on WDM-side. ● Supports the mapping of client-side 10GE LAN services into OTU2/OTU2e signals, OTU2e services into OTU2e signals, and the mapping of 10GE WAN/STM-64/OTU2 services into OTU2 signals. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM non-intrusive monitoring for ODU2. ● Supports SM functions for OTU2. TNF2LSX: ● Provides the OTU2 and OTU2e interface on WDM-side. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports the mapping of client-side 10GE LAN services into OTU2/OTU2e signals, FC1200/FICON 10G services into OTU2e signals, and the mapping of 10GE WAN/STM-64/FC800 services into OTU2 signals. ● Supports the OTN frame format and overhead processing by referring to the ITU-T G.709. ● Supports PM non-intrusive monitoring for ODU2. ● Supports SM functions for OTU2.
Tunable wavelength function	Supports the tunable wavelength optical module. Equipped with this module, the board can tune the optical signal output on the WDM side within the range of 40 wavelengths in C-band with the channel spacing of 100 GHz.
Alarms and performance events monitoring	Monitors B1, SM_BIP8, PM_BIP8 bytes to help locate faults. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side. Monitors the RMON performance of 10GE LAN services.
Regeneration board	The TNF1LSX board
Non-Intrusive Monitoring Function	Monitors WDM-side SDH/SONET signals and reports R_LOF/LOF, MS_AIS/AIS-L, J0_MM/TIM-S, B1_SD/SD-S, and B1_EXC/SF-S alarms and performance events related to B1 errors. **NOTE** This function is available only when SDH/SONET signals are accessed on the client side of the board. Only the TNF1LSX supports this function.

Functions and Features	Description
FEC function	• Supports forward error correction (FEC) that complies with ITU-T G.709. • Supports AFEC-2 that complies with ITU-T G.975.1. **NOTE** Boards that use different FEC modes cannot interoperate with each other.
Synchronous Ethernet services	When receiving 10GE LAN services on the client side, and the services are mapped in Bit Transparent Mapping (11.1 G), the board supports the transparent transmission of synchronous Ethernet services, the quality of the clock signals of the board meets the requirements of G.862.1.
PRBS test	Supports the PRBS function on the client side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is 10GE LAN/10GE WAN/STM-64/OC-192.
Ethernet port working mode	Supports 10 Gbit/s full duplex when the client-side service type is 10GE LAN or 10GE WAN.
Protection schemes	TNF1LSX: • Supports client 1+1 protection • Supports intra-board 1+1 protection TNF2LSX: • Supports client 1+1 protection • Supports intra-board 1+1 protection • Supports ODUk SNCP (k=2) protection **NOTE** If the TNF1LSX board is configured with the intra-board 1+1 protection, the OLP board must be used to achieve the protection.
Loopback	• Supports WDM side inloop • Supports WDM side outloop • Supports client side inloop • Supports client side outloop
ALS function	Supports the ALS function on the client side. **NOTE** • When the client side accesses OTU2 services, the ALS function is disabled. That is, the laser stays in enabling state.
ESC function	Supported
Cross-connect function	Not supported

Functions and Features	Description	
LPT function	The board supports the LPT function only when the client-side service type is 10GE LAN services.	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G. 694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	ITU-T G.707 ITU-T G.782 ITU-T G.783 NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI) NCITS FIBRE CHANNEL LINK SERVICES (FC-LS) NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2) NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3) NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3) IEEE 802.3ae **NOTE** Only the TNF2LSX board supports NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI), NCITS FIBRE CHANNEL LINK SERVICES (FC-LS), NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2), and NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3).

Functions and Features	Description	
	Protocols or standards (performance monitoring) for processing services	ITU-T G.805 ITU-T G.806 ITU-T G.709 ITU-T G.872 ITU-T G.7710 ITU-T G.798 ITU-T G.874 ITU-T M.3100 ITU-T G.873.1 ITU-T G.874.1 ITU-T G.875 ITU-T G.808.1 ITU-T G.841 ITU-T G.8201 ITU-T G.694.1 ITU-T G.694.2 **NOTE** Only the TNF2LSX board supports ITU-T G.873.1.

10.17.4 Working Principle and Signal Flow

The LSX board consists of the client-side optical module, WDM-side optical module, service processing module, the clock module, communication module, and power supply module.

Signal Flow of Transparent Transmission of One Channel of 10 Gbit/s Optical Signals

Figure 10-139 is the functional block diagram of the TNF1LSX that implement the transparent transmission of one channel of 10 Gbit/s optical signals.

Figure 10-139 Functional block diagram of the TNF1LSX (transparent transmission of one channel of 10 Gbit/s optical signals)

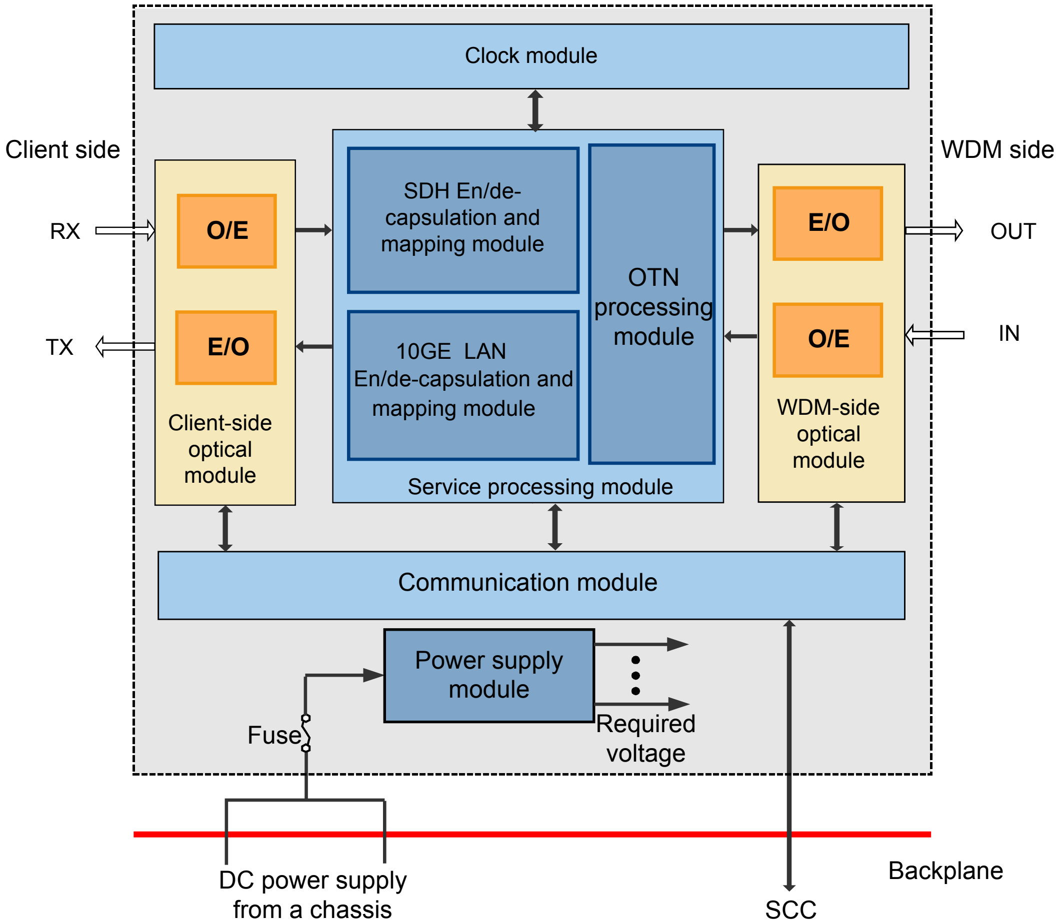
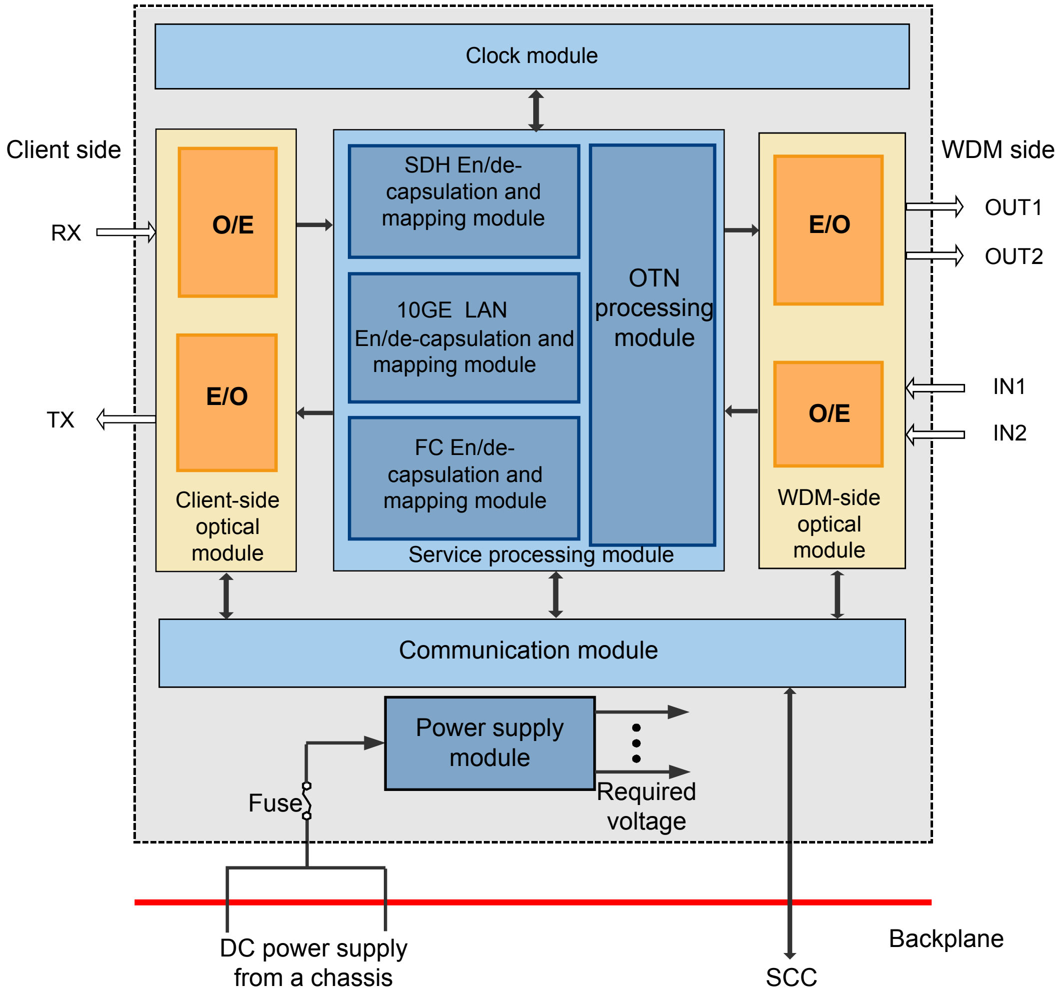


Figure 10-140 is the functional block diagram of the TNF2LSX that implement the transparent transmission of one channel of 10 Gbit/s optical signals, and dually feeds and selectively receives signals on the WDM side.

Figure 10-140 Functional block diagram of the TNF2LSX (transparent transmission of one channel of 10 Gbit/s optical signals)



In the signal flow of the LSX board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LSX to the WDM side of the LSX, and the receive direction is defined as the reverse direction.

TNF1LSX:

- In the transmit direction

  The client-side optical module receives one channel of the optical signals from client equipment through the RX optical port, and performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module. Different types of signals are sent to different encapsulation and mapping modules for encapsulation and mapping. In the end, operations such as the OTN framing are performed. Then, the module outputs one channel of OTU2/OTU2e electrical signals.

  The OTU2/OTU2e signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals through the OUT optical port.

- In the receive direction

  The WDM-side optical module receives one channel of the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals from the WDM side through the IN optical port. Then, the module performs the O/E conversion.

  After the O/E conversion, the OTU2/OTU2e signals are sent to the service processing module. The module performs operations such as OTU2/OTU2e in frame, and decapsulation processing. Then, the module outputs one channel of STM-64/10GE LAN/10GE WAN/CPRI option5/CPRI option6/CPRI option7/FC800/FICON 8G/FC1200/FICON 10G electrical signal.

  The client-side optical module performs the E/O conversion of the electrical signal, and then outputs client-side optical signals through the TX optical port.

TNF2LSX:

- In the transmit direction

  The client-side optical module receives one channel of the optical signals from client equipment through the RX optical port, and performs the O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service processing module. Different types of signals are sent to different encapsulation and mapping modules for encapsulation and mapping. In the end, operations such as the OTN framing are performed. Then, the module outputs one channel of OTU2/OTU2e electrical signals.

  The OTU2/OTU2e signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals through the OUT1/OUT2 optical port.

- In the receive direction

  The WDM-side optical module receives one channel of the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals from the WDM side through the IN1/IN2 optical port. Then, the module performs the O/E conversion.

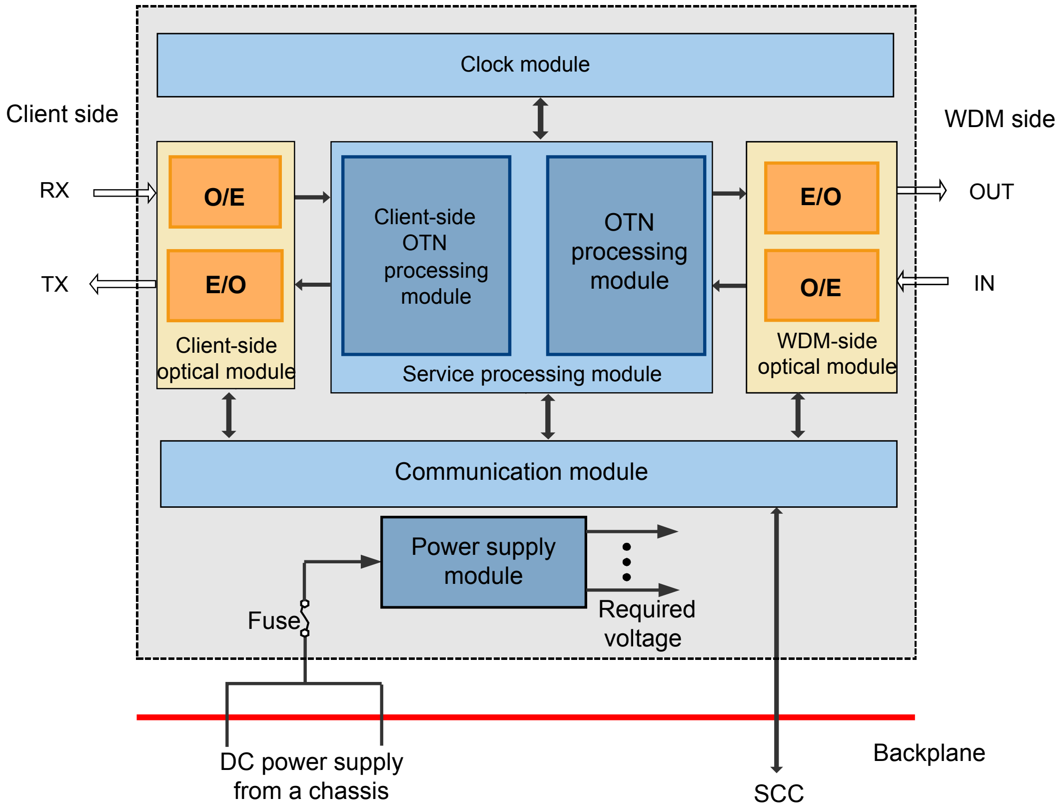
  After the O/E conversion, the OTU2/OTU2e signals are sent to the service processing module. The module performs operations such as OTU2/OTU2e in frame, and decapsulation processing. Then, the module outputs one channel of STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G electrical signal.

  The client-side optical module performs the E/O conversion of the electrical signal, and then outputs client-side optical signals through the TX optical port.

Signal Flow of Regeneration of One Channel of OTU2/OTU2e Signals

Figure 10-141 is the functional block diagram of the TNF1LSX that implement the regeneration of one channel of OTU2/OTU2e signals.

Figure 10-141 Functional block diagram of the TNF1LSX (regeneration of one channel of OTU2/OTU2e signals)



In the signal flow of the TNF1LSX board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the TNF1LSX to the WDM side of the LSX, and the receive direction is defined as the reverse direction.

TNF1LSX:

- In the transmit direction

  The client-side optical module receives one channel of OTU2 or OTU2e optical signals from client equipment through the RX optical port, and performs the O/E conversion.

  After the O/E conversion, the OTU2 or OTU2e electrical signals are sent to the client-side OTN processing module for performance monitoring. In the end, operations such as the OTN framing are performed. Then, the module outputs one channel of OTU2/OTU2e electrical signals.

  The OTU2/OTU2e signals are sent to the WDM-side optical module. After performing the E/O conversion, the module sends out the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals through the OUT optical port.

- In the receive direction

  The WDM-side optical module receives one channel of the ITU-T G.694.1-compliant or ITU-T G.694.2-compliant at WDM standard wavelengths OTU2/OTU2e optical signals from the WDM side through the IN optical port. Then, the module performs O/E conversion.

After the O/E conversion, the OTU2/OTU2e signals are sent to the service processing module. The module performs operations such as OTU2/OTU2e in frame, decapsulation processing. Then, the module outputs one channel of OTU2 or OTU2e electrical signals.

The client-side optical module performs the E/O conversion of OTU2 or OTU2e electrical signals, and then outputs client-side optical signals through the TX optical port.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the O/E conversion of STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G/OTU2/OTU2e optical signals.
  - Client-side transmitter: Performs the E/O conversion from the internal electrical signals to STM-64/10GE LAN/10GE WAN/FC800/FICON 8G/FC1200/FICON 10G/OTU2/OTU2e optical signals.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs the O/E conversion of OTU2/OTU2e optical signals.
  - WDM-side transmitter: Performs the E/O conversion from the internal electrical signals to OTU2/OTU2e optical signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.

- Service processing module

  The module consists of the SDH en/de-capsulation and mapping module, 10GE LAN en/de-capsulation and mapping module, FC en/de-capsulation and mapping module, Client-side OTN processing module, and OTN processing module.

  - SDH en/de-capsulation and mapping module

    Encapsulates one channel of SDH/10GE WAN signals and maps the signals into the OTU2 payload area. The module also performs the reverse process and has the SDH/10GE WAN performance monitoring function.

  - 10GE LAN en/de-capsulation and mapping module

    Encapsulates one channel of 10GE LAN signals and maps the signals into the OTU2/OTU2e payload area. The module also performs the reverse process and has the 10GE LAN performance monitoring function.

  - FC en/de-capsulation and mapping module

    Encapsulates one channel of FC800/FICON 8G signals and maps the signals into the OTU2 payload area. Encapsulates one channel of FC1200/FICON 10G signals and maps the signals into the OTU2e payload area. The module also performs the reverse process and has the FC800/FICON 8G/FC1200/FICON 10G performance monitoring function.

  - Client-side OTN processing module

    Implements the OTN performance monitoring function.

  - OTN processing module

Implements the framing of OTU2/OTU2e signals, processes the overheads of the OTU2/OTU2e signals, and performs the encoding and decoding.

- Clock module
  - Provides a clock for the board and implements clock transparent transmission.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

10.17.5 Front Panel

There are indicators and ports on the LSX front panel.

Appearance of the Front Panel

Figure 10-142 shows the front panel of the TNF1LSX.

Figure 10-142 Front panel of the TNF1LSX

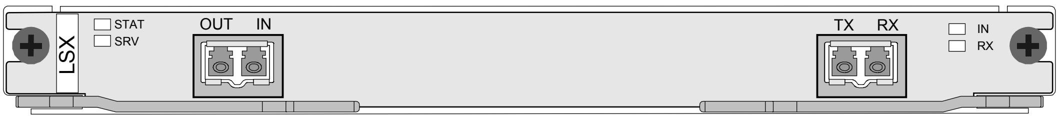
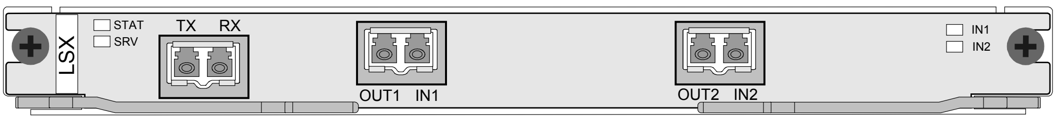


Figure 10-143 shows the front panel of the TNF2LSX.

Figure 10-143 Front panel of the TNF2LSX



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- Receive optical power status indicator (IN/RX and IN1/IN2)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

NOTE

The IN/RX ports are available only for the TNF1LSX board.

The IN1/IN2 ports are available only for the TNF2LSX board.

Ports

- When the TNF1LSX board implements to access one channel of optical signals, **Table 10-245** lists the type and function of each port.

Table 10-245 Types and functions of the TNF1LSX ports (access one channel of optical signals)

Port	Port Type	Function
IN/OUT	LC	Connected to the OADM board to receive/transmit the WDM signals.
TX/RX	LC	Transmits/receives the service signals to client-side equipment.

- When the TNF1LSX board implements to access one channel of OTU2 or OTU2e optical signals, **Table 10-246** lists the type and function of each port.

Table 10-246 Types and functions of the TNF1LSX ports (access one channel of OTU2 or OTU2e optical signals)

Port	Port Type	Function
OUT/RX	LC	Transmits/receives the regeneration OTU2/OTU2e service signals of the east direction.
TX/IN	LC	Transmits/receives the regeneration OTU2/OTU2e service signals of the west direction.

- When the TNF2LSX board implements to access one channel of optical signals, **Table 10-247** lists the type and function of each port.

Table 10-247 Types and functions of the TNF2LSX ports (access one channel of optical signals)

Port	Port Type	Function
IN1/OUT1	LC	Receives/Transmits the signal over the working channel of the optical add/drop multiplexer board on WDM equipment.
IN2/OUT2	LC	Receives/Transmits the signal over the protection channel of the optical add/drop multiplexer board on WDM equipment.

Port	Port Type	Function
TX/RX	LC	Transmits/receives the service signals to client-side equipment.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.17.6 Valid Slots

The LSX occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.17.7 Physical and Logical Ports

This section describes the display of ports on the board.

Display of Optical Ports

Table 10-248 lists the sequence number displayed on the U2000 of the port on the TNF1LSX board front panel.

Table 10-248 Display of the TNF1LSX optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	1
RX/TX	3

Table 10-249 lists the sequence number displayed on the U2000 of the port on the TNF2LSX board front panel.

Table 10-249 Display of the TNF2LSX optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
RX/TX	3

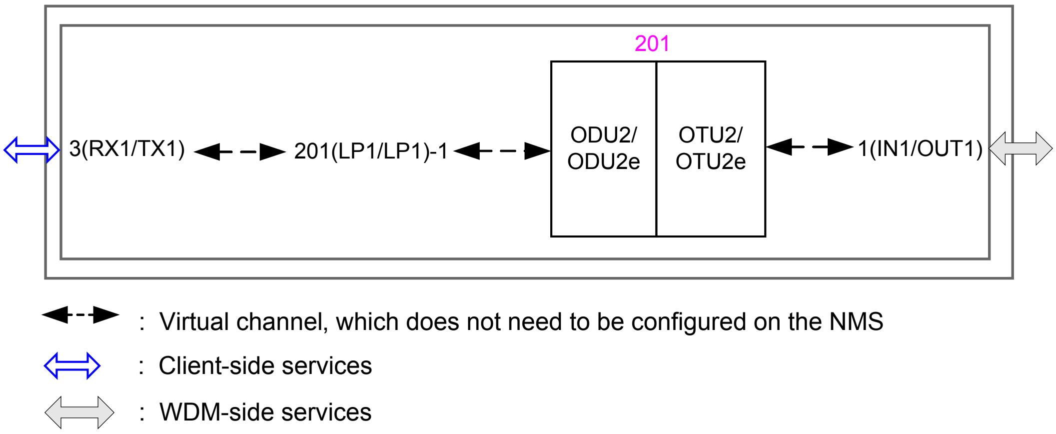
NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Port model of TNF1LSX board

Figure 10-144 shows the port model of the TNF1LSX board.

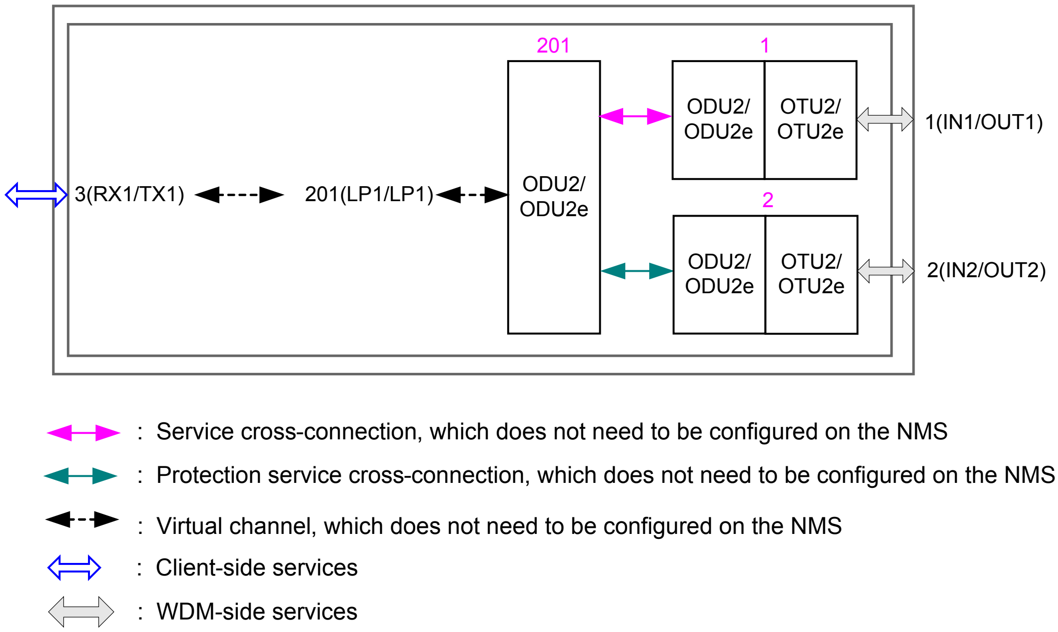
Figure 10-144 Port model of the TNF1LSX board



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical port 3(RX1/TX1).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1(IN1/OUT1).

Port model of TNF2LSX board

Figure 10-145 Port model of the TNF2LSX board



- Alarms and performance events related to client signal overheads are reported on channel 1 of client-side optical port 3(RX1/TX1).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1(IN1/OUT1), and 2(IN2/OUT2).
- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported on channel 1 of WDM-side optical ports 1 (IN1/OUT1) and 2 (IN2/OUT2).
- The WDM side supports intra-board 1+1 protection and ODUk SNCP (k = 2) protection. However, the two types of protection cannot be configured simultaneously. When intra-board 1+1 protection is configured, **Cross-Connection Configuration Mode** must be set to **Automatic**. Then the system automatically configures the following cross-connections: bidirectional cross-connections from port 201 to optical port 1 and unidirectional cross-connections from port 201 to optical port 2. When ODUk SNCP (k = 2) protection is configured, **Cross-Connection Configuration Mode** must be set to **Manual**.

10.17.8 LSX Parameters on the NMS

Parameter Description

Field	Value	Description
Cross-Connection Configuration Mode	• Automatic, Manual • Default: Manual	When intra-board 1+1 protection is configured for the board, set this parameter to **Automatic**. When ODUk SNCP protection is configured for the board, set this parameter to **Manual**. **NOTE** This parameter is only supported by the TNF2LSX.
Service Type	TNF1LSX: 10GE LAN, OTU-2, OTU-2e, STM-64, OC-192 Default: OTU-2 TNF2LSX: 10GE LAN, 10GE WAN, FC-1200, FICON 10G, FC-800, FICON 8G, OTU-2, OTU-2e, STM-64, OC-192 Default: 10GE LAN	Select a proper value according to the received services. **NOTE** TNF1LSX: The processing of the 10GE WAN service and the STM-64 service is the same. Therefore, when the 10GE WAN service is transmitted, you can configure it as the STM-64 service on the U2000. **NOTE** • Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.

Field	Value	Description
Port Mapping	Bit Transparent Mapping (11.1 G), MAC Transparent Mapping (10.7 G) Default: Bit Transparent Mapping (11.1 G)	This parameter is valid when **Service Type** is set to **10GE LAN**. ● When a board is used to transparently transmit synchronous Ethernet services, this parameter must be set to **Bit Transparent Mapping (11.1 G)**. ● Select **Bit Transparent Mapping (11.1 G)** when there are OTU2e signals on the WDM side. ● Select **MAC Transparent Mapping (10.7 G)** when there are OTU2 signals on the WDM side. **NOTE** Bit Transparent Mapping (11.1 G): Supports transparent bit (11.1 G) transport for 10GE LAN signals. In this port mapping mode, transmission of signals are achieved by increasing the OTU frame frequency. This ensures the encoding gain and correction capability of FEC. In this mode, the bit rate is 11.1 Gbit/s, which is higher than the standard bit rate of OTU2 signals. MAC Transparent Mapping (10.7 G): In this port mapping mode, 10GE LAN signals are encapsulated in the GFP-F format and then are mapped into standard OTU frames. This mode supports transparent transmission of only client 10GE MAC frames. In this mode, the signals are encapsulated in standard OTU2 frames and the bit rate of the signals is 10.71 Gbit/s. In addition, the FEC/AFEC code pattern is applicable to 10GE LAN services in this mode. Originally, the FEC code pattern is intended for 10G SDH services. **NOTE** ● Port mapping of the two boards that are interconnected with each other must be consistent.
FEC Working State	Enabled, Disabled Default: Enabled	● **Enabled** is recommended. ● **FEC Working State** of the two interconnected OTU boards must be consistent.
FEC Mode	FEC, AFEC Default: FEC	This parameter is available only when you set **FEC Working State** to **Enabled**. ● The default value is recommended. To improve the error correction capability, set this parameter to **AFEC**. ● **FEC Mode** of the two boards that are interconnected on the WDM side must be consistent. Otherwise, services are interrupted. **NOTE** The actual value is **AFEC-2**, but **AFEC** is displayed on the NMS. Users cannot set the FEC mode for client-side ports when they are used to receive and transmit OTU2/OTU2e services; they can set the FEC mode for WDM-side ports.

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	TNF1LSX: Enabled, Disabled Default: Disabled for client-side optical ports. TNF2LSX: Enabled, Disabled Default: Enabled for client-side optical ports.	• The default value is recommended. • On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query. In practical application, set this parameter according to the scenario where the board is used. For example, when the TNF1LSX board is used for regenerating OTU2 or OTU2e signals, set **Automatic Laser Shutdown** to **Disabled** for RX/TX optical ports.
ALS Auxiliary Condition	FW_Defect, BW_Client_R_LOS, BW_WDM_Defect Default: FW_Defect	Specifies auxiliary conditions for triggering ALS. • If a fault occurs on the client-side receiver of the upstream board or the WDM-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to FW_Defect. • If a fault occurs on the client-side receiver of the local board, the laser on the client-side transmitter of the local board must be shut down. For this situation, set this parameter to BW_Client_R_LOS. • If a fault occurs on the WDM-side receiver of the local board, the laser on the client-side transmitter of the upstream board must be shut down. For this situation, set this parameter to BW_WDM_Defect.
Hold-Off Time of Automatic Laser Shutdown	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.
Hold-off Time of Automatic Laser Turn-On	0s to 2s, with a step of 100 ms. Default: 0s	Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.

Field	Value	Description
Laser Status	TNF1LSX: ON, OFF Default: ● WDM side: ON ● Client side: ON TNF2LSX: ON, OFF Default: ● WDM side: ON ● Client side: OFF	● Usually, this parameter is set to **ON** for every WDM-side optical port. ● In the case of client-side optical ports, retain the default value because **Automatic Laser Shutdown** is usually set to **Enabled**. In practical application, set this parameter according to the scenario where the board is used. For example, when the TNF1LSX board is used for regenerating OTU2 or OTU2e signals, set **Laser Status** to **On** for RX/TX and IN/OUT optical ports. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the LSX board, the following situations occur when neither a standby channel is available nor protection is configured: ● When the TNF1LSX board is used for regenerating OTU2 or OTU2e signals, the NE becomes unreachable after the lasers at the RX/TX and IN/OUT optical ports on the TNF1LSX board are disabled. ● When the TNF1LSX/TNF2LSX board is used for transparently transmitting the 10 Gbit/s optical signals, the NE becomes unreachable after the lasers at the IN and OUT optical ports on the TNF1LSX/ TNF2LSX board are disabled.
Non-Intrusive Monitoring Status	Enabled, Disabled Default: Disabled	This parameter is valid when the board is used to receive SDH services. The default value is recommended. **NOTE** Only TNF1LSX supports this parameter.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Max. Packet Length	1518-9600 Default: 9600	This parameter is valid when **Service Type** is set to **10GE LAN** and **Port Mapping** is set to **MAC Transparent Mapping (10.7 G)**. The default value is recommended.
SD Trigger Condition	SM_BIP8_SD, PM_BIP8_SD, B1_SD Default: None	This parameter is valid only when the **SD Trigger Flag** is set to **Enable**. all the alarms can be set as the SD switching conditions.

Field	Value	Description
LPT Enabled	Enabled, Disabled Default: Disabled	This parameter is valid when **Service Type** is set to **10GE LAN**. ● The LPT function can work only with intra-board 1+1 protection and cannot work with any other protection. ● Set this parameter to **Enabled** when you want to enable the LPT function; otherwise, keep the default value for this parameter.
PRBS Test Status	Enabled, Disabled Default: /	● Retain the default value when a network works normally. ● Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
GCC Receive/ Transmit Mode	Dual fed and selective receiving, Independent Communication Default: Dual fed and selective receiving	● Independent Communication: In this mode, both WDM-side optical ports are allocated general communication channels (GCC) and they receive and transmit GCC signals separately. ● Dual fed and selective receiving: In this mode, only the active WDM-side optical port is allocated GCC channels. **NOTE** Only TNF2LSX supports this parameter. **CAUTION** The settings of **GCC Receive/Transmit Mode** for two interconnected boards must be the same; otherwise, the DCN communication is unavailable. For the boards that do not support **GCC Receive/Transmit Mode**, the parameter value is always set to **Dual fed and selective receiving**.
Planned Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: wavelength No./ optical port wavelength/ frequency, for example, 60/1552.52/193.100. Default: /	This parameter is used to set the wavelength and frequency only when the board uses TXFP modules on the WDM side.
Planned Band Type	C, CWDM Default: C	This parameter is available only when the board uses TXFP modules and must be set to **C**.

Field	Value	Description
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.17.9 LSX Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LSX	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 10Gbit/s single-mode-0.3km 10Gbit/s multi-mode-10km 10Gbit/s multi-mode-40km 10Gbit/s multi-mode-80km	N/A	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 10Gbit/s Multi-rate-10km 10Gbit/s Multi-rate-40km 10Gbit/s Multi-rate-80km

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF2LSX	800ps/nm-fixed-PIN-XFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP Multi-rate-10km-SFP+ Multi-rate-40km-SFP+ 10G BASE-SR 10G BASE-LR	N/A	800ps/nm-tunable-PIN-TXFP 800ps/nm-fixed-PIN-XFP 1600ps/nm-fixed-APD-XFP 1400ps/nm-fixed-APD-XFP 10Gbit/s Multi-rate-10km 10Gbit/s Multi-rate-40km 10Gbit/s Multi-rate-80km

NOTE

The ports on the WDM side support grey optical module.

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-250 Specifications of 800ps/nm-tunable-PIN-TXFP optical module

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Optical Module Type	-	NRZ-40 channels tunable
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	2
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	10
Central frequency	THz	192.10 to 196.00

Item	Unit	Value
		800ps/nm-tunable-PIN-TXFP
Central frequency deviation	GHz	±5
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	35
Dispersion tolerance	ps/nm	800
Eye pattern	-	-
Receiver parameter specifications at point R		
Receiver type	-	PIN
Operating wavelength range	nm	1270 to 1600
Receiver sensitivity	dBm	-16
Minimum receiver overload	dBm	0
Maximum reflectance	dB	-27

Table 10-251 Specifications of 800ps/nm-fixed-PIN-XFP and 1600ps/nm-fixed-APD-XFP optical modules

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	1600ps/nm-fixed-APD-XFP
Optical Module Type	-	NRZ-40 channels fixed	NRZ-40 channels fixed
Transmitter parameter specifications at point S			
Maximum mean launched power	dBm	2	3
Minimum mean launched power	dBm	-1	-1
Minimum extinction ratio	dB	10	8.2
Central frequency	THz	192.10 to 196.00	192.10 to 196.00[a]

Item	Unit	Value	
		800ps/nm-fixed-PIN-XFP	**1600ps/nm-fixed-APD-XFP**
Central frequency deviation	GHz	±10	±10
Maximum -20 dB spectral width	nm	0.3	0.3
Minimum side mode suppression ratio	dB	35	30
Dispersion tolerance	ps/nm	800	1600
Eye pattern	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	APD
Operating wavelength range	nm	1200 to 1650	1270 to 1600
Receiver sensitivity	dBm	-16	-24
Minimum receiver overload	dBm	0	-9
Maximum reflectance	dB	-27	-27
a: The module support 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, 193.6 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz and 196.0 THz in DWDM system, and support 1531 nm and 1551 nm in CWDM system.			

Table 10-252 Specifications of 1400ps/nm-fixed-APD-XFP optical module

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Line code format	-	NRZ
Target distance	km	70
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	4 (1471 nm to 1571 nm) 3 (1591 nm to 1611 nm)
Minimum mean launched power	dBm	0
Minimum extinction ratio	dB	8.2

Item	Unit	Value
		1400ps/nm-fixed-APD-XFP
Central wavelength	nm	1471 to 1611
Central wavelength deviation	nm	±6.5
Maximum -20 dB spectral width	nm	1
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	1400
Eye pattern mask	-	Compliant with Telcordia GR-253/ IEEE802.3ae/G.959
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1460 to 1620
Receiver sensitivity	dBm	-23 (1471 nm to 1551 nm) -22 (1571 nm) -21 (1591 nm to 1611 nm)
Minimum receiver overload	dBm	-9
Maximum reflectance	dB	-27

Table 10-253 Specifications of 10 Gbit/s single-rate and 10 Gbit/s Multi-rate optical modules

Item	Unit	Value			
Supported optical interface type	-	10 Gbit/s Single-rate -0.3 km	10 Gbit/s Multi-rate -10 km	10 Gbit/s Multi-rate -40 km	10 Gbit/s Multi-rate -80 km
Optical line code	-	NRZ	NRZ	NRZ	NRZ
Light source type	-	Multi-mode	SLM	SLM	SLM
Target distance	km	0.3	10	40	80
Transmitter characteristics at point S					
Operating wavelength range	nm	840 to 860	1290 to 1330	1530 to 1565	1530 to 1565
Maximum mean launched optical power	dBm	-1.3	-1	2	4

Item	Unit	Value			
Minimum mean launched optical power	dBm	-7.3	-6	-1	0
Minimum extinction ratio	dB	3	6	8.2	10
Maximum -20 dB spectrum width	nm	NA	NA	NA	NA
Minimum side-mode suppression ratio	dB	NA	NA	NA	NA
Eye pattern	-	Compliant with IEEE 802.3			
Receiver characteristics at point R					
Receiver type	-	PIN	PIN	PIN	APD
Operating wavelength range	nm	840 to 860	1290 to 1330	1260 to 1605	1270 to 1600
Receiver sensitivity (multirate)	dBm	-7.5	-11	-14	-24
Receiver sensitivity (10GE LAN)	dBm	-7.5	-14.4	-15.8	-24
Minimum overload point (multirate)	dBm	-1	-1	-1	-7
Minimum overload point (10GE LAN)	dBm	-1	0.5	-1	-7
Maximum reflectance	dB	-12	-27	-27	-27

NOTE

The preceding optical modules can be used on the WDM side grey optical modules.

Table 10-254 Specifications of Multi-Rate-SFP+ (with CDR) optical module

Item	Unit	Value	
		Multi-Rate-10km-SFP+	Multi-Rate-40km-SFP+
Rate	Gbit/s	9.95 to 11.1	9.95 to 11.1
Line code format	-	NRZ	NRZ
Optical source type	-	SLM	SLM
Target distance	km	10	40

Item	Unit	Value	
		Multi-Rate-10km-SFP+	**Multi-Rate-40km-SFP+**
Transmitter parameter specifications at point S			
Operating wavelength range	nm	1260 to 1355	1530 to 1565
Maximum mean launched power	dBm	-1	2
Minimum mean launched power	dBm	-6	-1
Minimum extinction ratio	dB	6	8.2
Maximum -20 dB spectral width	nm	NA	0.5
Minimum side mode suppression ratio	dB	NA	30
Eye pattern mask	-	Compliant with IEEE802.3/G.959.1/G.691	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	1260 to 1600	1260 to 1605
Receiver sensitivity	dBm	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	-16 (9.95Gbit/s) -15.8(10.3Gbit/s)
Minimum receiver overload	dBm	0.5	-1
Maximum reflectance	dB	-14	-27

Table 10-255 Specifications of 10G BASE-SR/10G BASE-LR optical modules

Item	Unit	Value	
Supported optical interface type	-	10G BASE-SR	10G BASE-LR
Line code format	-	NRZ	NRZ
Light source type	-	Multi-mode	SLM

Item	Unit	Value	
Target distance	km	0.3	10
Transmitter parameter specifications at point S			
Operating wavelength range	nm	840 to 860	1290 to 1330
Maximum mean launched power	dBm	-1	0.5
Minimum mean launched power	dBm	-7.3	-8.2
Minimum extinction ratio	dB	3	3.5
Eye pattern mask	-	Compliant with Telcordia GR-253/IEEE 802.3ae/G.959	
Receiver parameter specifications at point R			
Receiver type	-	PIN	PIN
Operating wavelength range	nm	840 to 860	1290 to 1330
Receiver sensitivity	dBm	-11.1	-14.4
Minimum receiver overload	dBm	-1	0.5
Maximum reflectance	dB	-12	-12

Mechanical Specifications

TNF1LSX/TNF2LSX

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.75 kg (1.65 lb.)

Power Consumption

Board	Typical Power Consumption at 25°C (77°F)	Maximum Power Consumption at 55°C (131°F)
TNF1LSX	21.9W	24.2W
TNF2LSX	17.3W	17.9W

10.18 LWX2

LWX2: Double Arbitrary Bit Rate Wavelength Conversion Board

10.18.1 Version Description

The available hardware version for the LWX2 is TNF1.

Version

Table 10-256 describes the version mapping of the LWX2 board. The mapping version of the equipment is V100R001C01 or later.

Table 10-256 Version description of the LWX2

Item	Description
Board hardware version	TNF1

10.18.2 Application

The LWX2 can be used in two different application scenarios: transparent transmission of two optical signals at any rate, and regeneration of two OTU1 optical signals.

Service Access Description

Table 10-257 describes the principle for configuring the ports of the LWX2 board.

Table 10-257 Principle for configuring the ports of the LWX2 board

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports	Remarks
Transparent transmission of two optical signals at any rate	Service signals at any rate in the range of 42 Mbit/s to 2.67 Gbit/s rate excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s	2	TX1/RX1 and TX2/RX2	The bandwidth of the service received by each port should be in the range of 42 Mbit/s to 2.67 Gbit/s excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s.

Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports	Remarks
Regeneration of two OTU1 optical signals	OTU1 optical signals	4	• The first regeneration wavelength: OUT1/RX1 and TX1/IN1 • The second regeneration wavelength: OUT3/RX2 and TX2/IN3	• RX1 receives the first east regeneration wavelength and OUT1 transmits the first east regeneration wavelength. IN1 receives the first west regeneration wavelength and TX1 transmits the first west regeneration wavelength. • RX2 receives the second east regeneration wavelength and OUT3 transmits the second east regeneration wavelength. IN3 receives the second west regeneration wavelength and TX2 transmits the second west regeneration wavelength. • The IN1/OUT1 and IN2/OUT2 optical ports on the WDM side corresponding to the RX1/TX1 optical port on the client side. This implements the dual fed and selective receiving function. • The IN3/OUT3 and IN4/OUT4 optical ports on

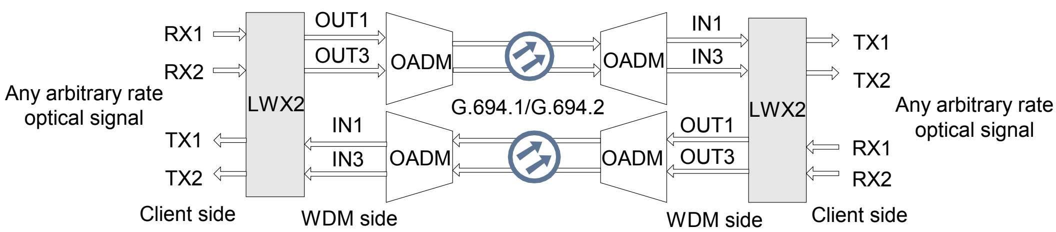
Application Scenario of the Board	Service Access	Number of Available Ports	Names of Available Ports	Remarks
				the WDM side corresponding to the RX2/TX2 optical port on the client side. This implements the dual fed and selective receiving function.

Application Scenario 1: Implements the Transparent Transmission of Two Any Services

The LWX2 board is mainly used to access two channels of Any (at any rate in the range of 42 Mbit/s to 2.67 Gbit/s excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s) signals, and convert the signals into DWDM standard wavelength compliant with ITU-T G.694.1 or CWDM standard wavelength compliant with ITU-T G.694.2.

For the application of the board to implement the transparent transmission of two channels of optical signals at any rate, see **Figure 10-146**.

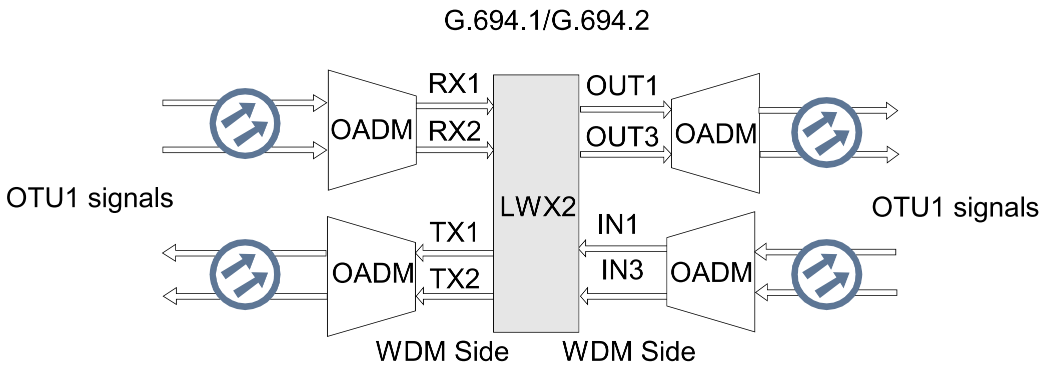
Figure 10-146 Application of the LWX2 board (access two channels of Any Services)



Application Scenario 2: Implements the Regeneration of Two Channels of OTU1 Signals

For the application of the board as a regeneration board of two OTU1 optical signals, see **Figure 10-147**.

Figure 10-147 Application of the LWX2 board (access two channels of OTU1 optical signals)



NOTE

- When the LWX2 board is used to regenerate OTU1 signals, optical port modules must be used on the client side of the LWX2 board.

NOTE

- When the LWX2 board does not receive any services on the client side, an R_LOS alarm is reported on the WDM side of the peer board.

Background Information

Table 10-258 describes the service rates of common service types.

Table 10-258 Service rates of common service types

Service Type		Service Rate (Mbit/s)
OTN	OTU1	2667.0
	STM-16	2488.3
	STM-4	622.2
SDH	STM-1	155.5
SAN	FC200	2125.0
	FC100	1062.5
	FC50	531.2
	FC25	255.6
Ethernet	GE	1250.0
	FE	125.0
ESCON		200.0
FICON		1062.0
FICON EXPRESS		2124.0

Service Type	Service Rate (Mbit/s)
DVB-ASI	270.0
SDI	270.0
HD-SDI	1485.0 or 1483.5
CPRI	2457.6
	1228.8
	614.4

10.18.3 Functions and Features

The main functions and features supported by the LWX2 are wavelength conversion, system clock processing and ALS.

For detailed information about the functions and features, see **Table 10-259**.

Table 10-259 Functions and features of the LWX2

Functions and Features	Description
Basic function	The board is used to reshape, regenerate, and retime two channels of the service signals at any rate in the range of 42 Mbit/s to 2.67 Gbit/s rate excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s in both the transmit and receive directions. The board supports bidirectional regeneration of two channels of OTU1 optical signals on the client side. Converts the accessed services into the G.694.1-compliant DWDM wavelength or the G.694.2-compliant CWDM wavelength. The reverse process is similar. The optical ports on the WDM side provide the dual fed and selective receiving function.

Functions and Features	Description
Services type	• Transparent transmission services: – GE: Ethernet services, the rate is 1.25 Gbit/s. Supports GE optical signals and GE electrical signals. – FE: Ethernet services, the rate is 125 Mbit/s. Supports FE optical signals and FE electrical signals. – STM-1: SDH service, the rate is 155.52 Mbit/s. – STM-4: SDH service, the rate is 622.08 Mbit/s. – STM-16: SDH service, the rate is 2.488 Gbit/s. – ESCON: Enterprise system connection services, the rate is 200 Mbit/s. – FC100: Fiber channel services, the type is 1.06 Gbit/s. – FC200: Fiber channel services, the rate is 2.12 Gbit/s. – FICON: Fiber channel services, the rate is 1.06 Gbit/s. – FICON EXPRESS: Fiber channel services, the rate is 2.12 Gbit/s. – DVB-ASI (Digital Video Broadcasting -Asynchronous Serial Interface): Digital TV services, the rate is 270 Mbit/s. – SDI (Digital Video Broadcasting - Serial Digital Interface): Digital TV services, the rate is 270 Mbit/s. – HD-SDI: High-definition digital TV services, the rate is 1.485 Gbit/s. – CPRI option1: The rate is 0.6144 Gbit/s. – CPRI option2: The rate is 1.2288 Gbit/s. – CPRI option3: The rate is 2.4576 Gbit/s. – Other services at any rate in the range of 42 Mbit/s to 2.67 Gbit/s rate excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s. • Regeneration services: – OTU1: OTN services, the rate is 2.67 Gbit/s. **NOTE** The "SDI" is also called the "SD-SDI" according to SMPTE 259M standard.
Alarms and performance events monitoring	Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.
FEC function	Not supported
Regeneration board	The WDM-side signals of the LWX2 board can be regenerated by the LWX2 board.

Functions and Features	Description
Protection schemes	● Supports intra-board wavelength protection. ● Supports client 1+1 protection
Loopback	● Supports WDM side outloop ● Supports client side inloop ● Supports client side outloop
ALS function	Supports the ALS function on the client side. **NOTE** ● When the client side receives OTU1 services, the ALS function is disabled. That is, the laser stays in enabling state. **NOTE** ● When the client side receives CPRI services and is configured with intra-board wavelength protection, the ALS function is disabled. That is, the laser stays in enabling state. The ALS function is enabled after intra–board wavelength protection is deleted.
ESC function	Not supported
Cross-connect function	Not supported
LPT function	Not supported
PRBS test	Supports the PRBS function on the TX1/RX1 port of client side.
Ethernet port working mode	● GE optical port: 1000M full-duplex or auto-negotiation ● GE electrical port: auto-negotiation ● FE optical port: 100M full-duplex ● FE electrical port: 100M full-duplex
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.

<table>
<tr><th>Functions and Features</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">Protocol or standard compliance</td><td>Protocols or standards (non-performance monitoring) with which transparently transmitted services comply</td><td>IEEE 802.3u
IEEE 802.3z
ITU-T G.707
ITU-T G.782
ITU-T G.783
NCITS FIBRE CHANNEL PHYSICAL INTERFACES (FC-PI)
NCITS FIBRE CHANNEL LINK SERVICES (FC-LS)
NCITS FIBRE CHANNEL FRAMING AND SIGNALING-2 (FC-FS-2)
NCITS FIBRE CHANNEL BACKBONE-3 (FC-BB-3)
NCITS FIBRE CHANNEL SWITCH FABRIC-3 (FC-SW-3)
NCITS FIBRE CHANNEL - PHYSICAL AND SIGNALING INTERFACE (FC-PH)
SMPTE 292M Bit-Serial Digital Interface for High-Definition Television Systems
ETSI TR 101 891 Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI)
SMPTE 259M 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals - Serial Digital Interface
NCITS SBCON Single-Byte Command Code Sets CONnection architecture (SBCON)
CPRI Specification V4.1</td></tr>
<tr><td>Protocols or standards (performance monitoring) for processing services</td><td>-</td></tr>
</table>

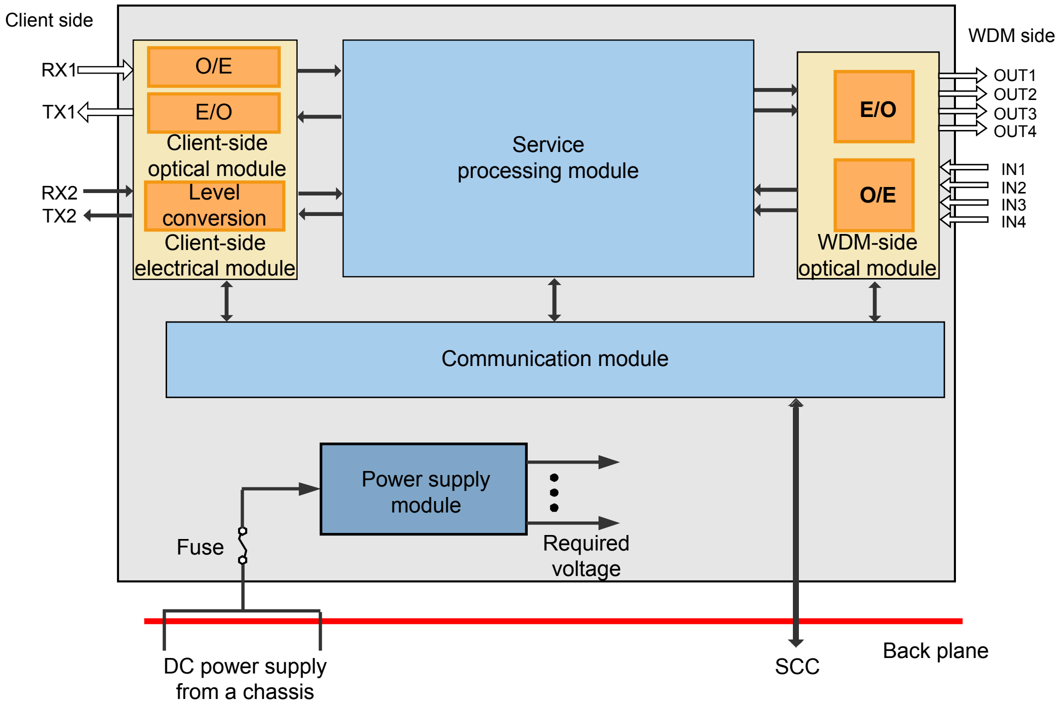
10.18.4 Working Principle and Signal Flow

The LWX2 consists of the client-side optical module or client-side electrical module, the WDM-side optical module, the service processing module, the communication module, and the power supply module.

Signal Flow of Transparent Transmission of Two Channels of Signals at Any Rate

Figure 10-148 is the functional block diagram of the LWX2 that implement the transparent transmission of two channels of signals at any rate. The diagram shows that the optical SFP module is used in the RX1/TX1 ports and the electrical SFP module is used in the RX2/TX2 ports.

Figure 10-148 Functional block diagram of the LWX2 (transparent transmission of two channels of signals at any rate)



In the signal flow of the LWX2, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LWX2 to the WDM side of the LWX2, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives optical signals from client equipment through the RX1 and RX2 ports, and performs O/E conversion.
  - The client-side electrical module receives electrical signals from client equipment through the RX1 and RX2 ports, and performs level conversion.

  After conversion, the signals are sent to the service processing module where reshaping, regenerating and retiming are performed.

  The WDM-side optical module performs E/O conversion of the signals. Then, the module sends out the G. 694.1-compliant optical signals at DWDM standard wavelengths or the G. 694.2-compliant optical signals at CWDM standard wavelengths. The optical signals are output through the OUT1 to OTU4 optical ports.
- Receive direction

  The WDM-side optical module receives the G.694.1-compliant optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths from the WDM side through the IN1 to IN4 optical ports. Then, the module performs O/E conversion.

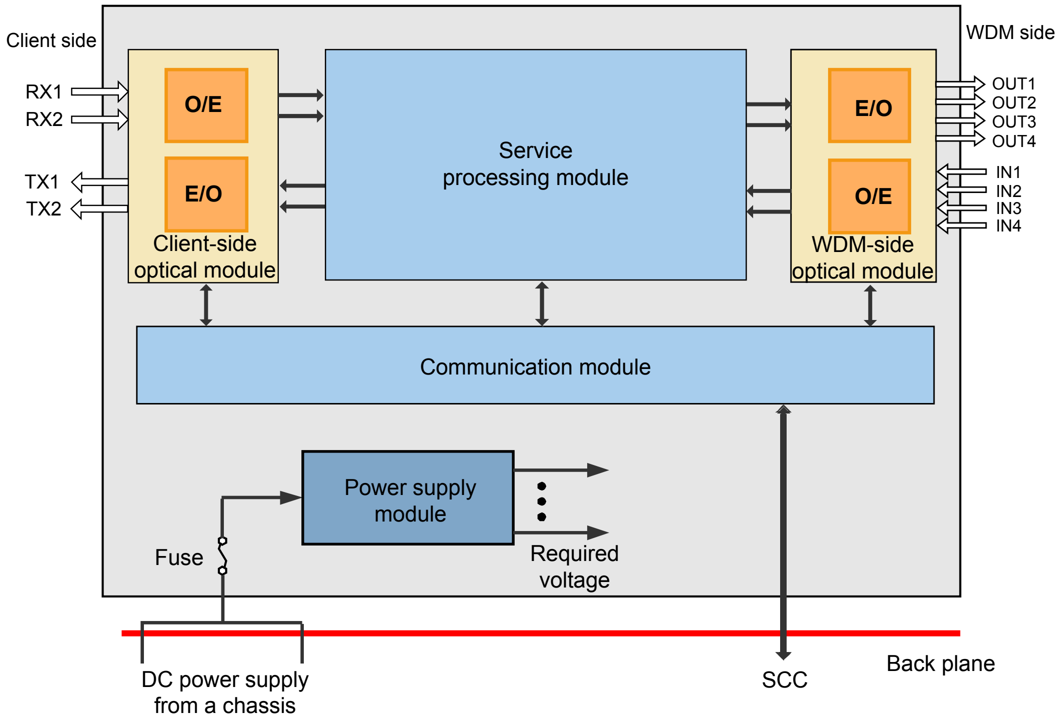
  After O/E conversion, the signals are sent to the service processing module where reshaping, regenerating and retiming are performed.

The client-side optical module performs E/O conversion, and then outputs client-side signals through the TX1 and TX2 ports.

Signal Flow of Regeneration of Two Channels of OTU1 Signals

Figure 10-149 is the functional block diagram of the LWX2 board that implements the regeneration of two channels of OTU1 signals.

Figure 10-149 Functional block diagram of the LWX2 (regeneration of two channels of OTU1 signals)



In the signal flow of the LWX2, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the LWX2 to the WDM side of the LWX2, and the receive direction is defined as the reverse direction.

- Transmit direction

  The client-side optical module receives OTU1 optical signals from client equipment through the RX1 and RX2 ports, and performs O/E conversion.

  After O/E conversion, the signals are sent to the service processing module where reshaping, regenerating and retiming are performed.

  The WDM-side optical module performs E/O conversion of the signals. Then, the module sends out the G. 694.1-compliant optical signals at DWDM standard wavelengths or the G. 694.2-compliant optical signals at CWDM standard wavelengths. The optical signals are output through the OUT1 to OUT4 optical port.

- Receive direction

  The WDM-side optical module receives the G.694.1-compliant optical signals at DWDM standard wavelengths or the G.694.2-compliant optical signals at CWDM standard wavelengths from the WDM line side through the IN1 to IN4 optical port. Then, the module performs O/E conversion.

After O/E conversion, the signals are sent to the service processing module where reshaping, regenerating and retiming are performed.

The client-side optical module performs E/O conversion, and then outputs client-side OTU1 optical signals through the TX1 and TX2 ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the O/E conversion of optical signals in any format.
  - Client-side transmitter: Performs E/O conversion from the internal electrical signals to optical signals in any format.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.

- Client-side electrical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Performs the level conversion of GE electrical signals.
  - Client-side transmitter: Performs level conversion from the internal electrical signals to GE electrical signals.

- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Performs O/E conversion of optical signals at any rate.
  - WDM-side transmitter: Performs E/O conversion from the internal electrical signals to optical signals at the arbitrary rate.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.

- Service processing module

  The module performs reshaping, regenerating and retiming of the signals.

- Communication module

  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.

- Power supply module

  - Converts the DC power into the power required by each module of the unit.

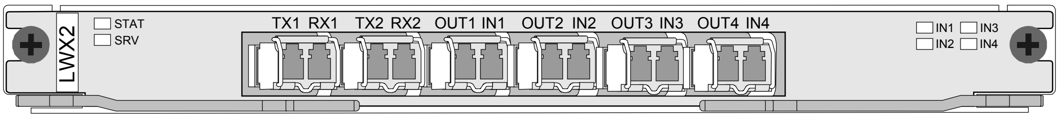
10.18.5 Front Panel

There are indicators and ports on the LWX2 front panel.

Appearance of the Front Panel

Figure 10-150 shows the front panel of the LWX2.

Figure 10-150 Front panel of the LWX2



NOTE

Figure 10-150 show the situation that the ports are inserted with optical SFP modules.

Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

- When the LWX2 board implements the transparent transmission of two optical signals at any rate, **Table 10-260** lists the type and function of each port.

Table 10-260 Types and functions of the LWX2 ports (transparent transmission of two optical signals at any rate)

Port	Port Type	Function	Remarks
IN1/OUT1	LC	Connected to the OADM board to receive/transmit the first group WDM signals coming from the active channel.	● The IN1/OUT1 and IN2/OUT2 optical ports on the WDM side corresponding to the RX1/TX1 optical port on the client side. This implements the dual fed and selective receiving function. ● The IN3/OUT3 and IN4/OUT4 optical ports on the WDM side corresponding to the RX2/TX2 optical
IN2/OUT2	LC	Connected to the OADM board to receive/transmit the first group WDM signals coming from the standby channel.	
IN3/OUT3	LC	Connected to the OADM board to receive/transmit the second group WDM signals coming from the active channel.	

Port	Port Type	Function	Remarks
IN4/OUT4	LC	Connected to the OADM board to receive/transmit the second group WDM signals coming from the standby channel.	port on the client side. This implements the dual fed and selective receiving function.
TX1/RX1	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the first group service signals to client-side equipment. Corresponds to the IN1/OUT1 and IN2/OUT2 ports	
TX2/RX2	LC (optical ports) RJ-45 (electrical ports)	Transmits/receives the second group service signals to client-side equipment. Corresponds to the IN3/OUT3 and IN4/OUT4 ports	

- When the LWX2 board implements the regeneration of two OTU1 optical signals, **Table 10-261** lists the type and function of each port.

Table 10-261 Types and functions of the LWX2 ports (regeneration of two OTU1 optical signals)

Port	Port Type	Function	Remarks
OUT1/RX1	LC	Transmits/receives the east optical signals of the first OTU1 regeneration coming from the active channel.	• The IN1/OUT1 and IN2/OUT2 optical ports on the WDM side corresponding to the RX1/TX1 optical port on the client side. This implements the dual fed and selective receiving function. • The IN3/OUT3 and IN4/OUT4 optical ports on the WDM side corresponding to the RX2/TX2 optical port on the client side. This implements the dual fed and selective receiving function.
OUT2/RX1	LC	Transmits/receives the east optical signals of the first OTU1 regeneration coming from the standby channel.	
OUT3/RX2	LC	Transmits/receives the east optical signals of the second OTU1 regeneration coming from the active channel.	

Port	Port Type	Function	Remarks
OUT4/RX2	LC	Transmits/receives the east optical signals of the second OTU1 regeneration coming from the standby channel.	
TX1/IN1	LC	Transmits/receives the west optical signals of the first OTU1 regeneration coming from the active channel.	
TX1/IN2	LC	Transmits/receives the west optical signals of the first OTU1 regeneration coming from the standby channel.	
TX2/IN3	LC	Transmits/receives the west optical signals of the second OTU1 regeneration coming from the active channel.	
TX2/IN4	LC	Transmits/receives the west optical signals of the second OTU1 regeneration coming from the standby channel.	

NOTE

- The RX1/TX1 and RX2/TX2 ports on the client side support the optical port SFP module, electrical port SFP module, and single-fiber bidirectional GE SFP module. The preceding SFP modules can be used on the client side at the same time. The ports on the client side can access Any optical signals, GE/FE electrical signals, or GE optical signals through the replacement of the SFP modules.

NOTE

- FE electrical ports can use only crossover cables.

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.18.6 Valid Slots

The LWX2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

10.18.7 Physical and Logical Ports

This section describes the display of ports on the board and provides the configuration rules for this board on the NMS.

Display of Optical Ports

Table 10-262lists the sequence number displayed in an NMS system of the ports on the LWX2 board front panel.

Table 10-262 Display of the LWX2 ports

Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
IN3/OUT3	3
IN4/OUT4	4
TX1/RX1	5
TX2/RX2	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

Service Package

The LWX2 board supports two types of service packages for the GE service, as shown in **Table 10-263**.

Table 10-263 Configuration of the service packages of the LWX2 board

Service Package Mode	Port	Accessed Service	Configuration Method
GE service package	5(TX1/RX1)	GE	See Configuring Services in Service Package Mode.
	6(TX2/RX2)	GE	
GE/SDH(STM-1) service package	5(TX1/RX1)	GE	
	6(TX2/RX2)	GE	

10.18.8 LWX2 Parameters on the NMS

Parameter Description

Field	Value	Description
Client Side Service Bearer Rate (M)	Any rate in the range of 42 Mbit/s to 2.67 Gbit/s rate excluding the ranges of 400 Mbit/s to 500 Mbit/s, 800 Mbit/s to 1000 Mbit/s, and 1.6 Gbit/s to 2.0 Gbit/s Default: 2667.0 Mbit/s	Select a proper service type according to the actually received services or enter a service rate directly. The service rate must be accurate to 0.1 Mbit/s. For example, when the board is used to receive STM-16 services, you need to enter **2488.3**. **NOTE** After you set **Client Service Bearer Rate (M)** for the RX1/TX1 and the RX2/TX2 optical ports, the service rates are automatically updated at the corresponding IN1/OUT1 and IN3/OUT3 optical ports. That is, you do not need to set **Client Service Bearer Rate (M)** for the IN1/OUT1 and IN3/OUT3 optical ports. When setting the service rates at the IN1/OUT1 and IN3/OUT3 optical ports, make sure that the service rates on the client and WDM sides of the same channel are the same. That is, the service rate at the RX1/TX1 optical ports must be the same as that at the corresponding IN1/OUT1 optical ports; the service rate at the RX2/TX2 optical ports must be the same as that at the corresponding IN3/OUT3 optical ports. **NOTE** ● Before services are connected to the board, configure the service transmitting rate on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Automatic Laser Shutdown	Enabled, Disabled Default: Enabled for client-side optical ports.	● The default value is recommended. ● On the WDM side, this automatic laser shutdown function is not supported and therefore cannot be set or query. In practical application, set this parameter according to the scenario where the board is used. For example, when the LWX2 board functions as a regeneration board, set **Automatic Laser Shutdown** to **Disabled** for the IN1/OUT1, IN3/OUT3, RX1/TX1, and RX2/TX2 optical ports. **NOTE** When OTU1 services are received on the client side, the ALS function is disabled on the LWX2 board. That is, all lasers stay in enabled state.

<table>
<tr><th>Field</th><th>Value</th><th>Description</th></tr>
<tr><td>Hold-Off Time of Automatic Laser Shutdown</td><td>0s to 2s, with a step of 100 ms.
Default: 0s</td><td>Specifies the hold-off time for automatically disabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service interruption to the point when ALS automatically shuts down the related lasers.</td></tr>
<tr><td>Hold-off Time of Automatic Laser Turn-On</td><td>0s to 2s, with a step of 100 ms.
Default: 0s</td><td>Specifies the hold-off time for automatically enabling lasers. With ALS enabled, the hold-off time is a time period from the point when the system detects service recovery to the point when ALS automatically enables the related lasers.</td></tr>
<tr><td>Laser Status</td><td>ON, OFF
Default:
WDM side: ON
Client side: OFF</td><td>Usually, this parameter is set to ON for every WDM-side optical port.
In the case of client-side optical ports, retain the default value because Automatic Laser Shutdown is usually set to Enabled.
In practical application, set this parameter according to the scenario where the board is used. Examples are as follows:
When the LWX2 board is used as a regeneration board, set Laser Status to On for the IN1/OUT1, IN3/OUT3, RX1/TX1, and RX2/TX2 optical ports.
When the LWX2 board is used as a transparent transmission board, set Laser Status to On for the IN1/OUT1, and IN3/OUT3 optical ports. Automatic Laser Shutdown of the RX1/TX1, and RX2/TX2 optical ports is set to Enabled. Hence, lasers on client-side optical ports are enabled and disabled automatically according to the signal receiving conditions. That is, you do not need to set this parameter manually.
CAUTION
If the LWX2 board is used as a regeneration board between NEs and NEs communicates with each other through only the ESC provided by the OTU regenerated on the LWX2 board, do not disable the lasers on the LWX2 board. Otherwise, NEs become unreachable when neither a standby channel is available nor protection is configured.
NOTE
Service signals between NEs are regenerated by the LWX2 board and the communication between NEs is achieved through only ESC. If neither a standby channel is available nor protection is configured, the NEs are unreachable to the U2000 after the lasers on the LWX2 board are shut down.</td></tr>
</table>

Field	Value	Description
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
PRBS Test Status	Enabled, Disabled Default: /	• Retain the default value when a network works normally. • Set this parameter to **Enabled** for the auxiliary board if you need to perform a PRBS test during deployment commissioning. Set this parameter to **Disabled** after the test is complete.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.
Optical Interface/ Channel	-	-

10.18.9 LWX2 Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1LWX2	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP 1000BASE-SX-0.5km 1000BASE-LX-10km 1000BASE-LX-40km 1000BASE-ZX-80km 1000BASE-BX-10km (SM1310) 1000BASE-BX-10km (SM1490) 1000BASE-BX-40km (SM1310) 1000BASE-BX-40km (SM1490) I-16 S-16.1 L-16.2 S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2	GE electrical module FE electrical module	2400ps/nm-fixed-APD-eSFP 1600ps/nm-fixed-APD-eSFP 800ps/nm-fixed-PIN-eSFP

Specifications for Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-264 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

Table 10-265 Specifications of 1600ps/nm-fixed-APD-eSFP and 800ps/nm-fixed-PIN-eSFP optical modules

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum wavelength count	-	8	8
Line code format	-	NRZ	NRZ
Target distance	km	80	40
Transmitter parameter specifications at point S			

Item	Unit	Value	
		1600ps/nm-fixed-APD-eSFP	800ps/nm-fixed-PIN-eSFP
Maximum mean launched power	dBm	5	5
Minimum mean launched power	dBm	0	0
Minimum extinction ratio	dB	10	8.2
Central wavelength	nm	1471 to 1611	1471 to 1611
Central wavelength deviation	nm	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1
Minimum side mode suppression ratio	dB	30	30
Dispersion tolerance	ps/nm	1600	800
Eye pattern mask	-	G.957-compliant	
Receiver parameter specifications at point R			
Receiver type	-	APD	PIN
Operating wavelength range	nm	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19
Minimum receiver overload	dBm	-9	-3
Maximum reflectance	dB	-27	-27

NOTE

In **Table 10-264** and **Table 10-265**, the eye pattern mask indicates the eye pattern mask of the signals on the WDM side when the OTU1 service is accessed on the client side. When the client side accesses other services, the eye pattern mask of the signals on the WDM side is the same as that of the services on the client side.

Table 10-266 Specifications of 1000BASE-SX/1000BASE-LX/1000BASE-ZX optical modules

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Line code format	-	NRZ	NRZ	NRZ	NRZ

Item	Unit	Value			
		1000BASE-SX-0.5km	1000BASE-LX-10km	1000BASE-LX-40km	1000BASE-ZX-80km
Target distance	km	0.5	10	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Maximum mean launched power	dBm	-2.5	-3	0	5
Minimum mean launched power	dBm	-9.5	-9	-5	-2
Minimum extinction ratio	dB	9	9	9	9
Eye pattern mask	-	IEEE802.3z-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	PIN	PIN
Operating wavelength range	nm	770 to 860	1270 to 1355	1270 to 1355	1500 to 1580
Receiver sensitivity	dBm	-17	-20	-23	-23
Minimum receiver overload	dBm	0	-3	-3	-3

Table 10-267 Specifications of I-16/S-16.1/L-16.2 optical modules

Item	Unit	Value			
		I-16	S-16.1	L-16.1	L-16.2
Line code format	-	NRZ	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM	SLM

Item	Unit	Value			
		I-16	**S-16.1**	**L-16.1**	**L-16.2**
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1266 to 1360	1260 to 1360	1280 to 1335	1500 to 1580
Maximum mean launched power	dBm	-3	0	3	3
Minimum mean launched power	dBm	-10	-5	-2	-2
Minimum extinction ratio	dB	8.5	8.2	8.2	8.2
Maximum -20 dB spectral width	nm	NA	1	1	1
Minimum side mode suppression ratio	dB	NA	30	30	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1280 to 1335	1200 to 1650
Receiver sensitivity	dBm	-18	-18	-27	-28
Minimum receiver overload	dBm	-3	0	-9	-9
Maximum reflectance	dB	-27	-27	-27	-27

Table 10-268 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	**L-4.1**	**L-4.2**
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-269 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	S-1.1	L-1.1	L-1.2
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Specifications for Client-Side Electrical Modules

Table 10-270 Specifications of FE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	100
Transmission distance	m	100
Transmission bandwidth	-	98%
Maximum transmission packet	byte	9600
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3 and enterprise regulations ● 100Base-T interface test regulations

Table 10-271 Specifications of GE electrical modules

Item	Unit	Value
Electrical interface rate	Mbit/s	1000
Transmission distance	m	100
Transmission bandwidth	-	98%
RJ-45 electrical interface specification	-	Compliant with the following norms: ● IEEE 802.3ab and enterprise regulations ● 1000Base-T interface test regulations

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.69 kg (1.52 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 5.1 W

- Maximum Power Consumption at 55°C (131°F): 9.7 W

10.19 TSP

TSP: 21-channel E1/T1 and 2-channel STM-1 Service Convergence and Wavelength Conversion Board

10.19.1 Version Description

The available hardware version for the TSP is TNF1.

Version

Table 10-272 describes the version mapping of the TSP board. The mapping version of the equipment is V100R002C00 or later.

Table 10-272 Version description of the TSP

Item	Description
Board hardware version	TNF1

Type

The system provides two types of the TSP, **Table 10-273** lists the types of the TSP.

Table 10-273 Type description of the TSP

Board Name	Description
TSPA	21-channel E1/T1 and 2-channel STM-1 service convergence and wavelength conversion board (75-ohm E1)
TSPB	21-channel E1/T1 and 2-channel STM-1 service convergence and wavelength conversion board (120-ohm E1/100-ohm T1)

10.19.2 Application

The TSP board can access 21 channels of E1/T1 electrical signals and two channels of STM-1 optical signals, and convert the input signals into two channels of STM-1/STM-4 optical signals.

Service Access Description

Table 10-274 describes the principle for configuring the ports of the TSP board.

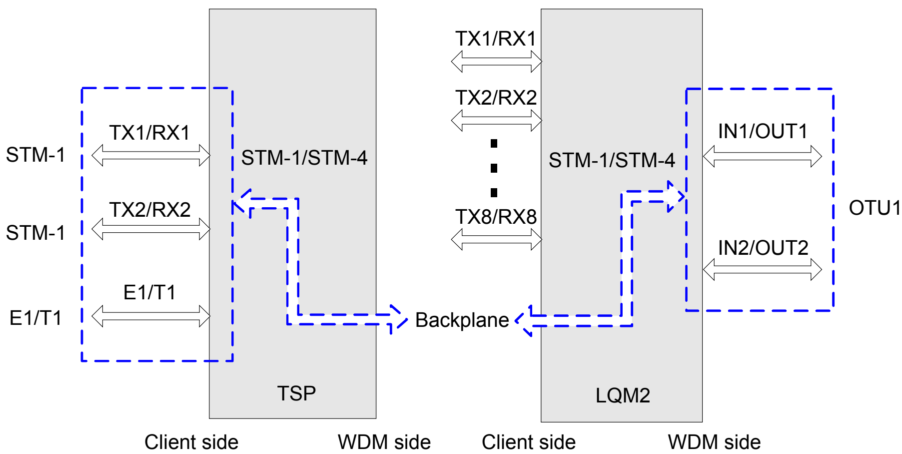
Table 10-274 Principle for configuring the ports of the TSP board

Application Scenario of the Board	Service Access	Number of Available Service Access	Names of Available Ports	Remarks
Access of two channels of STM-1 optical signals	STM-1	2	TX1/RX1 to TX2/RX2	-
Access of 21 channels of E1/T1 electrical signals	E1/T1	21	E1/T1	-

Application Scenario 1: Interconnection with the LQM2 Board by Using the Backplane

The TSP board can be interconnected with the LQM2 board by using the backplane to cross-connect STM-1/STM-4 signals, achieving the transmission of E1/T1 signals on the WDM network. For details, see **Figure 10-151**.

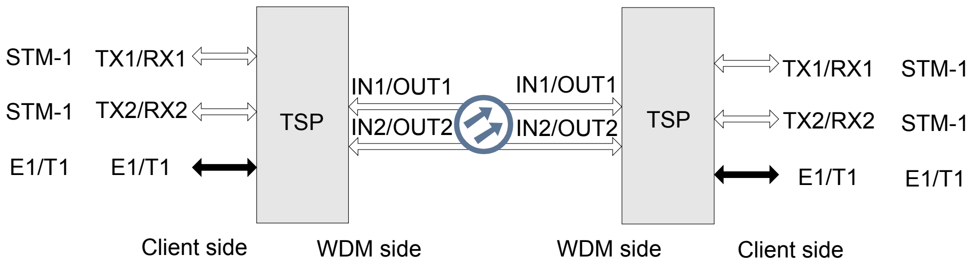
Figure 10-151 Interconnection with the LQM2 board by using the backplane



Application Scenario 2: Interconnection Between TSP Boards

The TSP board can be used either on a ring or chain network. On the networks, NEs are interconnected by using TSP boards. For details, see **Figure 10-152**.

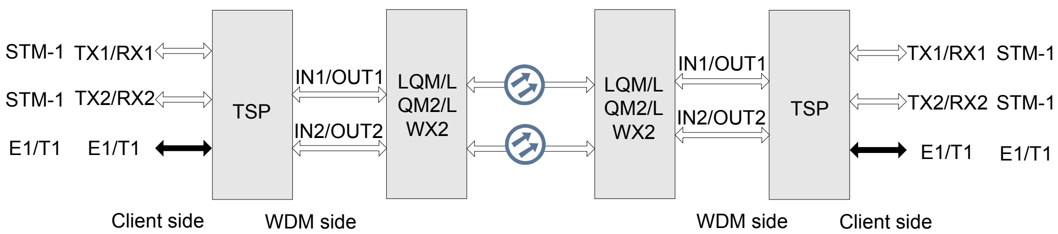
Figure 10-152 Interconnection between TSP boards



Application Scenario 3: Interconnection with the LQM/LQM2/LWX2 Board

The TSP board can be interconnected with the LQM/LQM2/LWX2 board by directly connecting the WDM-side ports on the TSP board to the client-side ports on the LQM/LQM2/LWX2 board, achieving the transmission of E1/T1 signals on the WDM network. For details, see **Figure 10-153**.

Figure 10-153 Interconnection with the LQM/LQM2/LWX2 board



10.19.3 Functions and Features

The main functions and features supported by the TSP board are wavelength conversion, cross-connections, clock, and multiplexing of STM-1/E1/T1 signals.

For detailed functions and features, see **Table 10-275**.

Table 10-275 Functions and features of the TSP board

Function and Feature	Description
Basic Function	Accesses 21 channels of E1/T1 electrical signals and two channels of STM-1 optical signals, and converts the input signals into two channels of STM-1/STM-4 optical signals. The optical ports on the WDM side provide the dual fed and selective receiving function (implemented through the electrical-layer SNCP).

Function and Feature	Description
Service type	- STM-1: SDH services, the rate is 155.52 Mbit/s. - E1(75/120 ohms): PDH services, the rate is 2.048 Mbit/s. - T1 (100 ohms): PDH services, the rate is 1.544 Mbit/s.
FEC function	Not supported
Alarms and performance events monitoring	Provides abundant alarms and performance events to facilitate management and maintenance of the equipment. Monitors performance parameters and alarm signals, including the monitoring of laser bias current, laser working temperature and optical power on the WDM side.
Protection schemes	Supports sub-network connection protection
Overhead processing	- Supports processing of section overheads of the STM-1/STM-4 signals. - Supports the transparent transmission and termination of path overheads. - Supports the setting and querying of the J0/J1/J2/C2/V5 byte. - Supports processing of the AU/TU pointer. - Supports one to four channels for DCC communication.
Tributary function	- Receives/Transmits 21 channels of 75-ohm/120-ohm E1 or 100-ohm T1 signals. - Asynchronously maps E1/T1 signals into VC-12 containers. - Processes overheads of VC-12 paths, and monitors alarms on the service paths. - Provides inloop and outloop to test the quality of E1/T1 services or to locate a faulty point, facilitating the maintenance of the equipment. - Provides the clock unit with two tributary clock sources contained in the first channel of signals and the twenty-first channel of signals output by the tributary-side port.

Function and Feature	Description
Clock function	• Supports the non-SSM protocol, standard SSM protocol and extended SSM protocol. • Provides the synchronization clock required by the board. • Provides the clock unit with seven synchronous timing sources contained in the two channels of signals output by the two client-side ports, two channels of signals output by the two WDM-side ports, one channel of signals output by the external clock port, and the first channel of signals and the twenty-first channel of signals output by the tributary-side port. • Supports the three working modes: trace, hold-over, and free-run. • Supports the control of the clock source priority levels. • Supports the control of the clock source switching function. • Processes and sets the S1 byte. • Provides two 2048 KHz or 2048 kbit/s external clock ports, of which the impedance is 120 ohms. • Supports tributary retiming.
Loopback	• Supports inloop and outloop on a WDM-side VC-4 path. • Supports inloop and outloop on a client-side VC-4 path. • Supports inloop and outloop on each tributary path (1-21 paths).
Regeneration board	LWX2
ALS function	Not supported
ESC function	Supported
LPT function	Not supported
PRBS test	Supports the PRBS function on the client side and tributary side. **NOTE** The PRBS function on the client side is supported only when the client-side service type is STM-1, and on the tributary side is supported only when the client-side service type is E1/T1.

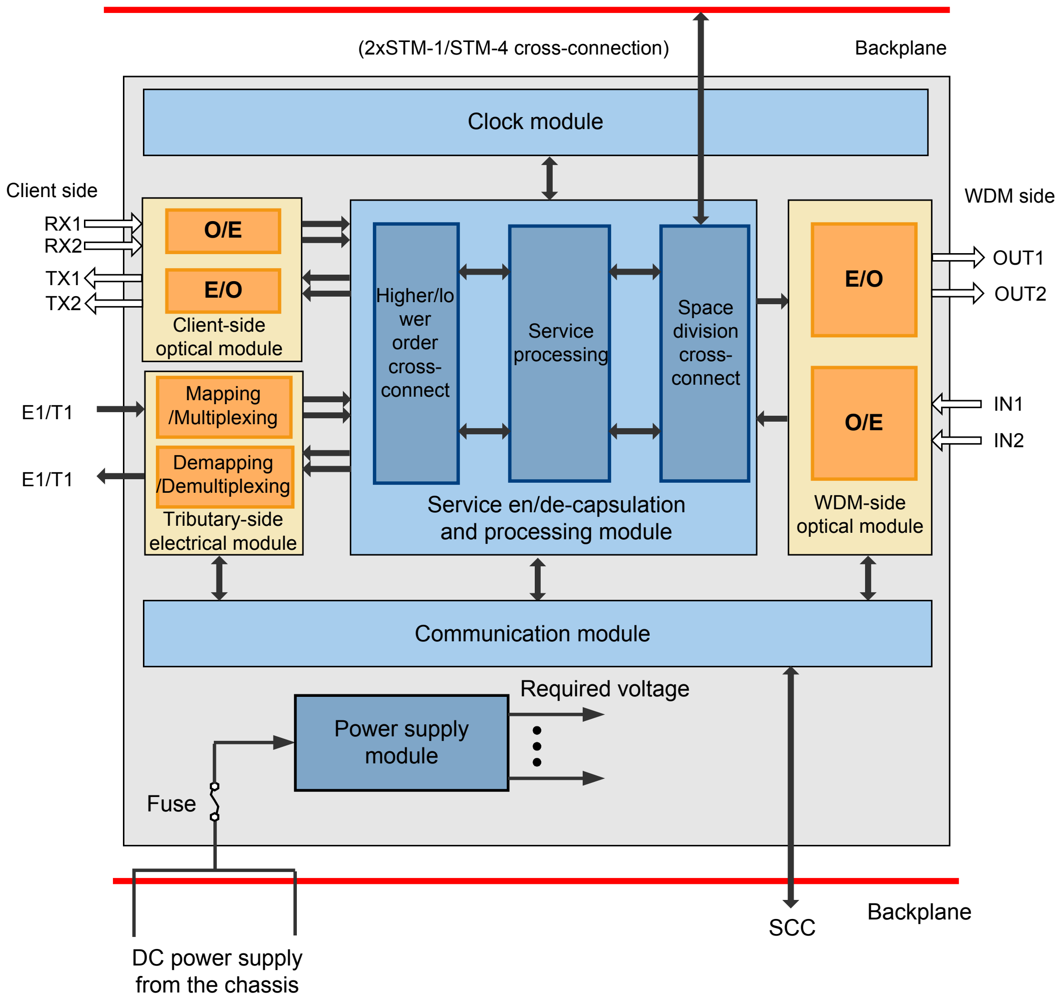
Function and Feature	Description	
Cross-connect function	● Supports 11x11 cross-connections of VC-4 signals, or 693x693 full cross-connections of VC-12 signals. ● Supports two cross-connections on the WDM side of the TSP board to the client side of the LQM2 board. ● Supports cross-connections of STM-1/STM-4 services between paired slots, cross-connections between transverse slots, and cross-connections between diagonal slots. For details, see **Slots for Cross-Connect Boards**.	
WDM specifications	Supports ITU-T G.694.1-compliant DWDM specifications and ITU-T G.694.2-compliant CWDM specifications.	
Protocol or standard compliance	Protocols or standards (non-performance monitoring) with which transparently transmitted services comply	-
	Protocols or standards (performance monitoring) for processing services	ITU-T G.702 ITU-T G.703 ITU-T G.707 ITU-T G.774.1 ITU-T G.774.3 ITU-T G.774.6 ITU-T G.775 ITU-T G.783 ITU-T G.813 ITU-T G.823 ITU-T G.824 ITU-T G.825 ITU-T G.829 ITU-T G.841

10.19.4 Working Principle and Signal Flow

The TSP board consists of the following modules: the client-side optical module, the tributary-side electrical module, the WDM-side optical module, the service en/de-capsulation and processing module, the clock module, the communication module, and the power supply module.

Figure 10-154 shows the functional block diagram of the TSP.

Figure 10-154 Functional block diagram of the TSP board



In the signal flow of the TSP board, the transmit and the receive directions are defined. The transmit direction is defined as the direction from the client side of the TSP to the WDM side of the TSP, and the receive direction is defined as the reverse direction.

- Transmit direction
  - The client-side optical module receives two channels of STM-1 optical signals from client equipment through the RX1 and RX2 ports, and performs O/E conversion.
  - The tributary-side electrical module receives 21 channels of E1/T1 electrical signals through the E1/T1 (1-21) ports.

  After the E/O conversion, the optical signals are sent to the service en/de-capsulation and processing module, where the signals are multiplexed, clock signals are generated, and frame processing is performed. Then, the module outputs one channel of STM-1/STM-4 optical signals.

  The STM-1/STM-4 optical signals are sent to the WDM-side optical module, where serial signals are converted into parallel signals, clock signals are extracted, data is restored, and overheads are processed. Then, the WDM-side optical module outputs standard STM-1/ STM-4 optical signals through the OUT1 and OUT2 ports.

- Receive direction

  The WDM-side optical module receives STM-1/STM-4 optical signal from the WDM side through the IN1 and IN2 optical ports. Then, the module performs O/E conversion.

  After the O/E conversion, the electrical signals are sent to the service en/de-capsulation and processing module, where clock signals are restored and demultiplexing and demapping are performed. Then, the module outputs STM-1 electrical signals.

  Then, the client-side optical module outputs two channels of STM-1 optical signals through the TX1 and TX2 ports and the tributary-side electrical module outputs 21 channels of E1/T1 signals through the E1/T1 (1-21) ports.

Module Function

- Client-side optical module

  The module consists of two parts: the client-side receiver and the client-side transmitter.

  - Client-side receiver: Receives STM-1 optical signals from the client side devices and performs the O/E conversion of the optical signals in internal electrical signals.
  - Client-side transmitter: Performs E/O conversion from internal electrical signals to STM-1 optical signals, and transmits the optical signals to client side devices.
  - Reports the performance of the client-side optical port.
  - Reports the working state of the client-side laser.
- Tributary-side electrical module

  This module consists of tributary-side receivers and transmitters.

  - Tributary-side receiver: Receives 21 channels of E1/T1 electrical signals, and performs signal encoding, inserts frame headers, signal mapping and logic control.
  - Tributary-side transmitter: Decodes the internal electrical signals, extracts frame headers, performs signal demapping and logic control, and outputs 21 channels of E1/T1 electrical signals.
- WDM-side optical module

  The module consists of two parts: the WDM-side receiver and the WDM-side transmitter.

  - WDM-side receiver: Receives one channel of STM-4/STM-1 optical signals, performs O/E conversion.
  - WDM-side transmitter: Performs E/O conversion between internal electrical signals and STM-1/STM-4 optical signals.
  - Reports the performance of the WDM-side optical port.
  - Reports the working state of the WDM-side laser.
- Service en/de-capsulation and processing module
  - Higher/lower order cross-connect module
    - Performs intra-board cross-connections. That is, implements cross-connections between the tributary-side and client-side ports, cross-connections between the tributary-side and WDM-side ports, and cross-connections between the client-side and WDM-side ports on the TSP board.
    - Adds/Drops tributary services and implements adaptation of VC-12, VC-4, and STM-1 services.
  - Service processing module

    - Processes overheads and reports the performance monitoring status of service signals.
    - Multiplexes the STM-1 signals into STM-4 signals, and performs the reverse process.
  - Space division cross-connect module
    - Performs inter-board cross-connections. That is, implements cross-connections between the WDM-side ports on the TSP board and the client-side ports on the LQM2 board.
    - Implements cross-connections of STM-1/STM-4 services.
- Clock module
  - Implements the synchronization function, supports phase-locked loop (PLL) of an external clock source, and achieves system synchronization.
  - Provides a synchronous clock for all functional units of the board.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

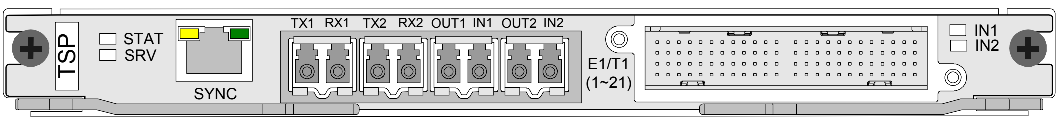
10.19.5 Front Panel

There are indicators and ports on the TSP front panel.

Appearance of the Front Panel

Figure 10-155 shows the front panel of the TSP.

Figure 10-155 Front panel of the TSP



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

Table 10-276 lists the type and function of each port.

Table 10-276 Types and functions of the TSP ports

Port	Port Type	Function
TX1/RX1 to TX2/RX2	LC	Transmits/Receives STM-1 optical signals from the client equipment.
IN1/OUT1 to IN2/OUT2	LC	Transmits/Receives STM-1 or STM-4 optical signals to/from the client-side ports on the LQM/LQM2/LWX2 board.
SYNC	RJ-45	Inputs/Outputs external 120-ohm clock signals.
E1/T1 (1-21)	Anea96 connector	Inputs/Outputs 21 channels of E1 or T1 electrical signals.
NOTE Shielded cables should be used to transmit external 120-ohm clock signals.		

Table 10-277 Descriptions of the pins of SYNC port

Pins	Definition	Description
1	EXT0R-	External clock input
2	EXT0R+	External clock input
3	NC	Not defined
4	EXT0T-	External clock output
5	EXT0T+	External clock output
6	NC	Not defined
7	NC	Not defined
8	NC	Not defined

NOTE

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

10.19.6 Valid Slots

The TSP occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

Slots for Cross-Connect Boards

The TSP board supports inter-board cross-connection of the STM-4/STM-1 services and intra-board of the STM-1/VC-4/VC-12 services, and supports the cross-connection of a maximum of two services between paired slots.

- In the OptiX OSN 1800 I chassis,
  - SLOT3 and SLOT4 are paired slots that support the cross-connection of a maximum of two services.
  - In addition to the cross-connection between paired slots, the cross-connection of one service is also supported between SLOT3 and SLOT1, and between SLOT4 and SLOT1.
- In the OptiX OSN 1800 II chassis,
  - SLOT1 and SLOT2 are paired slots, SLOT3 and SLOT5 are paired slots, and SLOT4 and SLOT6 are paired slots. Each pair of slots supports the cross-connection of a maximum of two services.
  - In addition to the cross-connection between paired slots, the cross-connection of one service is also supported between SLOT3 and SLOT4, between SLOT3 and SLOT6, between SLOT4 and LOT5, and between SLOT5 and SLOT6.

10.19.7 Physical and Logical Ports

This section describes the display of ports on the TSP board and provides the configuration rules for this board on the U2000.

Display of Ports

Table 10-278 lists the sequence number displayed on the U2000 of the port on the TSP board front panel.

Table 10-278 Display of the TSP ports

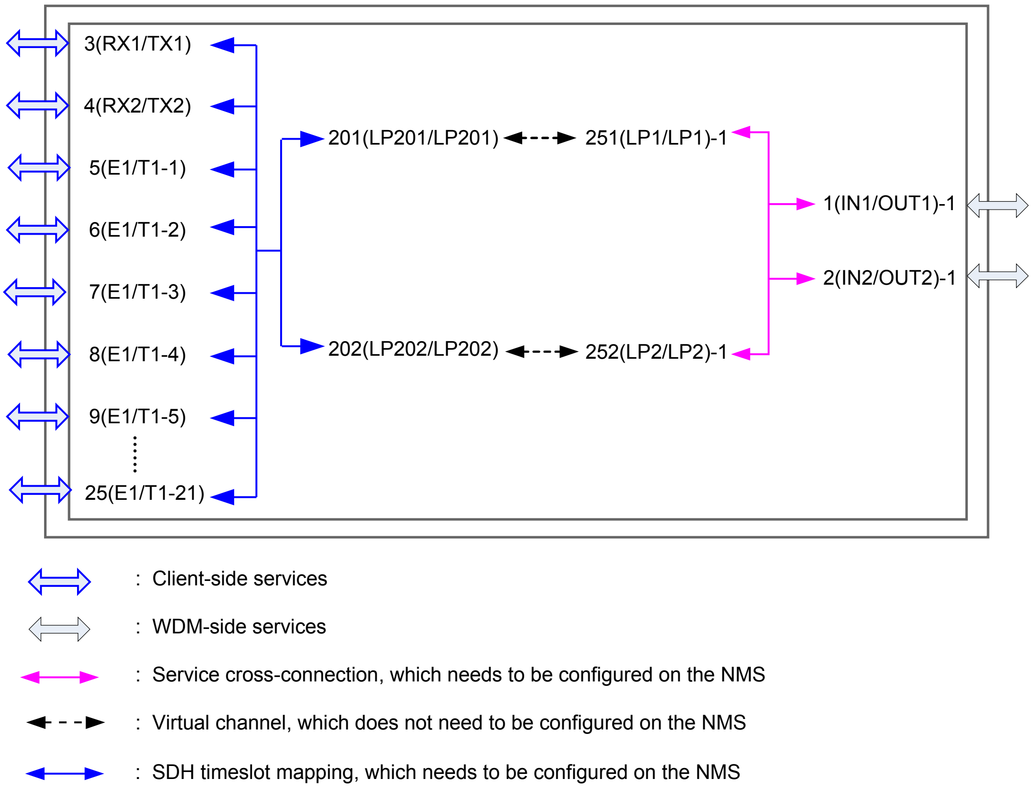
Ports on the Front Panel	Port Displayed on the U2000
IN1/OUT1	1
IN2/OUT2	2
TX1/RX1	3
TX2/RX2	4
E1/T1 (1)	5

Ports on the Front Panel	Port Displayed on the U2000
E1/T1 (2)	6
...	...
E1/T1 (21)	25

Port model

Figure 10-156 shows the port model of the TSP board.

Figure 10-156 Port model of the TSP board



- Alarms and performance events related to client-side signal overheads are reported through channel 1 of client-side optical ports 3 (RX1/TX1) and 4 (RX2/TX2).
- Alarms and performance events related to tributary-side signal overheads are reported through tributary-side electrical ports 5 (E1/T1-1) to 25 (E1/T1-21).
- If the types of services at optical ports 251 (LP1/LP1) and 252 (LP2/LP2) are set to STM-4, alarms and performance events related to SDH electrical-layer overheads are reported through channels 1–4 of logical ports 201 and 202 in the board model. If the types of services at optical ports 251 (LP1/LP1) and 252 (LP2/LP2) are set to STM-1, alarms and performance events related to SDH electrical-layer overheads are reported through channel 1 of logical ports 201 and 202 in the board model.

- Alarms related to the WDM-side optical module and optical-layer alarms and performance events are reported through channel 1 of WDM-side optical ports 1 and 2 (IN1/OUT1 and IN2/OUT2).

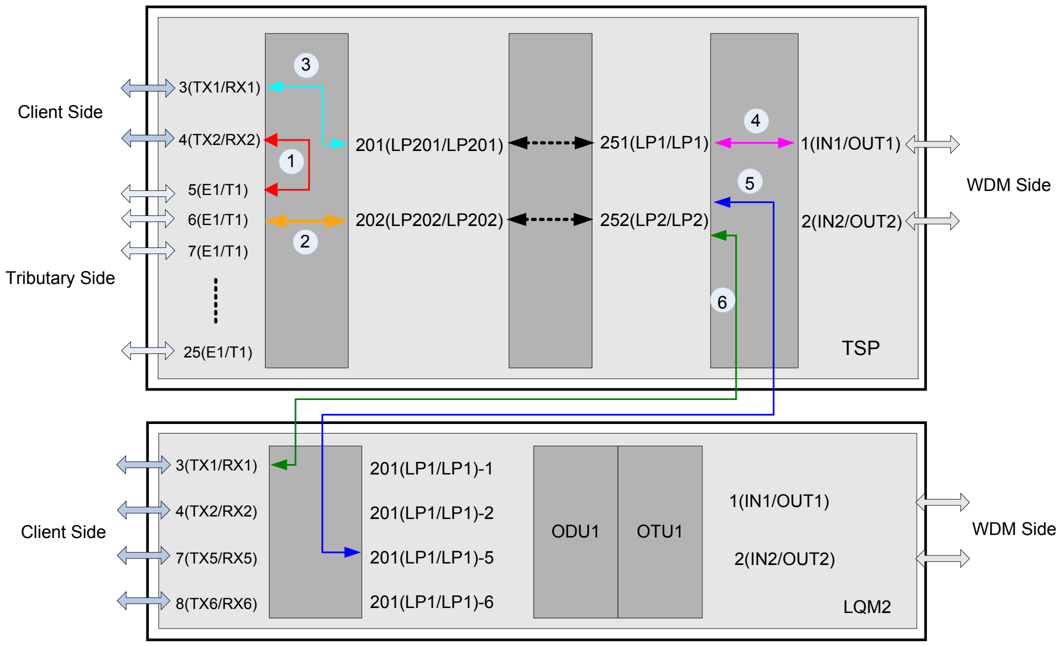
10.19.8 Configuration of Cross-Connections

This section describes how to configure service cross-connections for the TSP board on the U2000.

Cross-Connections

The TSP board supports inter-board cross-connections of STM-4/STM-1 signals and intra-board cross-connections of VC-4/VC-12 signals. This board implements service cross-connections using its cross-connect module. **Figure 10-157** shows examples of cross-connections implemented on the TSP board.

Figure 10-157 Example of cross-connections on the TSP board



- Intra-board cross-connections
  - Configure cross-connections from any of the tributary-side electrical ports 5(E1/T1)-25 (E1/T1) to client-side optical port 3(RX1/TX1) or 4(RX2/TX2) so that the tributary-side VC-12 signals are mapped to the client side. See 1 in **Figure 10-157**.
  - Configure cross-connections from any of the tributary-side electrical ports 5(E1/T1)-25 (E1/T1) to port 201(LP201/LP201) or 202(LP202/LP202) so that the tributary-side VC-12 signals are mapped to LP ports. See 2 in **Figure 10-157**.
  - Configure cross-connections from client-side optical port 3(TX1/RX1) or 4(TX2/RX2) to port 201(LP201/LP201) or 202(LP202/LP202) so that the client-side VC-4 or VC-12 signals are cross-connected to LP ports. See 3 in **Figure 10-157**.

- Configure cross-connections from port 251(LP1/LP1) or 252(LP2/LP2) to WDM-side optical port 1(IN1/OUT1) or 2(IN2/OUT2) so that signals are connected to the WDM network. See 4 in **Figure 10-157**.

CAUTION

Cross-connections between channels 251(LP1/LP1)-1 and 1(IN1/OUT1)-1, and between channels 252(LP2/LP2)-1 and 2(IN2/OUT2)-1 are configured by default. You can configure new cross-connections after deleting the configured cross-connections on the U2000. However, if services are carried on the channels, the deletion will interrupt the carried services.

- Inter-board cross-connections
  - Configure cross-connections from port 251(LP1/LP1) or 252(LP2/LP2) on the TSP board to any channel at port 201 on the LQM2 board so that the WDM-side STM-4 or STM-1 signals on the TSP board are cross-connected to the LQM2 board. See 5 in **Figure 10-157**.
  - Configure cross-connections from port 251(LP1/LP1) or 252(LP2/LP2) on the TSP board to 3(RX1/TX1), 4(RX2/TX2), 7(RX5/TX5), 8(RX6/TX6) on the LQM2 board so that STM-4 or STM-1 signals on the WDM side of the TSP board are output through the client-side optical ports on the LQM2 board. See 6 in **Figure 10-157**.

NOTE

You must delete the cross-connections that are configured at 4 by default before configuring new cross-connections.

10.19.9 TSP Parameters on the NMS

Parameter Description (WDM Interface)

Field	Value	Description
Service Type	STM-1, STM-4 Default: STM-1	Select a value according to the service rate on the WDM side. The parameter settings are supported only by the 251 (LP1/LP1) and 252 (LP2/LP2) logical ports on the WDM side. **NOTE** ● Before services are connected to the board, configure the service types on the client side through the U2000 according to the actually accessed services. Otherwise, services cannot be connected normally.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.

Field	Value	Description
Laser Status	ON, OFF Default: ON	It is recommended to set this parameter to **ON** for all optical ports. **CAUTION** If the communication between NEs is achieved through only the ESC provided by the TSP board, the following situation occurs when neither a standby channel is available nor protection is configured: the NEs are unreachable after the lasers on the WDM side of the TSP board are disabled.
E1/T1 Mode	E1, T1 Default: E1	Select a value according to the actual type of service that the E1/T1 port carries. Only the TSPB board supports switchover between the E1 and T1 services. When you set the E1/T1 mode, the E1/T1 modes at logical ports 5-25 on the client side are automatically changed to the mode that you set.
Optical Interface Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface Name	-	-
Optical Interface/ Channel	-	-

Parameter Description (SDH Interface)

Field	Value	Description
Laser Switch	On, Off Default: On	It is recommended to set this parameter to **On** for all optical ports.
VC4 Path	NE ID-subrack ID-slot-board name-optical port number-channel ID	Displays the number of a VC4 channel.
VC4 Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
VC12 Channel	NE ID-subrack ID-slot-board name-optical port number-channel ID	Displays the number of a VC12 channel.
Port	NE ID-subrack ID-slot-board name-optical port number	Displays the number of a port on the board.
Optical Interface Name	-	An optical interface name contains a maximum of 64 characters. Any characters are supported.

Parameter Description (PDH Interface)

Field	Value	Description
E1/T1 Mode	E1, T1 Default: E1	Select a value according to the actual type of service that the E1/T1 port carries. Only the TSPB board supports switchover between the E1 and T1 services. When you set the E1/T1 mode, the E1/T1 modes at logical ports 5-25 on the client side are automatically changed to the mode that you set.
Board	NE ID-subrack ID-slot-board name	Displays the name of the board.

Field	Value	Description
Port	NE ID-subrack ID-slot-board name-channel ID	Displays the E1/T1 channel of the board.
Port Name	1 to 21	Displays the E1/T1 channel ID.
Tributary Loopback	Non-Loopback, Inloop, Outloop Default: Non-Loopback	Set this parameter to **Non-Loopback** when a network works normally. It can be set to **Inloop** or **Outloop** to help locate a faulty point in a test or a process of removing a fault on a network. However, it must be set to **Non-Loopback** right after the test is complete or the fault is removed. When **Automatic Disabling of NE Function** is set to the default value **Enabled**, the loopback setting is automatically cancelled after **Auto Disabling Time** (default: 5 minutes) elapses.
Re-timing Mode	Normal, Re-timing Mode of Tributary Clock, Re-timing Mode of Cross-connect Clock Default: Normal	• Normal: The re-timing function is not enabled. • Re-timing Mode of Tributary Clock: A tributary clock is used as the reference clock for retiming. • Re-timing Mode of Cross-connect Clock: The cross-connect (external) clock is used as the reference clock for retiming.

10.19.10 TSP Specifications

Specifications include electrical specifications, optical specifications, mechanical specifications and power consumption.

Board Name	Optical Module on Client Side	Electrical Module on Client Side	Optical Module on WDM Side
TNF1TSP	100BASE-FX S-1.1 L-1.1 L-1.2	GE electrical module FE electrical module	S-4.1 L-4.1 L-4.2 100BASE-FX S-1.1 L-1.1 L-1.2

Specifications of Optical Modules

NOTE

There is a margin between the input power low alarm threshold and the receiver sensitivity and a margin between the input power high alarm threshold and the overload point. This ensures that the system can report an input power low alarm before the actual input power reaches the receiver sensitivity or an input power high alarm before the actual input power reaches the overload point.

Table 10-279 Specifications of S-4.1/L-4.1/L-4.2 optical modules

Item	Unit	Value		
		S-4.1	L-4.1	L-4.2
Line code format	-	NRZ	NRZ	NRZ
Optical source type	-	MLM	SLM	SLM
Target distance	km	15	40	80
Transmitter parameter specifications at point S				
Operating wavelength range	nm	1274 to 1356	1280 to 1335	1480 to 1580
Maximum mean launched power	dBm	-8	2	2
Minimum mean launched power	dBm	-15	-3	-3
Minimum extinction ratio	dB	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	1	1
Spectral Width-RMS	nm	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	30	30
Eye pattern mask	-	G.957-compliant		
Receiver parameter specifications at point R				
Receiver type	-	PIN	PIN	PIN
Operating wavelength range	nm	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-28	-28	-28
Minimum receiver overload	dBm	-8	-8	-8
Maximum reflectance	dB	-27	-14	-27

Table 10-280 Specifications of 100BASE-FX/S-1.1/L-1.1/L-1.2 optical modules

Item	Unit	Value			
		100BASE-FX	**S-1.1**	**L-1.1**	**L-1.2**
Line code format	-	LED	NRZ	NRZ	NRZ
Optical source type	-	Multi-mode	MLM	MLM	SLM
Target distance	km	2	15	40	80
Transmitter parameter specifications at point S					
Operating wavelength range	nm	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Maximum mean launched power	dBm	-14	-8	0	0
Minimum mean launched power	dBm	-19	-15	-5	-5
Minimum extinction ratio	dB	10	8.2	10.5	10.5
Maximum -20 dB spectral width	nm	NA	NA	NA	1
Spectral Width-RMS	nm	63	NA	NA	NA
Minimum side mode suppression ratio	dB	NA	NA	NA	30
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	PIN	APD	APD	PIN
Operating wavelength range	nm	1270 to 1380	1260 to 1580	1260 to 1580	1260 to 1580
Receiver sensitivity	dBm	-30	-28	-34	-34
Minimum receiver overload	dBm	-14	-8	-10	-10
Maximum reflectance	dB	NA	NA	NA	NA

Specifications of the Tributary-Side Electrical Modules

Table 10-281 Specifications of electrical port for E1/T1 service at tributary side

Item	Unit	Value	
		T1 service	E1 service
Rate	kbit/s	1544	2048
Access capacity	-	21 x T1	21 x E1
Code pattern	-	B8ZS	HDB3
Connector	-	Anea96	
Interface impedance	Ω	100	75/120
Bit rate at the output interface	-	ITU-T G.703-compliant	
Permitted frequency deviation at the input interface	-	ITU-T G.703-compliant	ITU-T G.823-compliant
Permitted attenuation at the input interface	-	ITU-T G.703-compliant	
Input jitter tolerance	-	ITU-T G.824-compliant	ITU-T G.823-compliant

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.72 kg (1.59 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 20.2 W
- Maximum Power Consumption at 55°C (131°F): 24.0 W

11 Optical Multiplexer and Demultiplexer Board

About This Chapter

Describes the functions and the working principle of optical multiplexers and optical demultiplexers.

11.1 FIU

FIU: Fiber Port Unit

11.1.1 Version Description

The available hardware version for the FIU is TNF1.

Version

Table 11-1 describes the version mapping of the FIU board. The mapping version of the equipment is V100R001C01 or later.

Table 11-1 Version description of the FIU

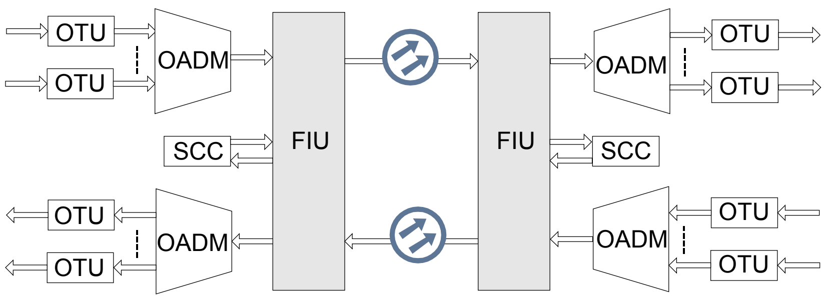
Item	Description
Board hardware version	TNF1

11.1.2 Application

The FIU are mainly used to multiplex and demultiplex the main path and the optical supervisory channel (OSC).

For the application of the board in WDM systems, see **Figure 11-1**.

Figure 11-1 FIU board application in a WDM system



NOTE

An OTU is a transceiver that can transmit and receive signals for the same wavelength at the same time.

11.1.3 Functions and Features

The main functions and features supported by the FIU are multiplexing or demultiplexing.

For detailed functions and features, see **Table 11-2**.

Table 11-2 Functions and features of the FIU board

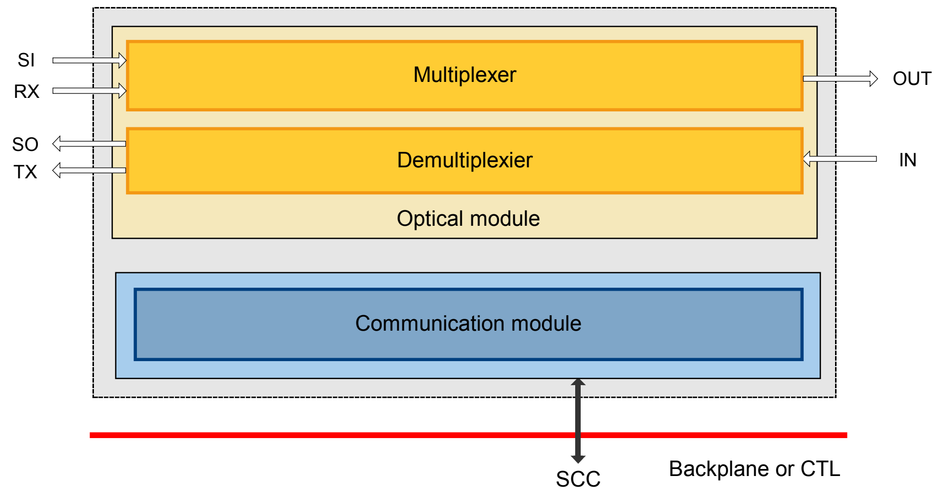
Functions and Features	Description
Basic function	Implements the multiplexing and demultiplexing of the main path and the OSC.
WDM specification	Supports both the DWDM and CWDM specification.

11.1.4 Working Principle and Signal Flow

The FIU unit consists of two parts: the optical module and the communication module.

Figure 11-2 is the functional block diagram of the FIU board.

Figure 11-2 Functional block diagram of the FIU board



Signal Flow

The multiplexing module multiplexes the main path optical signals received through the RX optical port and the supervisory optical signals received through the SI optical port into one channel of optical signals. The one channel of signals is output through the OUT optical port.

The IN optical port receives line optical signals, which are then sent to the demultiplexing module. The module demultiplexes the line optical signals into the main path optical signals and supervisory channel signals, and outputs them through the TX and SO optical ports respectively.

Module Function

- Optical module
  - Performs the multiplexing and demultiplexing of main path signals and supervisory channel signals.
- Communication module

– Communicates with the SCC unit, to control and operate on each module of the unit.

11.1.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 11-3 shows the front panel of the FIU board.

Figure 11-3 Front panel of the FIU board

NOTE

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The FIU board does not have indicators.

Ports

There are six optical ports on the front panel of the FIU, **Table 11-3** lists the type and function of each port.

Table 11-3 Ports on the front panel of the FIU

Port	Connector Type	Description
IN/OUT	LC	Receives/transmits the line signal.
RX/TX	LC	Receives/transmits the main path signal.
SI/SO	LC	Receives/transmits the OSC signal.

11.1.6 Valid Slots

The FIU occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

11.1.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 11-4 lists the sequence number displayed in an NMS system of the optical port on the FIU board front panel.

Table 11-4 Display of the FIU optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	1
RX/TX	2
SI/SO	3

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

11.1.8 FIU Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 11-5 and **Table 11-6** list the optical specifications of the FIU.

Table 11-5 TNF1FIU board specifications in DWDM system

Corresponding Interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-SO SI-OUT	Insertion loss	dB	< 1.0
IN-TX RX-OUT	Insertion loss	dB	< 0.8
IN-SO	Isolation	dB	> 25
IN-TX	Isolation	dB	> 40
-	Reflectance	dB	< -40

Table 11-6 TNF1FIU board specifications in CWDM system

Corresponding Interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-SO SI-OUT	Insertion loss	dB	< 1.0
IN-TX RX-OUT	Insertion loss	dB	< 0.8
IN-SO	Isolation	dB	> 25
IN-TX	Isolation	dB	> 40
-	Reflectance	dB	< -40

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.85 kg (1.87 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

11.2 X40

X40: 40-Channel Multiplexing or Demultiplexing Board

11.2.1 Version Description

The available hardware version for the X40 is TNF1.

Version

Table 11-7 describes the version mapping of the X40 board. The mapping version of the equipment is V100R002C00 or later.

Table 11-7 Version description of the X40

Item	Description
Board hardware version	TNF1

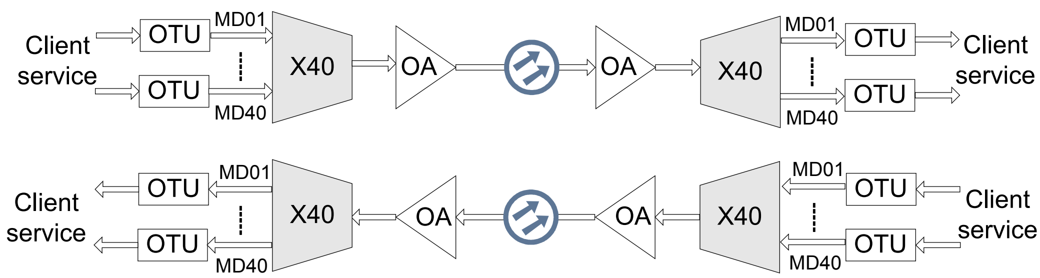
11.2.2 Application

The X40 board multiplexes and demultiplexes wavelengths. It can be used in two scenarios: multiplexing or demultiplexing of 40 channels of optical signals in the two-fiber bidirectional system, and multiplexing and demultiplexing of 16 channels of optical signals synchronously in the single-fiber bidirectional system.

Application Scenario 1: Achieves Multiplexing or Demultiplexing of 40 Channels of Optical Signals in the Two-Fiber Bidirectional System

The X40 board can be used in the two-fiber bidirectional system. It multiplexes a maximum of 40 channels of ITU-T G.694.1-compliant standard-wavelength optical signals into one channel of optical signals or demultiplexes one channel of optical signals into a maximum of 40 channels of ITU-T G.694.1-compliant standard-wavelength optical signals. **Figure 11-4** shows the details.

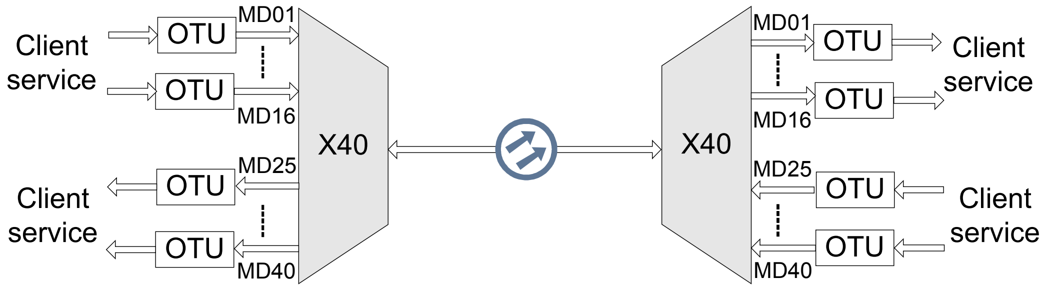
Figure 11-4 Application of the X40 board in the two-fiber bidirectional system



Application Scenario 2: Achieves Multiplexing and Demultiplexing of 16 Channels of Optical Signals Synchronously in the Single-Fiber Bidirectional System

The X40 board can be used in the single-fiber bidirectional system. It multiplexes a maximum of 16 channels of ITU-T G.694.1-compliant standard-wavelength optical signals into one channel of optical signals and demultiplexes one channel of optical signals into a maximum of 16 channels of ITU-T G.694.1-compliant standard-wavelength optical signals at the same time. **Figure 11-5** shows the details.

Figure 11-5 Application of the X40 board in the single-fiber bidirectional system



NOTE

When the X40 board is used in the single-fiber bidirectional system, optical interfaces MD01 to MD16 form a group and optical interfaces MD25 to MD40 form a group. One group is used for receiving optical signals and the other is used for transmitting optical signals.

NOTE

- When the board is used in the two-fiber bidirectional system to multiplex or demultiplex optical signals, the MD01-MD40 optical interfaces are used to access wavelength signals. When the board in used in the single-fiber bidirectional system to multiplex and demultiplex optical signals, the MD01-MD16 and MD25-MD40 optical interfaces are used to access wavelength signals.

11.2.3 Functions and Features

The main functions and features supported by the X40 are multiplexing or demultiplexing.

For detailed functions and features, refer to **Table 11-8**.

Table 11-8 Functions and features of the X40 board

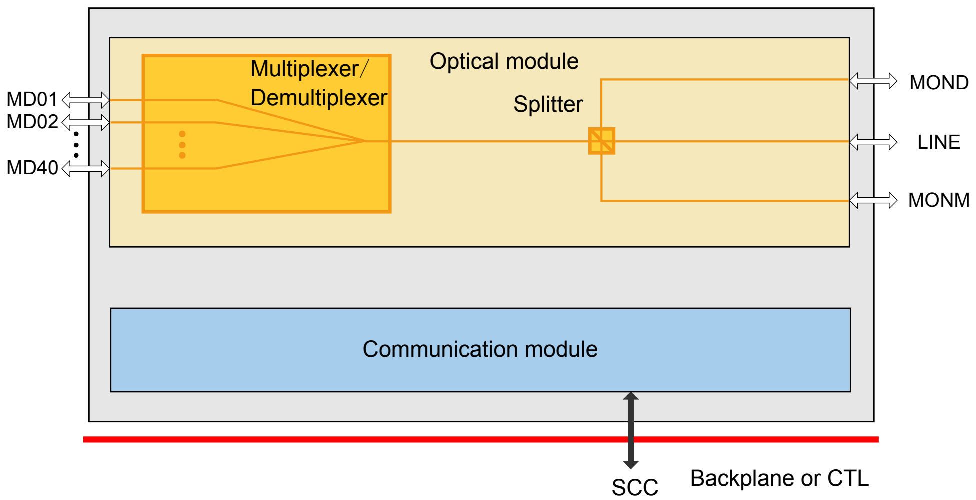
Functions and Features	Description
Basic function	● In the two-fiber bidirectional system, multiplexes a maximum of 40 channels of ITU-T G.694.1-compliant standard-wavelength optical signals with a channel spacing of 100 GHz into one channel of multiplexed optical signals. ● In the two-fiber bidirectional system, demultiplexes one channel of multiplexed optical signals into a maximum of 40 channels of ITU-T G.694.1-compliant standard single-wavelength optical signals with a channel spacing of 100 GHz. ● In the single-fiber bidirectional system, multiplexes a maximum of 16 channels of ITU-T G.694.1-compliant standard-wavelength optical signals with a channel spacing of 100 GHz into one channel of multiplexed optical signals and demultiplexes one channel of multiplexed optical signals into a maximum of 16 channels of ITU-T G.694.1-compliant standard single-wavelength optical signals with a channel spacing of 100 GHz at the same time.
Online optical performance monitoring	Provides an online monitoring optical interface to which a spectrum analyzer can be connected to monitor the spectrum the main optical path without interrupting services.
WDM specification	Supports the DWDM specification.

11.2.4 Working Principle and Signal Flow

The X40 unit consists of two parts: the optical module and the communication module.

Figure 11-6 is the functional block diagram of the X40 board.

Figure 11-6 Functional block diagram of the X40 board



Signal Flow

Each of the MD01-MD40 optical interfaces receives one channel of single-wavelength optical signals, and sends the signals to the multiplexer. The multiplexer multiplexes the 40 channels of single-wavelength optical signals into one channel of multiplexed optical signals, and then outputs them through the LINE optical interface.

The LINE optical interface receives one channel of multiplexed optical signals and sends the signals to the demultiplexer. The demultiplexer demultiplexes the channel of multiplexed optical signals into 40 channels of single-wavelength optical signals, and then outputs them through the MD01-MD40 optical interfaces.

Module Function

- Optical module
  - The multiplexer multiplexes 40 channels of single-wavelength optical signals into one channel of multiplexed optical signals.
  - The demultiplexer demultiplexes one channel of multiplexed optical signals into 40 channels of single-wavelength optical signals.
  - The splitter splits a channel of optical signals from the multiplexed optical signals and sends the channel of optical signals to the MONM for detection.
  - The splitter splits a channel of optical signals from the optical signals to be demultiplexed and sends the channel of optical signals to the MOND for detection.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

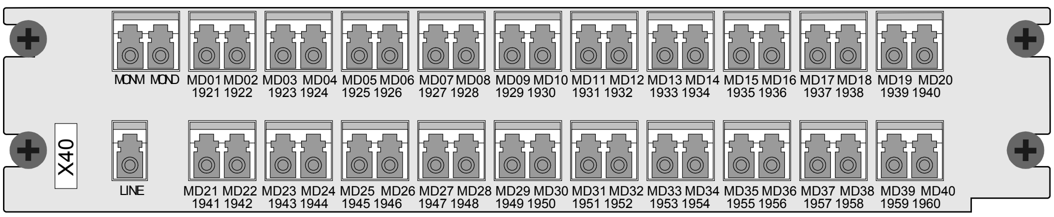
11.2.5 Front Panel

There are interfaces on the front panel of the board.

Appearance of the Front Panel

Figure 11-7 shows the front panel of the X40 board.

Figure 11-7 Front panel of the X40 board



Indicators

The X40 board does not have indicators.

Interfaces

There are 43 optical interfaces on the front panel of the X40, **Table 11-9** lists the type and function of each interface.

Table 11-9 Types and functions of the X40 interfaces

Optical Interface	Interface Type	Function
MD01 to MD40	LC	Connected to the OTU board to input optical signals to be multiplexed or output demultiplexed optical signals. The MD01-MD40 optical interfaces are arranged according to the wavelengths from 192.1THz to 196.0THz orderly.
MONM	LC	Connected to the input optical interface of the optical spectrum analyzer to detect multiplexed optical signals online. The optical power at the MONM optical interface is 1/9 of the optical power at the LINE optical interface, that is, the optical power at the MONM optical interface is 9.5 dB lower than the optical power at the LINE optical interface.
MOND	LC	Connected to the input optical interface of the optical spectrum analyzer to detect optical signals to be demultiplexed online. The optical power at the MOND optical interface is 1/9 of the optical power at the LINE optical interface, that is, the optical power at the MOND optical interface is 9.5 dB lower than the optical power at the LINE optical interface.
LINE	LC	Inputs or outputs multiplexed optical signals.

11.2.6 Valid Slots

The X40 occupies two slots.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are slot 1 and slot 3.

In the OptiX OSN 1800 II chassis, the valid slots of the board are slot 2 and slot 4, slot 4 and slot 6, slot 1 and slot 3, or slot 3 and slot 5, or slot 5 and slot 7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are slot 1 and slot 3, or slot 2 and slot 4.

Display of Slots

The board occupies two slots on the U2000. The board connects to the backplane of the chassis through the slot in the lower position. Therefore, the slot ID of the board displayed on the NMS is the slot of lower-position between the two slots that the board occupies. For example, if the board occupies slot 1 and slot 3, the slot displayed on the NMS is slot 1. If the board occupies slot 3 and slot 5, the slot displayed on the NMS is slot 3.

11.2.7 Optical Interfaces

This section introduces the display of optical interfaces on the board.

Display of Optical Interfaces

Table 11-10 lists the sequence number displayed in an NM system of the optical interface on the X40 board front panel.

Table 11-10 Display of the X40 optical interfaces

Optical Interfaces on the Front Panel	Optical Interface Displayed on the U2000
LINE	1
MD01	2
MD02	3
...	...
MD40	41
MONM	42
MOND	43

11.2.8 X40 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 11-11 lists the optical specifications of the X40.

Table 11-11 TNF1X40 board specifications

Corresponding Interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
LINE-MDx	Insertion loss	dB	< 6.5

Corresponding Interfaces	Item	Unit	Value
	Adjacent channel isolation	dB	> 25
	Non-adjacent channel isolation	dB	> 30
-	Reflectance	dB	< -40
-	Polarization dependence loss	dB	≤ 0.5
-	Temperature characteristics	nm/°C	≤ 0.002
-	Maximum channel insertion loss difference	dB	≤ 3

Wavelength Allocation Principles

The 40 optical interfaces of the X40 board access wavelengths of 40 different frequencies. **Table 11-12** lists the mapping relationship between the optical interfaces and the frequencies.

Table 11-12 Mapping relationship between optical interfaces on the X40 board and the frequencies

Optical Interface	Frequency (THz)	Optical Interface	Frequency (THz)	Optical Interface	Frequency (THz)	Optical Interface	Frequency (THz)
MD01	192.1	MD11	193.1	MD21	194.1	MD31	195.1
MD02	192.2	MD12	193.2	MD22	194.2	MD32	195.2
MD03	192.3	MD13	193.3	MD23	194.3	MD33	195.3
MD04	192.4	MD14	193.4	MD24	194.4	MD34	195.4
MD05	192.5	MD15	193.5	MD25	194.5	MD35	195.5
MD06	192.6	MD16	193.6	MD26	194.6	MD36	195.6
MD07	192.7	MD17	193.7	MD27	194.7	MD37	195.7
MD08	192.8	MD18	193.8	MD28	194.8	MD38	195.8
MD09	192.9	MD19	193.9	MD29	194.9	MD39	195.9
MD10	193.0	MD20	194.0	MD30	195.0	MD40	196.0

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 40.1 mm x 193.8 mm x 208.7 mm (1.6 in. x 7.6 in. x 8.2 in.)
- Weight: 1.05 kg (2.31 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12 Optical Add and Drop Multiplexing Board

About This Chapter

Describes the functions and the working principle of optical add/drop multiplexers.

12.1 DMD1

DMD1: Bidirectional Single Channel Optical Add/drop Multiplexing Board

12.1.1 Version Description

The available hardware version for the DMD1 is TNF1.

Version

Table 12-1 describes the version mapping of the DMD1 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-1 Version description of the DMD1

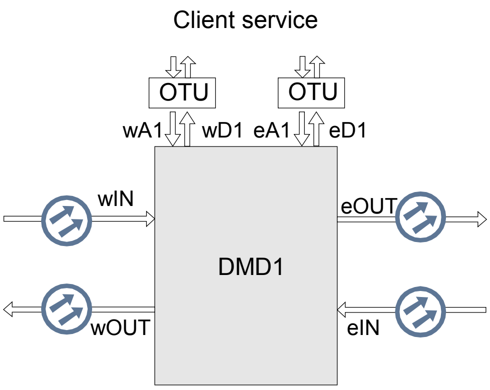
Item	Description
Board hardware version	TNF1

12.1.2 Application

The DMD1 board, in two directions, adds one wavelength to and drops one wavelength from the multiplexed signals respectively. It supports both the DWDM and CWDM specifications.

The DMD1 supports two-fiber bidirectional transmission. **Figure 12-1** shows the DMD1 board application in a WDM system.

Figure 12-1 DMD1 board application in a WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.1.3 Functions and Features

The main functions and features supported by the DMD1 are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-2**.

Table 12-2 Functions and features of the DMD1 board

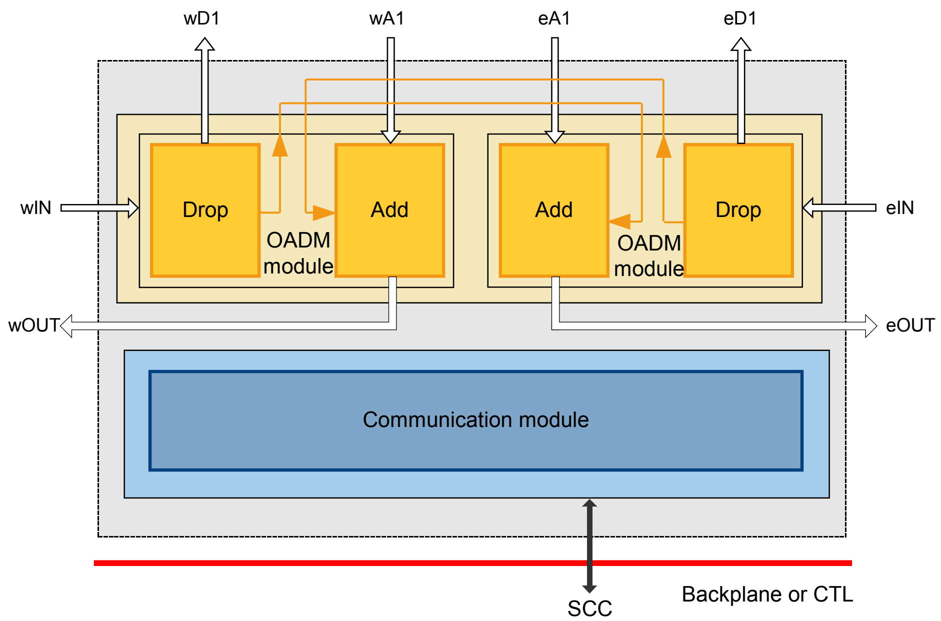
Functions and Features	Description
Basic Function	Adds/drops in two directions one channel of wavelength signals to/from the multiplexed signals respectively.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.1.4 Working Principle and Signal Flow

The DMD1 unit consists of two parts: the OADM module, and communication module.

Figure 12-2 shows the principle block diagram of the DMD1.

Figure 12-2 Principle block diagram of the DMD1



Signal Flow

In the east, the DMD1 board receives multiplexed signals through optical port eIN. After the optical module processes the multiplexed signals, the board splits out one channel of optical signals from the multiplexed signals and outputs them through optical port eD1. Then, the remaining wavelengths are sent to the west add module.

The east add module receives the signals from the west drop module. The signals are multiplexed with one wavelength that is input through the eA1 optical port. The multiplexed signals are output through the eOUT optical port.

The working principle of west signals is the same as that of east signals; while the signal flows in the two directions are different.

Module Function

- Optical module
  - Performs the add/drop multiplexing of one wavelength respectively in two directions.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

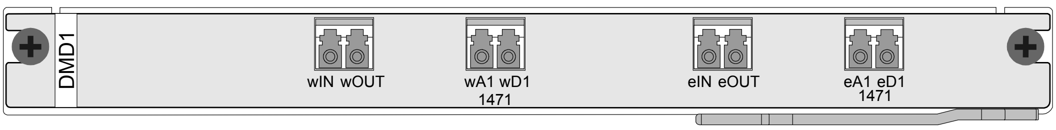
12.1.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-3 shows the front panel of the DMD1.

Figure 12-3 Front panel of the DMD1



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The DMD1 board does not have indicators.

Ports

There are eight optical ports on the front panel of the DMD1 board, Table 12-3 lists the type and function of each port.

Table 12-3 Types and functions of the DMD1 ports

Optical Port	Port Type	Function
wIN/wOUT	LC	Receive or transmit the westward multiplexed signal.

Optical Port	Port Type	Function
wA1	LC	Receive the westward optical signals from the OTU or integrated client-side equipment, thus adding one westward channel.
wD1	LC	Transmit the westward optical signals to the OTU or integrated client-side equipment, thus dropping one westward channel.
eIN/eOUT	LC	Receive or transmit the eastward multiplexed signal.
eA1	LC	Receive the eastward optical signals from the OTU or integrated client-side equipment, thus adding one eastward channel.
eD1	LC	Transmit the eastward optical signals to the OTU or integrated client-side equipment, thus dropping one eastward channel.

12.1.6 Valid Slots

The DMD1 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.1.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-4 lists the sequence number displayed in an NMS system of the optical port on the DMD1 board front panel.

Table 12-4 Display of the DMD1 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
wA1/wD1	1
eA1/eD1	2
wIN/wOUT	3
eIN/eOUT	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.1.8 DMD1 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-5 and Table 12-6 list the optical specifications of the DMD1.

Table 12-5 TNF1DMD1 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
eIN-eD1 wIN-wD1	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eA1-eOUT wA1-wOUT	1.0 dB spectral width	nm	≥ 0.2

Corresponding interfaces	Item	Unit	Value
	Add channel insertion loss	dB	< 1.2
eIN-wOUT wIN-eOUT	Insertion loss	dB	< 1.4
-	Reflectance	dB	< -40

Table 12-6 TNF1DMD1 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
eIN-eD1 wIN-wD1	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eA1-eOUT wA1-wOUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.2
eIN-wOUT wIN-eOUT	Insertion loss	dB	< 1.4
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelength

In DWDM and CWDM systems, the DMD1 supports adding/dropping of any wavelength. The wavelength that is accessed by each optical port should comply with the following rules:

The wavelength added on the east (eA1), that dropped on the east (eD1), that added on the west (wA1), and that dropped on the west (wD1) should be the same.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- weight: 0.70 kg (1.54 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.2 DMD1S

DMD1S: Bidirectional Single Channel Optical Add/drop Multiplexing Board with OSC

12.2.1 Version Description

The available hardware version of the DMD1S is TNF1.

Version

Table 12-7 describes the version mapping of the DMD1S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-7 Version description of the DMD1S

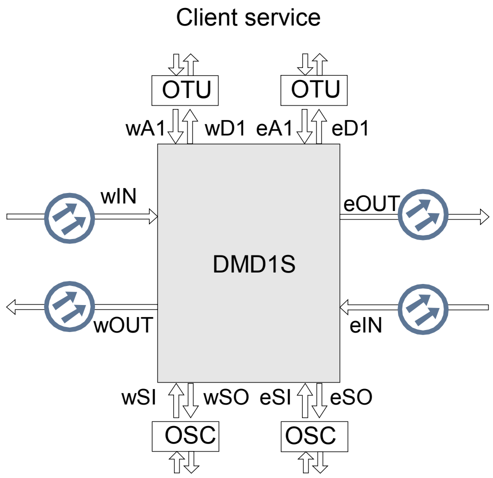
Item	Description
Board hardware version	TNF1

12.2.2 Application

The DMD1S board, in two directions, adds one wavelength to and drops one wavelength from the multiplexed signals respectively. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The DMD1S supports two-fiber bidirectional transmission. **Figure 12-4** shows the DMD1S board application in a WDM system.

Figure 12-4 DMD1S board application in a WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.2.3 Functions and Features

The main functions and features supported by the DMD1S are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-8**.

Table 12-8 Functions and features of the DMD1S board

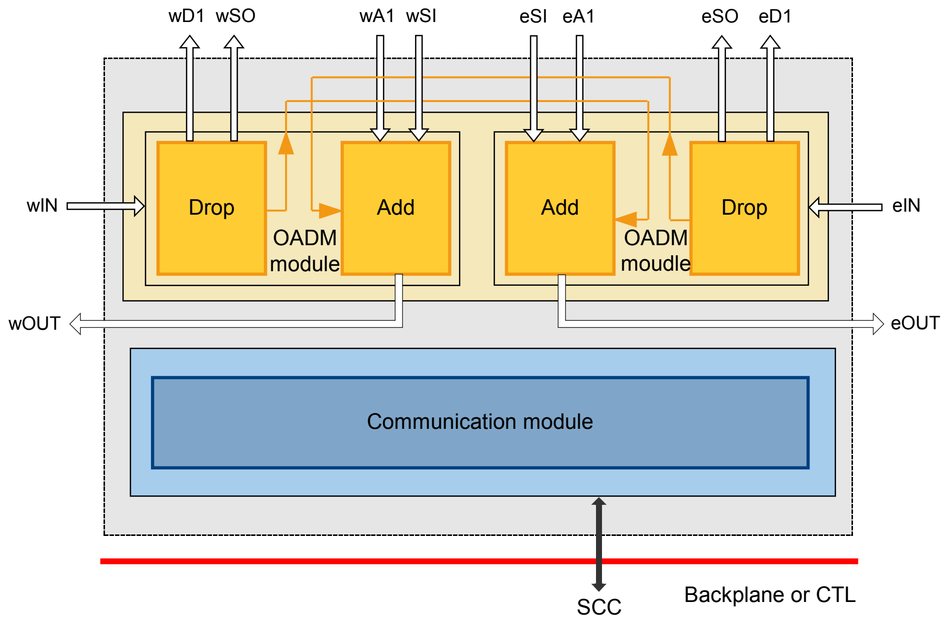
Functions and Features	Description
Basic Function	Adds/drops in two directions one channel of wavelength signals to/from the multiplexed signals respectively. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports the CWDM specifications.

12.2.4 Working Principle and Signal Flow

The DMD1S unit consists of two parts: the OADM module and the communication module.

Figure 12-5 shows the principle block diagram of the DMD1S.

Figure 12-5 Principle block diagram of the DMD1S



Signal Flow

The board receives the east multiplexed signals from the upstream station through the eIN optical port. The drop module extracts one wavelength and one channel of supervisory signals. The one wavelength is output through the eD1 optical port and the one channel of supervisory signals is output through the eSO optical port. Then, the remaining wavelengths are sent to the west add module.

The east add module receives the signals from the west drop module. The signals are multiplexed with one channel of supervisory signals that are input through the eSI optical port and then are multiplexed with one wavelength that is input through the eA1 optical port. The multiplexed signals are output through the eOUT optical port.

The working principle of west signals is the same as that of east signals; while the signal flows in the two directions are different.

Module Function

- Optical module
  - Performs the add/drop multiplexing of one wavelength respectively in two directions, and multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

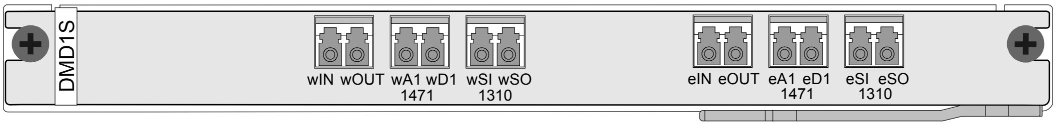
12.2.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-6 shows the front panel of the DMD1S.

Figure 12-6 Front panel of the DMD1S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The DMD1S does not have indicators.

Ports

There are twelve optical ports on the front panel of the DMD1S, Table 12-9 lists the type and function of each port.

Table 12-9 Types and functions of the DMD1S ports

Port	Connector type	Description
wIN/wOUT	LC	Receive or transmit the westward multiplexed signal.
wA1	LC	Receive the westward optical signals from the OTU or integrated client-side equipment, thus adding one westward channel.
wD1	LC	Transmit the westward optical signals to the OTU or integrated client-side equipment, thus dropping one westward channel.
wSI/wSO	LC	Receive or transmit the westward OSC signal.
eIN/eOUT	LC	Receive or transmit the eastward multiplexed signal.
eA1	LC	Receive the eastward optical signals from the OTU or integrated client-side equipment, thus adding one eastward channel.
eD1	LC	Transmit the eastward optical signals to the OTU or integrated client-side equipment, thus dropping one eastward channel.

Port	Connector type	Description
eSI/eSO	LC	Receive or transmit the eastward OSC signal.

12.2.6 Valid Slots

The DMD1S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.2.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-10 lists the sequence number displayed on an NMS system of the optical port on the DMD1S board front panel.

Table 12-10 Display of the DMD1S optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
wIN/wOUT	3
wA1/wD1	1
wSI/wSO	5

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
eIN/eOUT	4
eA1/eD1	2
eSI/eSO	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.2.8 DMD1S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-11 lists the optical specifications of the DMD1S.

Table 12-11 TNF1DMD1S board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
eIN-eD1 wIN-wD1	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eIN-eSO wIN-wSO	Insertion loss	dB	< 1.4
eA1-eOUT wA1-wOUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.2

Corresponding interfaces	Item	Unit	Value
eSI-eOUT wSI-wOUT	Insertion loss	dB	< 1.4
eIN-wOUT wIN-eOUT	Insertion loss	dB	< 2.1
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the CWDM system, the DMD1S supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- The wavelength added in the east (eA1), the wavelength dropped in the east (eD1), the wavelength added in the west (wA1) and the wavelength dropped in the west (wD1) must be the same.
- The 1310 nm wavelength should be used to carry the supervisory signal from the east (eSI), the supervisory signal to the east (eSO), the supervisory signal from the west (wSI), and the supervisory signal to the west (wSO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.72 kg (1.59 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.3 DMD2

DMD2: Bidirectional Double Channel Optical Add/drop Multiplexing Board

12.3.1 Version Description

The available hardware version of the DMD2 is TNF1.

Version

Table 12-12 describes the version mapping of the DMD2 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-12 Version description of the DMD2

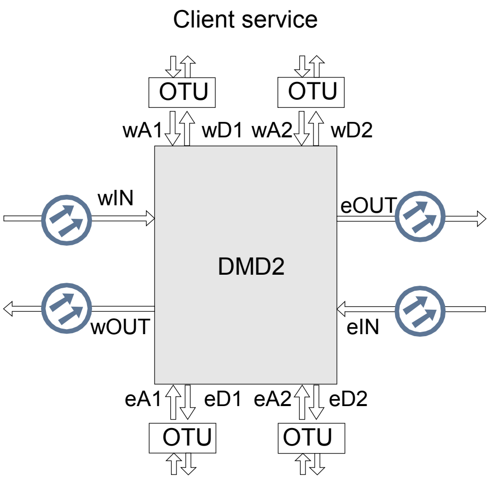
Item	Description
Board hardware version	TNF1

12.3.2 Application

The DMD2 board, in two directions, adds two wavelengths to and drops two wavelengths from the multiplexed signals respectively. It supports both the DWDM and CWDM specifications.

The DMD2 supports two-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-7**.

Figure 12-7 Application of the DMD2 in WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.3.3 Functions and Features

The main functions and features supported by the DMD2 are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-13**.

Table 12-13 Functions and features of the DMD2 board

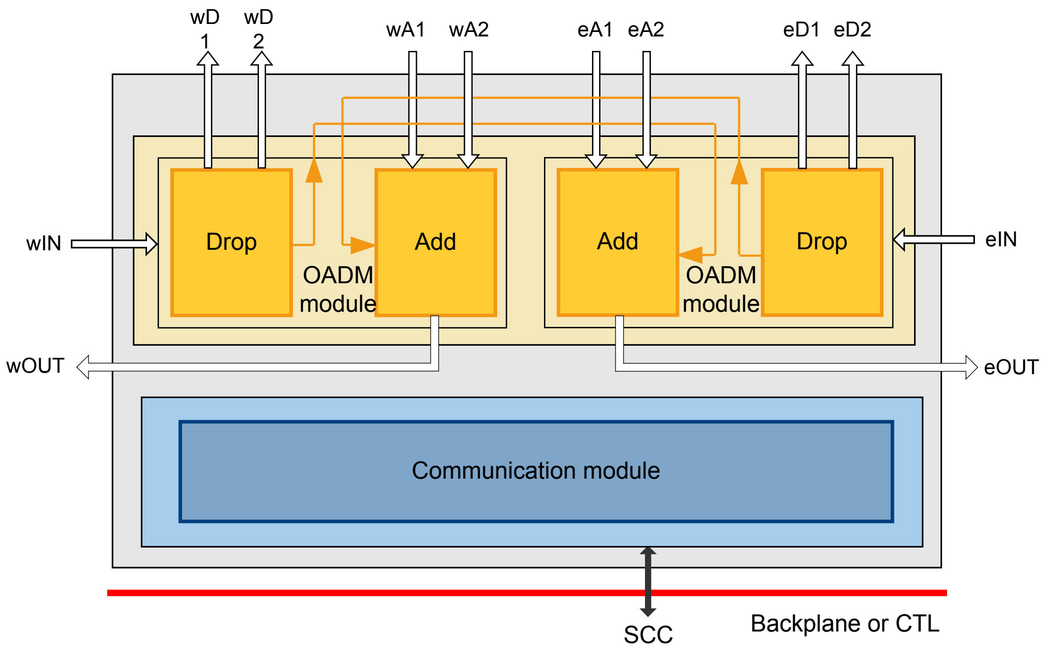
Functions and Features	Description
Basic Function	Adds/drops in two directions two channels of wavelength signals to/from the multiplexed signals respectively.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.3.4 Working Principle and Signal Flow

The DMD2 unit consists of two parts: the OADM module, the communication module.

Figure 12-8 shows the principle block diagram of the DMD2.

Figure 12-8 Principle block diagram of the DMD2



Signal Flow

In the east, the DMD2 board receives multiplexed signals through optical port eIN. After the optical module processes the multiplexed signals, the board splits out two channels of optical signals from the multiplexed signals and outputs them through optical port eD1 and eD2. Then, the remaining wavelengths are sent to the west add module.

The east add module receives the signals from the west drop module. The signals are multiplexed with two wavelengths that are input through the eA1 and eA2 optical ports. The multiplexed signals are output through the eOUT optical port.

The working principle of west signals is the same as that of east signals; while the signal flows in the two directions are different.

Module Function

- Optical module
  - Performs the add/drop multiplexing of two wavelengths respectively in two directions.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

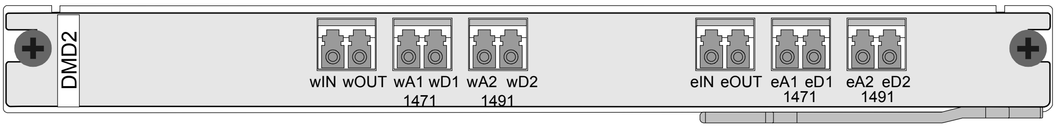
12.3.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-9 shows the front panel of the DMD2.

Figure 12-9 Front panel of the DMD2



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The DMD2 board does not have indicators.

Ports

There are twelve optical ports on the front panel of the DMD2. Table 12-14 lists the type and function of each port.

Table 12-14 Types and descriptions of the DMD2 ports

Port	Connector Type	Description
wIN/wOUT	LC	Receive or transmit the westward multiplexed signal.
wA1/wA2	LC	Receive the westward optical signals from the OTU or integrated client-side equipment, thus adding one westward channel respectively.
wD1/wD2	LC	Transmit the westward optical signals to the OTU or integrated client-side equipment, thus dropping one westward channel respectively.

Port	Connector Type	Description
eIN/eOUT	LC	Receive or transmit the eastward multiplexed signal.
eA1/eA2	LC	Receive the eastward optical signals from the OTU or integrated client-side equipment, thus adding one eastward channel respectively.
eD1/eD2	LC	Transmit the eastward optical signals to the OTU or integrated client-side equipment, thus dropping one eastward channel respectively.

12.3.6 Valid Slots

The DMD2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.3.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-15 lists the sequence number displayed in an NMS system of the optical port on the DMD2 board front panel.

Table 12-15 Display of the DMD2 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
wIN/wOUT	5
wA1/wD1	1
wA2/wD2	3
eIN/eOUT	6
eA1/eD1	2
eA2/eD2	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.3.8 DMD2 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-16 and **Table 12-17** list the optical specifications of the DMD2.

Table 12-16 TNF1DMD2 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
eIN-eD1 eIN-eD2 wIN-wD1 wIN-wD2	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eA1-eOUT eA2-eOUT wA1-wOUT	1.0 dB spectral width	nm	≥ 0.2

Corresponding interfaces	Item	Unit	Value
wA2-wOUT	Add channel insertion loss	dB	< 1.5
eIN-wOUT wIN-eOUT	Add channel insertion loss	dB	< 2.2
-	Reflectance	dB	< -40

Table 12-17 TNF1DMD2 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
eIN-eD1 eIN-eD2 wIN-wD1 wIN-wD2	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eA1-eOUT eA2-eOUT wA1-wOUT wA2-wOUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
eIN-wOUT wIN-eOUT	Add channel insertion loss	dB	< 2.2
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the DWDM and CWDM systems, the DMD2 supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- On the first channel, the wavelength added in the east (eA1), the wavelength dropped in the east (eD1), the wavelength added in the west (wA1), and the wavelength dropped in the west (wD1) should be the same.
- On the second channel, the wavelength added in the east (eA2), the wavelength dropped in the east (eD2), the wavelength added in the west (wA2), and the wavelength dropped in the west (wD2) should be the same.
- The wavelength on the first channel is smaller than the wavelength on the second channel.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.72 kg (1.59 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.4 DMD2S

DMD2S: Bidirectional Double Channel Optical Add/drop Multiplexing Board with OSC

12.4.1 Version Description

The available hardware version for the DMD2S is TNF1.

Version

Table 12-18 describes the version mapping of the DMD2S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-18 Version description of the DMD2S

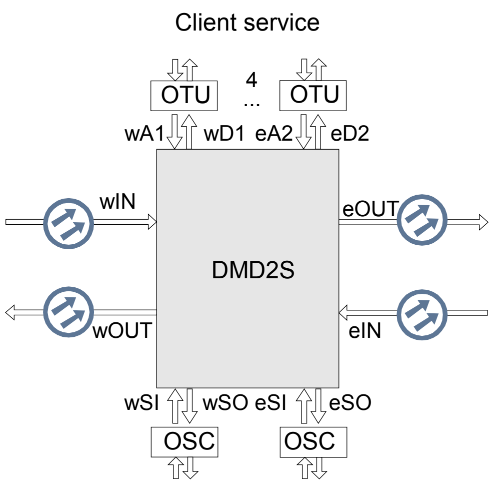
Item	Description
Board hardware version	TNF1

12.4.2 Application

The DMD2S board, in two directions, adds two wavelengths to and drops two wavelengths from the multiplexed signals respectively. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The DMD2S supports two-fiber bidirectional transmission. **Figure 12-10** shows the DMD2S board application in the WDM system.

Figure 12-10 DMD2S board application in the WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.4.3 Functions and Features

The main functions and features supported by the DMD2S are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-19**.

Table 12-19 Functions and features of the DMD2S board

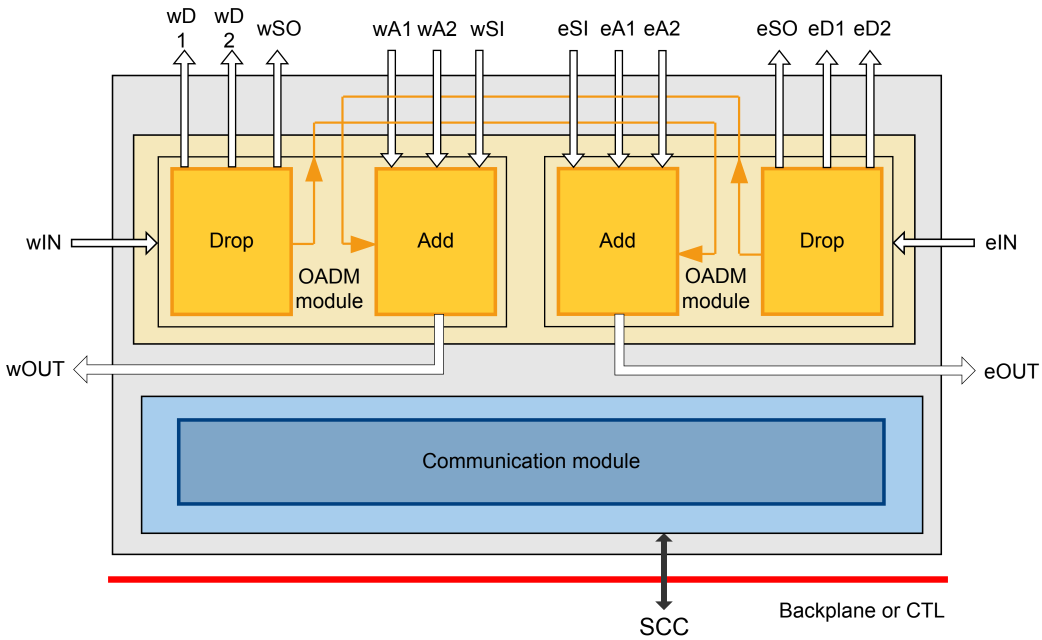
Functions and Features	Description
Basic Function	The DMD2S board, in two directions, adds two wavelengths to and drops two wavelengths from the multiplexed signals respectively. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports the CWDM specifications.

12.4.4 Working Principle and Signal Flow

The DMD2S unit consists of two parts: the OADM module, the communication module.

Figure 12-11 shows the principle block diagram of the DMD2S.

Figure 12-11 Principle block diagram of the DMD2S



Signal Flow

The board receives the east multiplexed signals from the upstream station through the eIN optical port. The drop module extracts two wavelengths and one channel of supervisory signals. The two wavelengths are output through the eD1 and eD2 optical ports and the one channel of supervisory signals is output through the eSO optical port. Then, the remaining wavelengths are sent to the west add module.

The east add module receives the signals from the west drop module. The signals are multiplexed with one channel of supervisory signals that are input through the eSI optical port and then are multiplexed with two wavelengths that are input through the eA1 and eA2 optical ports. The multiplexed signals are output through the eOUT optical port.

The working principle of west signals is the same as that of east signals; while the signal flows in the two directions are different.

Module Function

- Optical module
  - Performs the add/drop multiplexing of two wavelengths respectively in two directions, and multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

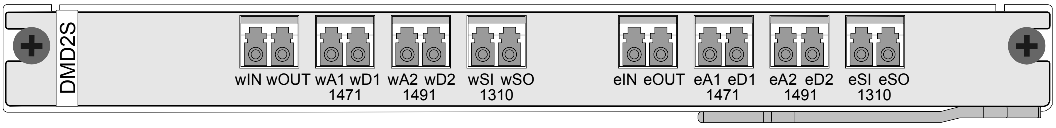
12.4.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-12 shows the front panel of the DMD2S.

Figure 12-12 Front panel of the DMD2S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The DMD2S board does not have indicators.

Ports

There are sixteen optical ports on the front panel of the DMD2S board, Table 12-20 lists the type and function of each port.

Table 12-20 Types and functions of the DMD2S ports

Optical Port	Port Type	Function
wIN/wOUT	LC	Receive or transmit the westward multiplexed signal.
wA1/wA2	LC	Receive the westward optical signals from the OTU or integrated client-side equipment, thus adding one westward channel respectively.
wD1/wD2	LC	Transmit the westward optical signals to the OTU or integrated client-side equipment, thus dropping one westward channel respectively.
wSI/wSO	LC	Receive or transmit the westward OSC signal.
eIN/eOUT	LC	Receive or transmit the eastward multiplexed signal.
eA1/eA2	LC	Receive the eastward optical signals from the OTU or integrated client-side equipment, thus adding one eastward channel respectively.
eD1/eD2	LC	Transmit the eastward optical signals to the OTU or integrated client-side equipment, thus dropping one eastward channel respectively.

Optical Port	Port Type	Function
eSI/eSO	LC	Receive or transmit the eastward OSC signal.

12.4.6 Valid Slots

The DMD2S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.4.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-21 lists the sequence number displayed in an NMS system of the optical port on the DMD2S board front panel.

Table 12-21 Display of the DMD2S ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
wIN/wOUT	5
wA1/wD1	1
wA2/wD2	3

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
wSI/wSO	8
eIN/eOUT	6
eA1/eD1	2
eA2/eD2	4
eSI/eSO	7

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.4.8 DMD2S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-22 list the optical specifications on the client and WDM side of the DMD2S.

Table 12-22 TNF1DMD2S board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
eIN-eD1 eIN-eD2 wIN-wD1 wIN-wD2	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
eIN-eSO wIN-wSO	Insertion loss	dB	< 2.0
eA1-eOUT eA2-eOUT wA1-wOUT wA2-wOUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5

Corresponding interfaces	Item	Unit	Value
eSI-eOUT wSI-wOUT	Insertion loss	dB	< 2.0
wIN-eOUT eIN-wOUT	Insertion loss	dB	< 3.0
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the CWDM system, the DMD2S supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- On the first channel, the wavelength added in the east (eA1), the wavelength dropped in the east (eD1), the wavelength added in the west (wA1), and the wavelength dropped in the west (wD1) should be the same.
- On the second channel, the wavelength added in the east (eA2), the wavelength dropped in the east (eD2), the wavelength added in the west (wA2), and the wavelength dropped in the west (wD2) should be the same.
- The wavelength on the first channel is smaller than the wavelength on the second channel.
- The 1310 nm wavelength should be used to carry the supervisory signal from the east (eSI), the supervisory signal to the east (eSO), the supervisory signal from the west (wSI), and the supervisory signal to the west (wSO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.74 kg (1.63 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.5 MD8

MD8: 8 Channel Multiplexing and Demultiplexing Board

12.5.1 Version Description

The available hardware version for the MD8 is TNF1.

Version

Table 12-23 describes the version mapping of the MD8 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-23 Version description of the MD8

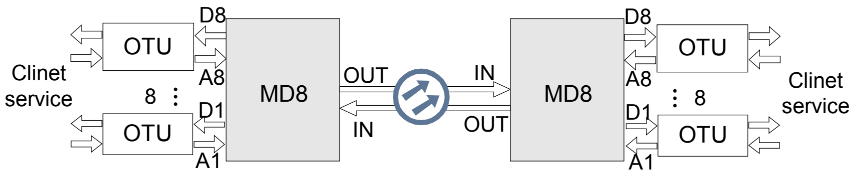
Item	Description
Board hardware version	TNF1

12.5.2 Application

The MD8 board mainly serves to add/drop eight channels of wavelength signals to/from the multiplexed signals.

The MD8 supports two-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-13**.

Figure 12-13 Application of the MD8 in WDM systems



12.5.3 Functions and Features

The main functions and features supported by the MD8 are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-24**.

Table 12-24 Functions and features of the MD8 board

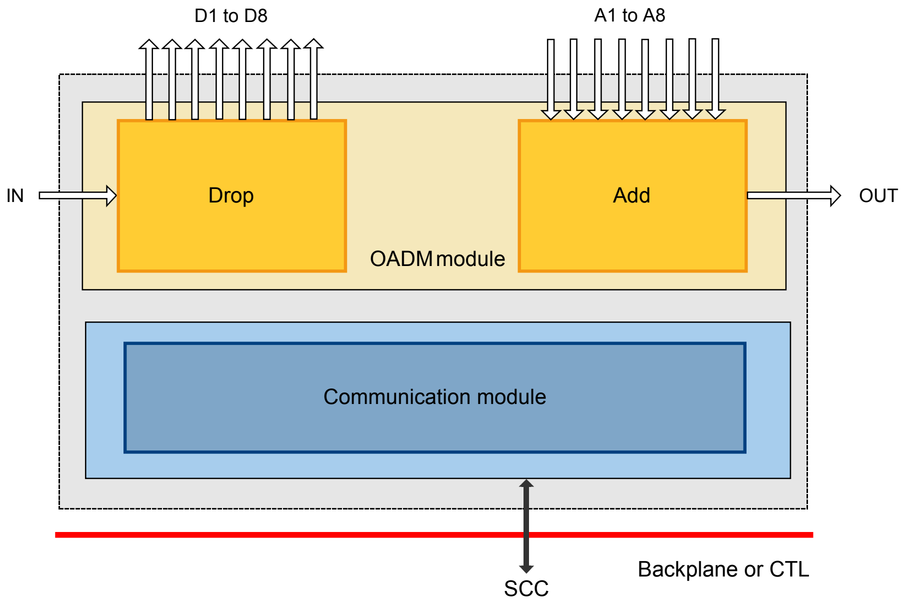
Functions and Features	Description
Basic Function	Adds/drops and multiplexes eight channels of signals from the multiplexed signals.
WDM specifications	Supports the CWDM specifications.

12.5.4 Working Principle and Signal Flow

The MD8 unit consists of two parts: the OADM module, and communication module.

Figure 12-14 shows the principle block diagram of the MD8.

Figure 12-14 Principle block diagram of the MD8



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops eight wavelengths from the multiplexed signals through the D1 to D8 optical ports.

The add module multiplexes the signals with the eight wavelengths added through the A1 to A8 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of eight wavelengths.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

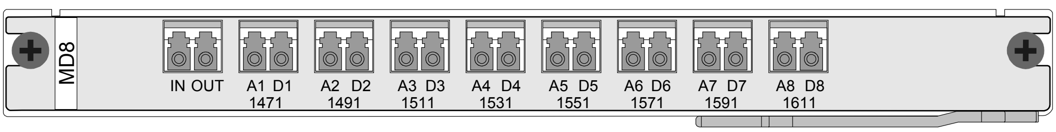
12.5.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-15 shows the front panel of the MD8.

Figure 12-15 Front panel of the MD8



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MD8 board does not have indicators.

Ports

There are eighteen optical ports on the front panel of the MD8 board, **Table 12-25** lists the type and function of each port.

Table 12-25 Types and functions of the MD8 ports

Optical Port	Port Type	Function
A1 to A8	LC	Receive the optical signals from the OTU or integrated client side equipment, thus adding one channel respectively.
D1 to D8	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
IN/OUT	LC	Receive or transmit the multiplexed signal.

12.5.6 Valid Slots

The MD8 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:

- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.5.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-26 lists the sequence number displayed in an NMS system of the optical port on the MD8 board front panel.

Table 12-26 Display of the MD8 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	9
A1/D1	1
A2/D2	2
A3/D3	3
A4/D4	4
A5/D5	5
A6/D6	6
A7/D7	7
A8/D8	8

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.5.8 MD8 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-27 lists the optical specifications of the MD8.

Table 12-27 TNF1MD8 board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
IN-D1 IN-D2 IN-D3 IN-D4 IN-D5 IN-D6 IN-D7 IN-D8	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	≤ 2.0
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT A3-OUT A4-OUT A5-OUT A6-OUT A7-OUT A8-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	≤ 2.0
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the CWDM system, the MD8 supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

The add wavelength and drop wavelength of each channel are the same. In addition, the wavelengths are incremented from the first channel to the eighth channel. (A1 = D1 < A2 = D2 < A3 = D3 < A4 = D4 < A5 = D5 < A6 = D6 < A7 = D7 < A8 = D8)

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.64 kg (1.41 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.6 MD8S

MD8S: 8 Channel Multiplexing and Demultiplexing Board with OSC

12.6.1 Version Description

The available hardware version for the MD8S is TNF1.

Version

Table 12-28 describes the version mapping of the MD8S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-28 Version description of the MD8S

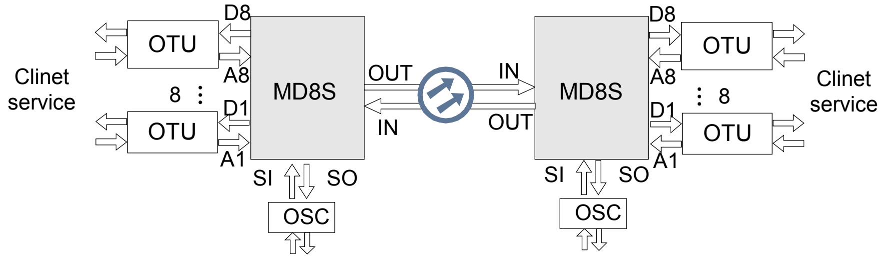
Item	Description
Board hardware version	TNF1

12.6.2 Application

The MD8S board is mainly used to demultiplex eight wavelength signals from the multiplexed signal in one transmission direction. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The MD8S supports two-fiber bidirectional transmission. For the application of the in WDM system, see **Figure 12-16**.

Figure 12-16 Application of the MD8S in WDM system



12.6.3 Functions and Features

The MD8S board supports optical add/drop multiplexing. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

For detailed functions and features, see **Table 12-29**.

Table 12-29 Functions and features of the MD8S

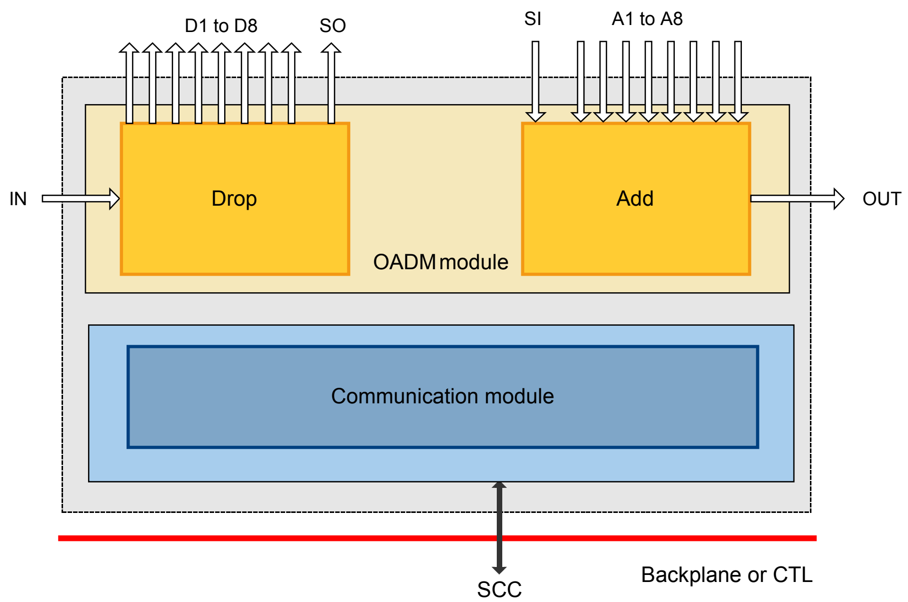
Functions and Features	Description
Basic function	Adds/drops and multiplexes eight channels of signals from the multiplexed signals. Multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports the CWDM specifications.

12.6.4 Working Principle and Signal Flow

The MD8S unit consists of two parts: the OADM module, and communication module.

Figure 12-17 shows the principle block diagram of the MD8S.

Figure 12-17 Principle block diagram of the MD8S



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops eight wavelengths from the multiplexed signals through the D1 to D8 optical ports, and then drops one channel of OSC signal through the SO optical port.

The add module multiplexes one channel of OSC signals through the SI optical port, and then multiplexes the signals with the eight wavelengths added through the A1 to A8 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of eight wavelengths. Multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

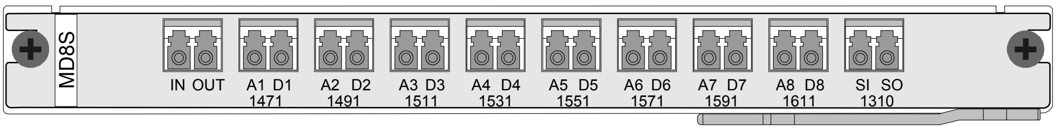
12.6.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-18 shows the front panel of the MD8S.

Figure 12-18 Front panel of the MD8S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MD8S board does not have indicators.

Ports

There are twenty optical ports on the front panel of the MD8S board, Table 12-30 lists the type and function of each port.

Table 12-30 Types and functions of the MD8S ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1 to A8	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1 to D8	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
SI/SO	LC	Receive or transmit the OSC signal.

12.6.6 Valid Slots

The MD8S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.6.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-31 lists the sequence number displayed in an NMS system of the optical port on the MD8S board front panel.

Table 12-31 Display of the MD8S ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	9
A1/D1	1
A2/D2	2
A3/D3	3
A4/D4	4
A5/D5	5
A6/D6	6
A7/D7	7
A8/D8	8
SI/SO	10

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.6.8 MD8S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-32 lists the optical specifications of the MD8S.

Table 12-32 TNF1MD8S board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1 IN-D2 IN-D3 IN-D4	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	≤ 2.5

Corresponding interfaces	Item	Unit	Value
IN-D5 IN-D6 IN-D7 IN-D8	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	≤ 1.0
A1-OUT A2-OUT A3-OUT A4-OUT A5-OUT A6-OUT A7-OUT A8-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	≤ 2.5
SI-OUT	Insertion loss	dB	≤ 1.0
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the CWDM system, the MD8S supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- The add wavelength and drop wavelength of each channel are the same. In addition, the wavelengths are incremented from the first channel to the eighth channel. (A1 = D1 < A2 = D2 < A3 = D3 < A4 = D4 < A5 = D5 < A6 = D6 < A7 = D7 < A8 = D8)
- The 1310 nm wavelength should be used to carry the input supervisory signal (SI) and output supervisory signal (SO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.66 kg (1.45 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.7 MR1

MR1: Single Channel Optical Add/Drop Multiplexing Board

12.7.1 Version Description

The available hardware version for the MR1 is TNF1.

Version

Table 12-33 describes the version mapping of the MR1 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-33 Version description of the MR1

Item	Description
Board hardware version	TNF1

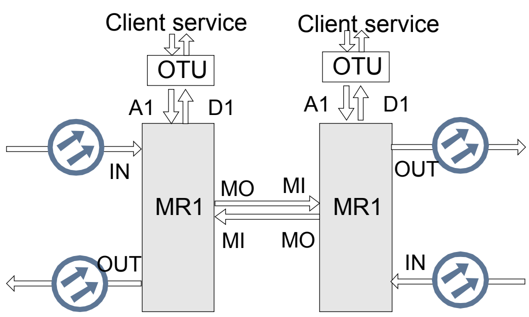
12.7.2 Application

The MR1 board mainly serves to add/drop a channel of wavelength signals to/from the multiplexed signals in a direction.

Application Scenario 1: OADM Mode

The MR1 supports two-fiber bidirectional transmission. **Figure 12-19** shows the MR1 board application in the WDM system.

Figure 12-19 MR1 board application in the two-fiber bidirectional WDM system



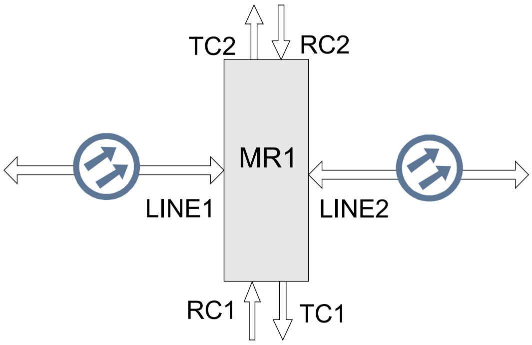
NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

Application Scenario 2: Bandpass Mode

In CWDM system, when the wavelength of MR1 board is 1531 nm, it supports bandpass mode, and applies in single-fiber bidirectional transmission system, as shown in **Figure 12-20**.

Figure 12-20 MR1 board application in the single-fiber bidirectional WDM system



NOTE

In CWDM system, when the wavelength of the MR1 board is any one of the 8 wavelengths: 1471 nm, 1491 nm, 1511 nm, 1531 nm, 1551 nm, 1571 nm, 1591 nm and 1611 nm, it can be used at OADM mode in two-fiber bidirectional system; when the wavelength of the MR1 board is 1531 nm, it can be used at OADM mode in two-fiber bidirectional system or at bandpass mode in single-fiber bidirectional system.

12.7.3 Functions and Features

The MR1 board supports optical add/drop multiplexing, cascading ports and bandpass mode (1531 nm wavelength).

For detailed functions and features, see **Table 12-34**.

Table 12-34 Functions and features of the MR1 board

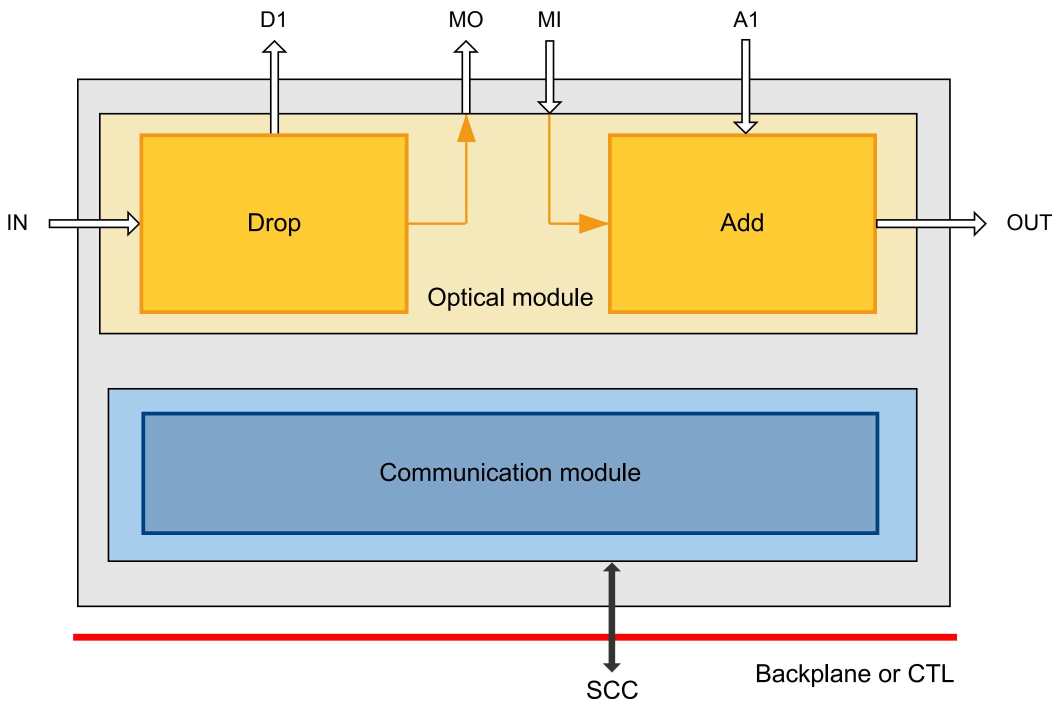
Functions and Features	Description
Basic Function	Adds/drops and multiplexes one channel of signal from the multiplexed signals. Provides the optical port to concatenate other OADM boards. The MR1 board with 1531 nm wavelengths in a CWDM system supports the bandpass mode.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.7.4 Working Principle and Signal Flow

The MR1 unit consists of two parts: the OADM module, and communication module.

Figure 12-21 and **Figure 12-22** show the principle block diagram of the MR1.

Figure 12-21 Principle block diagram of the MR1 (OADM mode in CWDM system and in DWDM system)



Signal Flow (OADM mode in CWDM system and in DWDM system)

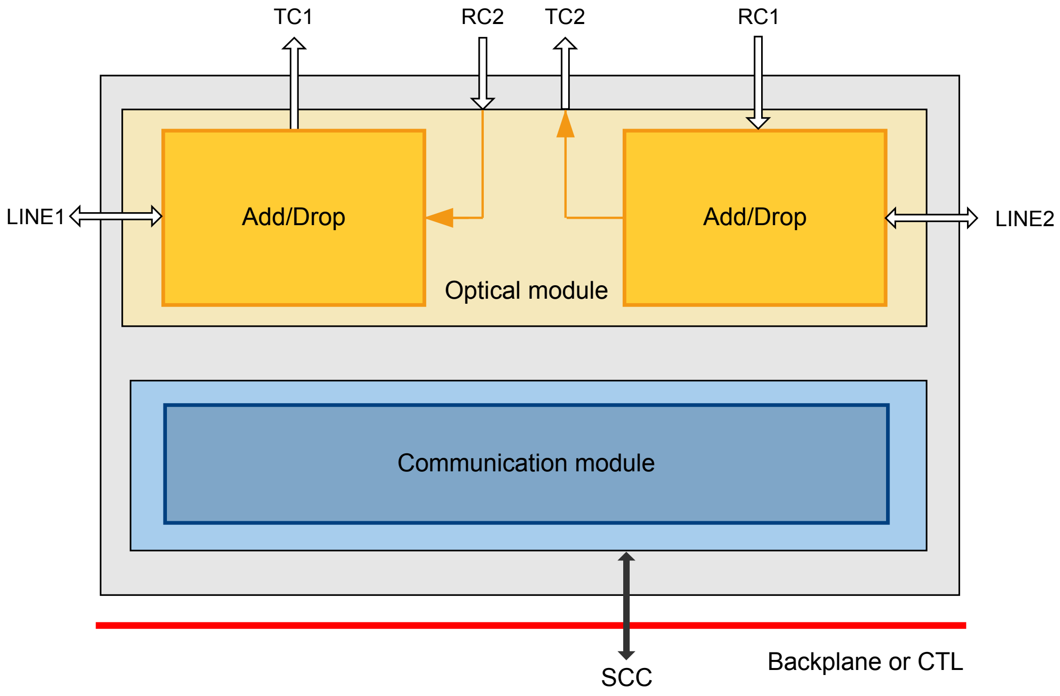
The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops one wavelength from the multiplexed signals through the D1 optical port. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes the signals with the one wavelength added through the A1 optical port. The multiplexed optical signals are output through the OUT optical port.

Module Function (OADM mode in CWDM system and in DWDM system)

- Optical module
  - Performs the add/drop multiplexing of one wavelength.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

Figure 12-22 Principle block diagram of the MR1 (bandpass mode in CWDM system)



Signal Flow (bandpass mode in CWDM system)

The board receives DWDM signals from the upstream station through the LINE1 optical port. Then, DWDM signals at a wavelength ranging from 195.3 THz to 196.0 THz are output through the TC1 optical port. After the signals are transmitted, the MR1 board receives the signals through the RC1 optical port and sends the signals to the line through the LINE2 optical port.

The board receives DWDM signals from the upstream station through the LINE2 optical port. Then, DWDM signals at a wavelength ranging from 192.9 THz to 193.6 THz are output through the TC2 optical port. After the signals are transmitted, the MR1 board receives the signals through the RC2 optical port and sends the signals to the line through the LINE1 optical port.

Module Function (bandpass mode in CWDM system)

- Optical module
  - The board provides the bandpass function when the wavelength is 1531 nm.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

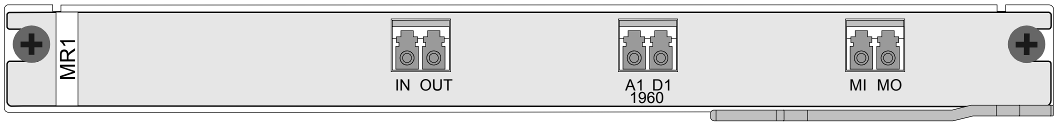
12.7.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-23 shows the front panel of the MR1 in DWDM system.

Figure 12-23 Front panel of the MR1 in DWDM system



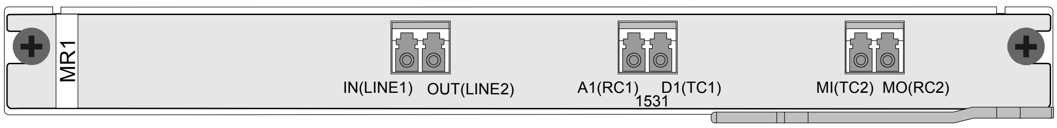
NOTE

The number under the optical port indicates one of the frequencies that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Figure 12-24 shows the front panel of the MR1 in CWDM system.

Figure 12-24 Front panel of the MR1 in CWDM system



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR1 board does not have indicators.

Ports

There are six optical ports on the front panel of the MR1 board, **Table 12-35** and **Table 12-36** list the type and function of each port.

Table 12-35 Types and functions of the MR1 ports in CWDM system

Optical Port	Port Type	Function
IN (LINE1)	LC	● When the board is used at OADM mode, the port is used to receive the multiplexed signals. ● When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to input/output DWDM signals.

Optical Port	Port Type	Function
OUT (LINE2)	LC	• When the board is used at OADM mode, the port is used to transmit the multiplexed signals. • When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to input/output DWDM signals.
A1 (RC1)	LC	• When the board is used at OADM mode, the port is used to receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel. • When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to input DWDM signals of 195.3 THz to 196.0 THz.
D1 (TC1)	LC	• When the board is used at OADM mode, the port is used to transmit the optical signals to the OTU or integrated client-side equipment, thus dropping one channel. • When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to output DWDM signals of 195.3 THz to 196.0 THz.
MI (TC2)	LC	• When the board is used at OADM mode, the port is a cascade input port, and used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signals. • When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to output DWDM signals of 192.9 THz to 193.6 THz.
MO (RC2)	LC	• When the board is used at OADM mode, the port is a cascade output port, and used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signals. • When the wavelength of the MR1 board is 1531 nm, it can be used at bandpass mode, and the port is used to input DWDM signals of 192.9 THz to 193.6 THz.

Table 12-36 Types and functions of the MR1 ports in DWDM system

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel.
D1	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel.

Optical Port	Port Type	Function
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signal.

12.7.6 Valid Slots

The MR1 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.7.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-37 and **Table 12-38** list the sequence number displayed in an NMS system of the optical port on the MR1 board front panel.

Table 12-37 Display of the MR1 ports (bandpass mode in CWDM system)

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
TC1/RC1	1
TC2/RC2	2

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
LINE1	3
LINE2	4

Table 12-38 Display of the MR1 ports (OADM mode in CWDM system and in DWDM system)

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
A1/D1	1
IN/OUT	2
MO/MI	3

12.7.8 MR1 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-39 and **Table 12-40** list the optical specifications of the MR1.

Table 12-39 TNF1MR1 board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
IN-D1	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 1.2
IN-MO	Insertion loss	dB	< 0.7

Corresponding interfaces	Item	Unit	Value
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 0.7
	Isolation	dB	> 15
-	Reflectance	dB	< -40

Table 12-40 TNF1MR1 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
IN (LINE1)-D1 (TC1)	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1 (RC1)-OUT (LINE2)	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.2
IN (LINE1)-MO (RC2)	Insertion loss	dB	< 1.2
	Isolation	dB	> 13
MI (TC2)-OUT (LINE2)	Insertion loss	dB	< 1.2
	Isolation	dB	> 15
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

The wavelength that is received by each optical port should comply with the following rules:

The add wavelength (A1) is the same as the drop wavelength (D1).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.54 kg (1.19 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.8 MR1S

MR1S: Single Channel Optical Add/drop Multiplexing Board with OSC

12.8.1 Version Description

The available hardware version for the MR1S is TNF1.

Version

Table 12-41 describes the version mapping of the MR1S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-41 Version description of the MR1S

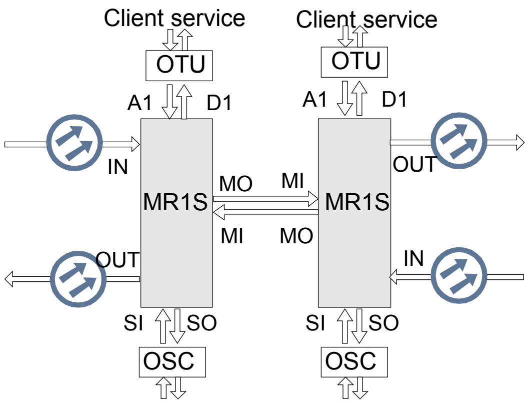
Item	Description
Board hardware version	TNF1

12.8.2 Application

The MR1S board mainly serves to add/drop one channel of wavelength signals to/from the multiplexed signals in a direction. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The MR1S supports two-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-25**.

Figure 12-25 Application of the MR1S in WDM systems



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.8.3 Functions and Features

The MR1S board supports optical add/drop multiplexing and cascading ports. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

For detailed information about the functions and features, see **Table 12-42**.

Table 12-42 Functions and features of the MR1S board

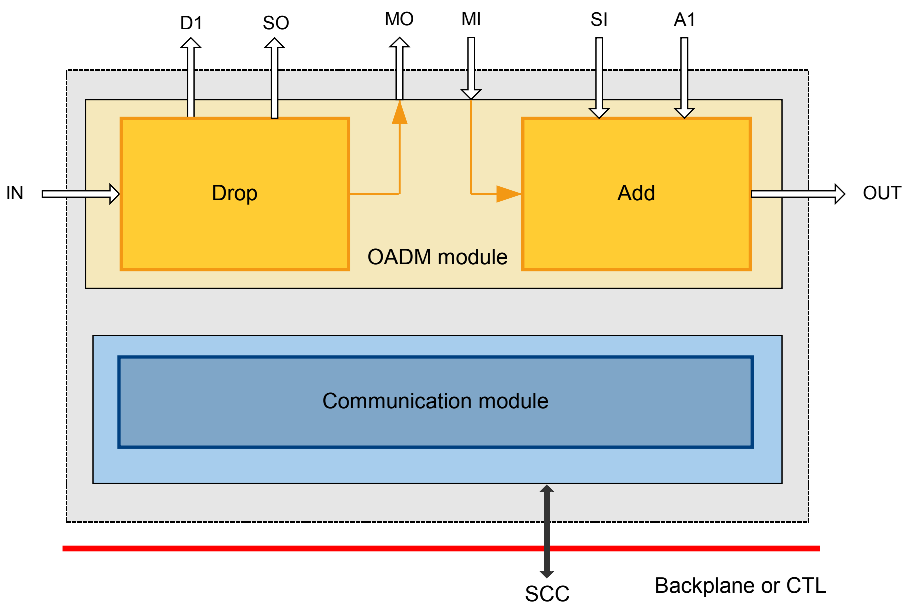
Functions and Features	Description
Basic Function	Adds/drops and multiplexes one channel of signal from the multiplexed signals. Provides the optical port to concatenate other OADM boards. Multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.8.4 Working Principle and Signal Flow

The MR1S unit consists of two parts: the OADM module, and communication module.

Figure 12-26 shows the principle block diagram of the MR1S.

Figure 12-26 Principle block diagram of the MR1S



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops one wavelength from the multiplexed signals through the D1 optical port, and then drops one channel of OSC signal through the SO optical port. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes one channel of OSC signals through the SI optical port, and then multiplexes the signals with the one wavelength added through the A1 optical port. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of one wavelength, and multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

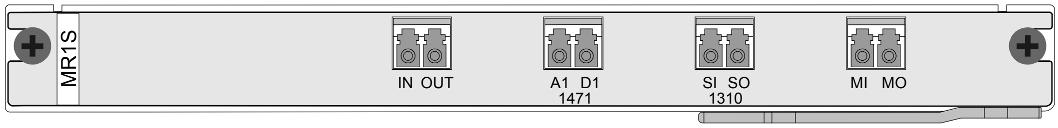
12.8.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-27 shows the front panel of the MR1S.

Figure 12-27 Front panel of the MR1S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR1S board does not have indicators.

Ports

There are eight optical ports on the front panel of the MR1S board, **Table 12-43** lists the type and function of each port.

Table 12-43 Types and functions of the MR1S ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel.
D1	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel.
SI/SO	LC	Receive or transmit the OSC signal.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.

12.8.6 Valid Slots

The MR1S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.8.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-44 lists the sequence number displayed in an NMS system of the optical port on the MR1S board front panel.

Table 12-44 Display of the MR1S ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
A1/D1	1
IN/OUT	2
MI/MO	3
SI/SO	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.8.8 MR1S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-45 and Table 12-46 list the optical specifications of the MR1S.

Table 12-45 TNF1MR1S board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.6
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	< 1.0
A1-OUT	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 1.6
SI-OUT	Insertion loss	dB	< 1.0
IN-MO	Insertion loss	dB	< 1.2
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.2
	Isolation	dB	> 15
-	reflectance	dB	< -40

Table 12-46 TNF1MR1S board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.2
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	< 1.2
A1-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.2
SI-OUT	Insertion loss	dB	< 1.2
IN-MO	Insertion loss	dB	< 1.2
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.2
	Isolation	dB	> 15
-	reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the DWDM and CWDM systems, the MR1S supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- The add wavelength (A1) is the same as the drop wavelength (D1).
- The 1310 nm wavelength should be used to carry the input supervisory signal (SI) and output supervisory signal (SO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.55 kg (1.21 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.9 MR2

MR2: Double Channel Optical Add/drop Multiplexing Board

12.9.1 Version Description

The available hardware version for the MR2 is TNF1.

Version

Table 12-47 describes the version mapping of the MR2 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-47 Version description of the MR2

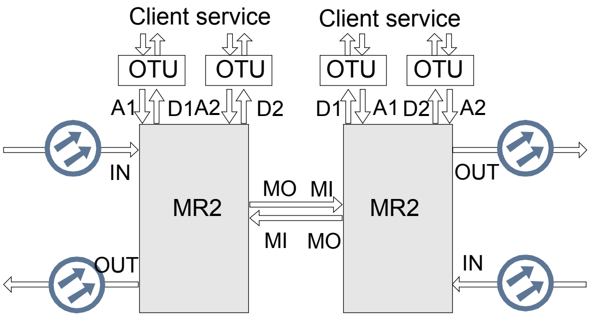
Item	Description
Board hardware version	TNF1

12.9.2 Application

The MR2 board mainly serves to add/drop two channels of wavelength signals to/from the multiplexed signals in a direction.

The MR2 supports two-fiber bidirectional transmission. **Figure 12-28** shows the MR2 board application in the WDM system.

Figure 12-28 MR2 board application in the WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.9.3 Functions and Features

The MR2 board supports optical add/drop multiplexing and cascading ports.

For detailed functions and features, see **Table 12-48**.

Table 12-48 Functions and features of the MR2 board

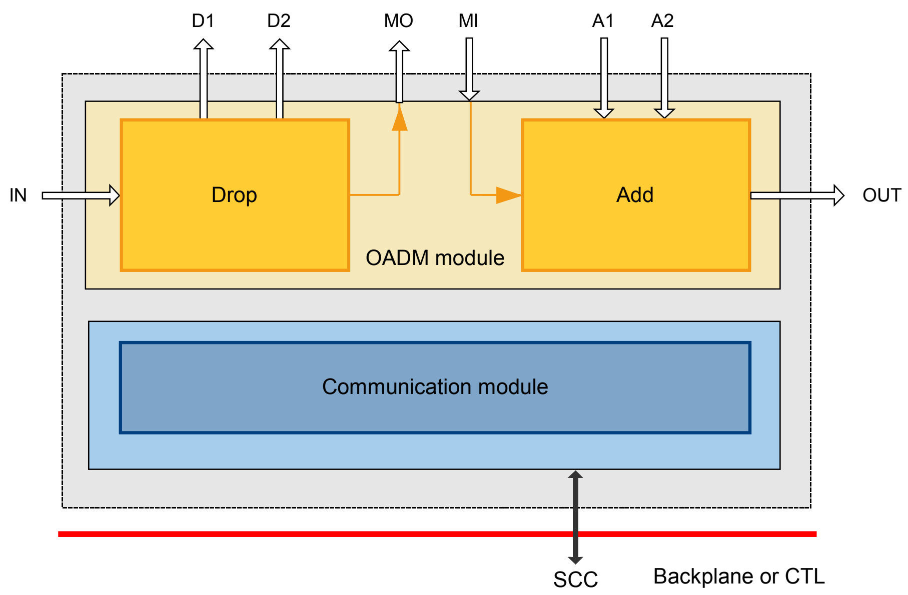
Functions and Features	Description
Basic Function	Adds/drops and multiplexes two channels of signal from the multiplexed signals. Provides the optical port to concatenate other OADM boards.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.9.4 Working Principle and Signal Flow

The MR2 unit consists of two parts: the OADM module, and communication module.

Figure 12-29 shows the principle block diagram of the MR2.

Figure 12-29 Principle block diagram of the MR2



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops two wavelengths from the multiplexed signals through the D1 and D2 optical ports. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes the signals with the two wavelengths added through the A1 and A2 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of two wavelengths in a direction.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

12.9.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-30 shows the front panel of the MR2.

Figure 12-30 Front panel of the MR2

NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR2 board does not have indicators.

Ports

There are eight optical ports on the front panel of the MR2 board, Table 12-49 lists the type and function of each port.

Table 12-49 Types and functions of the MR2 ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1/A2	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1/D2	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.

12.9.6 Valid Slots

The MR2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.9.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-50 lists the sequence number displayed in an NMS system of the optical port on the MR2 board front panel.

Table 12-50 Display of the MR2 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	3
A1/D1	1
A2/D2	2
MO/MI	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.9.8 MR2 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-51 and **Table 12-52** list the optical specifications of the MR2.

Table 12-51 TNF1MR2 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
IN-D1 IN-D2	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 1.5
IN-MO	Insertion loss	dB	< 1.0
	Isolation	dB	> 13

Corresponding interfaces	Item	Unit	Value
MI-OUT	Insertion loss	dB	< 1.0
	Isolation	dB	> 15
-	reflectance	dB	< -40

Table 12-52 TNF1MR2 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
IN-D1 IN-D2	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
IN-MO	Insertion loss	dB	< 1.0
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.0
	Isolation	dB	> 15
-	reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the DWDM and CWDM systems, the MR2 supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

The add wavelength and drop wavelength of each channel are the same. In addition, the wavelength on the first channel is smaller than the wavelength on the second channel. (A1 = D1 < A2 = D2)

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.55 kg (1.21 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.10 MR2S

MR2S: Double Channel Optical Add/drop Multiplexing Board with OSC

12.10.1 Version Description

The available hardware version for the MR2S is TNF1.

Version

Table 12-53 describes the version mapping of the MR2S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-53 Version description of the MR2S

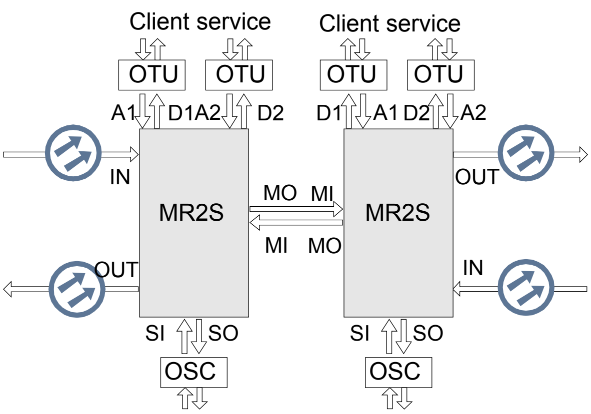
Item	Description
Board hardware version	TNF1

12.10.2 Application

The MR2S board mainly serves to add/drop two channels of wavelength signals to/from the multiplexed signals in a direction. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The MR2S supports two-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-31**.

Figure 12-31 MR2S board application in a WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.10.3 Functions and Features

The MR2S board supports optical add/drop multiplexing and cascading ports. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

For detailed functions and features, see **Table 12-54**.

Table 12-54 Functions and features of the MR2S board

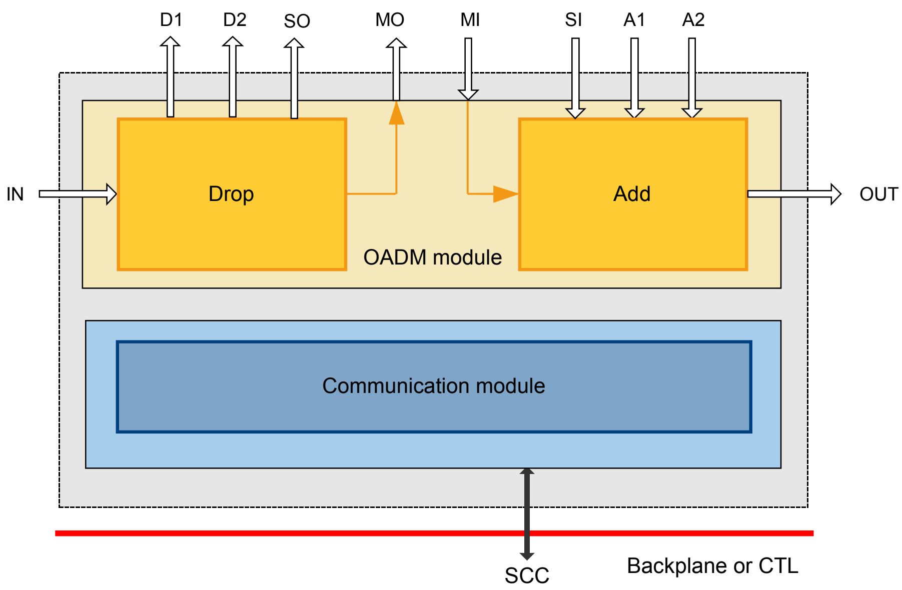
Functions and Features	Description
Basic Function	Adds/drops and multiplexes two channels of signals from the multiplexed signals. Provides the optical port to concatenate other OADM boards. Multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.10.4 Working Principle and Signal Flow

The MR2S unit consists of two parts: the OADM module, and communication module.

Figure 12-32 shows the principle block diagram of the MR2S.

Figure 12-32 Principle block diagram of the MR2S



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops two wavelengths from the multiplexed signals through the D1 and D2 optical port, and then drops one channel of OSC signal through the SO optical port. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes one channel of OSC signals through the SI optical port, and then multiplexes the signals with the two wavelengths added through the A1 and A2 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of two wavelengths in a direction, and multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

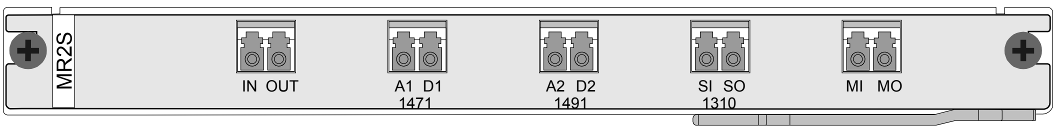
12.10.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-33 shows the front panel of the MR2S.

Figure 12-33 Front panel of the MR2S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR2S board does not have indicators.

Ports

There are ten optical ports on the front panel of the MR2S board, **Table 12-55** lists the type and function of each port.

Table 12-55 Types and functions of the MR2S ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1/A2	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1/D2	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.
SI/SO	LC	Receive or transmit the OSC signal.

12.10.6 Valid Slots

The MR2S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.10.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-56 lists the sequence number displayed in an NMS system of the optical port on the MR2S board front panel.

Table 12-56 Display of the MR2S optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	3
A1/D1	1
A2/D2	2
SI/SO	5
MI/MO	4

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.10.8 MR2S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-57 and **Table 12-58** list the optical specifications of the MR2S.

Table 12-57 TNF1MR2S board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1	1.0 dB spectral width	nm	≥ 0.2

Corresponding interfaces	Item	Unit	Value
IN-D2	Drop channel insertion loss	dB	< 2.0
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	< 1.0
A1-OUT A2-OUT	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 2.0
SI-OUT	Insertion loss	dB	< 1.0
IN-MO	Insertion loss	dB	< 1.5
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.5
	Isolation	dB	> 15
-	reflectance	dB	< -40

Table 12-58 TNF1MR2S board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1 IN-D2	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30

Corresponding interfaces	Item	Unit	Value
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	< 1.5
A1-OUT A2-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
SI-OUT	Insertion loss	dB	< 1.5
IN-MO	Insertion loss	dB	< 1.5
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.5
	Isolation	dB	> 15
-	reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the DWDM and CWDM systems, the MR2S supports adding/dropping of any wavelength. The wavelength that is received by each optical port should comply with the following rules:

- The add wavelength and drop wavelength of each channel are the same. In addition, the wavelength on the first channel is smaller than the wavelength on the second channel. (A1 = D1 < A2 = D2)
- The 1310 nm wavelength should be used to carry the input supervisory signal (SI) and output supervisory signal (SO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.57 kg (1.26 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.11 MR4

MR4: Four Channel Optical Add/drop Multiplexing Board

12.11.1 Version Description

The available hardware version for the MR4 is TNF1.

Version

Table 12-59 describes the version mapping of the MR4 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-59 Version description of the MR4

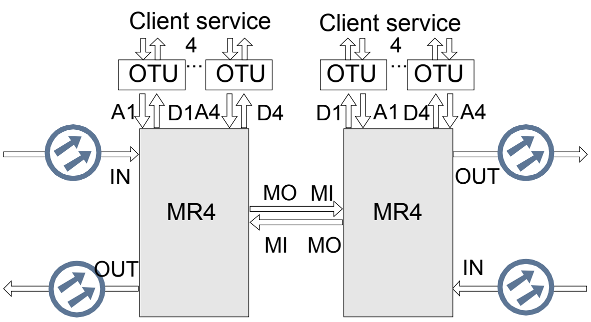
Item	Description
Board hardware version	TNF1

12.11.2 Application

The MR4 board mainly serves to add/drop four channels of wavelength signals to/from the multiplexed signals in a direction.

The MR4 supports two-fiber bidirectional transmission.**Figure 12-34** shows the MR4 board application in the WDM system.

Figure 12-34 MR4 board application in the WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.11.3 Functions and Features

The main functions and features supported by the MR4 are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-60**.

Table 12-60 Functions and features of the MR4 board

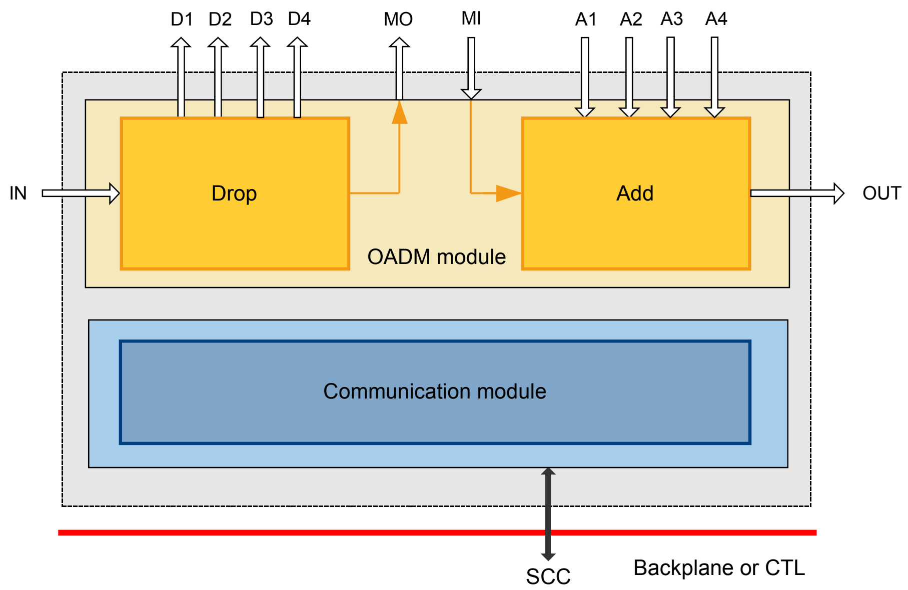
Functions and Features	Description
Basic Function	Adds/drops and multiplexes four channels of signal from the multiplexed signals. Provides the optical port to concatenate other OADM boards.
WDM specifications	Supports both the DWDM and CWDM specifications.

12.11.4 Working Principle and Signal Flow

The MR4 unit consists of two parts: the OADM module, and communication module.

Figure 12-35 shows the principle block diagram of the MR4.

Figure 12-35 Principle block diagram of the MR4



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops four wavelengths from the multiplexed signals through the D1, D2, D3 and D4 optical ports. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes the signals with the one wavelength added through the A1, A2, A3 and A4 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of four wavelengths.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

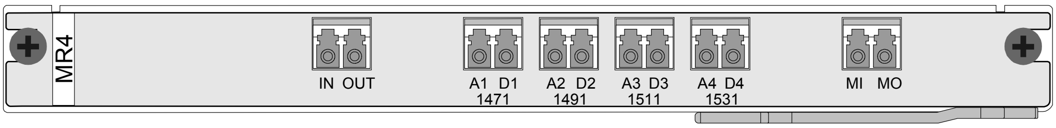
12.11.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-36 shows the front panel of the MR4.

Figure 12-36 Front panel of the MR4



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR4 board does not have indicators.

Ports

There are twelve optical ports on the front panel of the MR4 board, Table 12-61 lists the type and function of each port.

Table 12-61 Types and functions of the MR4 ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1 to A4	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.

Optical Port	Port Type	Function
D1 to D4	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.

12.11.6 Valid Slots

The MR4 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.11.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-62 lists the sequence number displayed in an NMS system of the optical port on the MR4 board front panel.

Table 12-62 Display of the MR4 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	5
A1/D1	1
A2/D2	2
A3/D3	3
A4/D4	4
MI/MO	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.11.8 MR4 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-63 and **Table 12-64** list the optical specifications of the MR4.

Table 12-63 TNF1MR4 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
IN-D1 IN-D2 IN-D3 IN-D4	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 2.0
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT A3-OUT	1.0 dB spectral width	nm	≥ 0.2

Corresponding interfaces	Item	Unit	Value
A4-OUT	Add channel insertion loss	dB	< 2.0
IN-MO	Insertion loss	dB	< 1.5
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.5
	Isolation	dB	> 15
-	Reflectance	dB	< -40

Table 12-64 TNF1MR4 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
IN-D1 IN-D2 IN-D3 IN-D4	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT A3-OUT A4-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
IN-MO	Insertion loss	dB	< 1.5
		dB	< 1.5
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 1.5
	Isolation	dB	> 15

Corresponding interfaces	Item	Unit	Value
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelength

In a DWDM system, the MR4 supports adding/dropping of four channels in the same band of the same board. **Table 12-65** shows the rules of wavelength distribution.

Table 12-65 Wavelength distribution rules of the MR4 in a DWDM system

Band Group	Frequency (THz)			
	A1/D1	A2/D2	A3/D3	A4/D4
1	192.1	192.2	192.3	192.4
2	192.5	192.6	192.7	192.8
3	192.9	193.0	193.1	193.2
4	193.3	193.4	193.5	193.6
5	193.7	193.8	193.9	194.0
6	194.1	194.2	194.3	194.4
7	194.5	194.6	194.7	194.8
8	194.9	195.0	195.1	195.2
9	195.3	195.4	195.5	195.6
10	195.7	195.8	195.9	196.0

In a CWDM system, the MR4 supports adding/dropping of four wavelengths in the same band of the same board. **Table 12-66** shows the rules of wavelength distribution.

Table 12-66 Wavelength distribution rules of the MR4 in a CWDM system

Wavelength (nm)			
A1/D1	A2/D2	A3/D3	A4/D4
1471	1491	1511	1531
1551	1571	1591	1611

The wavelength that is sent to each optical port should comply with the following rules:

The add wavelength and drop wavelength of each channel are the same. In addition, the wavelengths are incremented from the first channel to the fourth channel. (A1 = D1 < A2 = D2 < A3 = D3 < A4 = D4)

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.56 kg (1.23 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.12 MR4S

MR4S: Four Channel Optical Add/drop Multiplexing Board with OSC

12.12.1 Version Description

The available hardware version for the MR4S is TNF1.

Version

Table 12-67 describes the version mapping of the MR4S board. The mapping version of the equipment is V100R001C01 or later.

Table 12-67 Version description of the MR4S

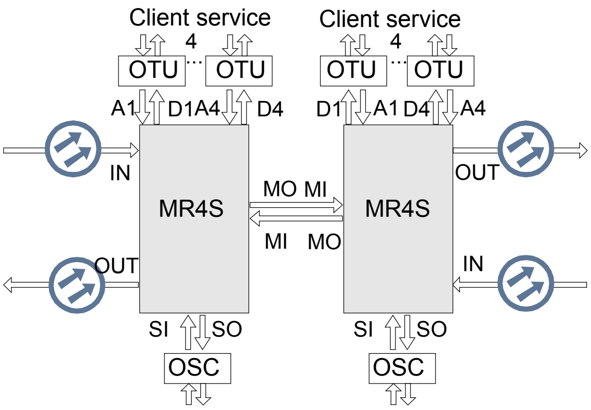
Item	Description
Board hardware version	TNF1

12.12.2 Application

The MR4S board mainly serves to add/drop four channels of wavelength signals to/from the multiplexed signals in a direction. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

The MR4S supports two-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-37**.

Figure 12-37 MR4S board application in a WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.12.3 Functions and Features

The MR4S board supports optical add/drop multiplexing and cascading ports. In addition, it is used to multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.

For detailed functions and features, see **Table 12-68**.

Table 12-68 Functions and features of the MR4S board

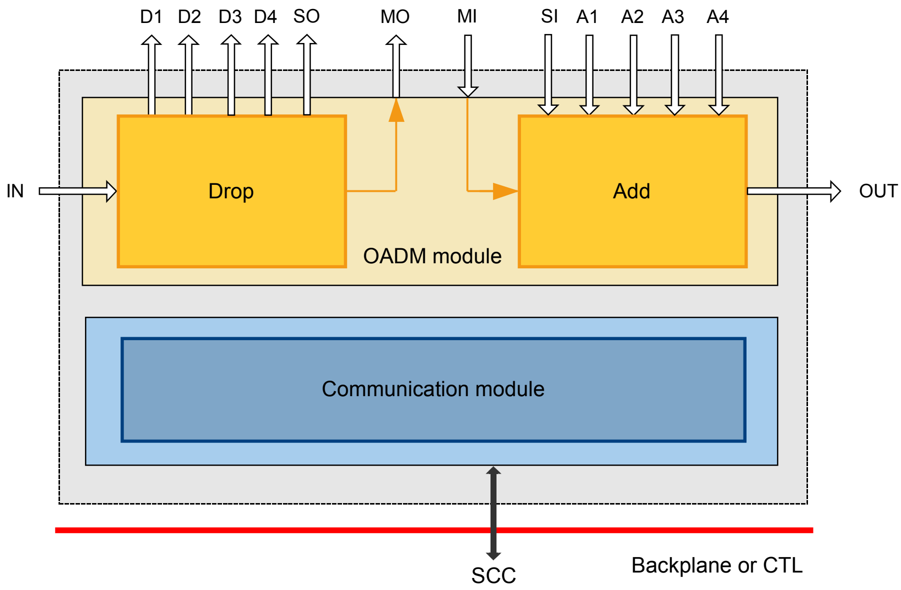
Functions and Features	Description
Basic Function	Adds/drops and multiplexes four channels of signals from the multiplexed signals. Provides the optical port to concatenate other OADM boards. Multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
WDM specifications	Supports the CWDM specifications.

12.12.4 Working Principle and Signal Flow

The MR4S unit consists of two parts: the OADM module, and communication module.

Figure 12-38 shows the principle block diagram of the MR4S.

Figure 12-38 Principle block diagram of the MR4S



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops four wavelengths from the multiplexed signals through the D1, D2, D3 and D4 optical ports, and then drops one channel of OSC signal through the SO optical port. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes one channel of OSC signals through the SI optical port, and then multiplexes the signals with the four wavelengths added through the A1, A2, A3 and A4 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of four wavelengths, and multiplex the signals in the main optical path and the signals in the 1310 nm supervisory channel into one signal, and completes the reverse process.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

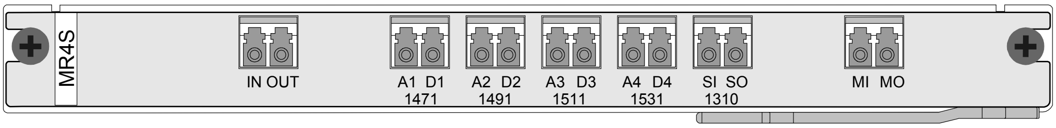
12.12.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-39 shows the front panel of the MR4S.

Figure 12-39 Front panel of the MR4S



NOTE

The number under the optical port indicates one of the wavelengths that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR4S board does not have indicators.

Ports

There are fourteen optical ports on the front panel of the MR4S board, Table 12-69 lists the type and function of each port.

Table 12-69 Types and functions of the MR4S ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1 to A4	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1 to D4	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
SI/SO	LC	Receive or transmit the OSC signal.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.

12.12.6 Valid Slots

The MR4S occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.12.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-70 lists the sequence number displayed in an NMS system of the optical port on the MR4S board front panel.

Table 12-70 Display of the MR4S ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	5
A1/D1	1
A2/D2	2
A3/D3	3
A4/D4	4
SI/SO	7
MI/MO	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.12.8 MR4S Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-71 lists the optical specifications of the MR4S.

Table 12-71 TNF1MR4S board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
-	Operating wavelength range of 1310 nm	nm	1260 to 1360
IN-D1 IN-D2 IN-D3 IN-D4	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
IN-SO	Insertion loss	dB	< 2.0
A1-OUT A2-OUT A3-OUT A4-OUT	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
SI-OUT	Insertion loss	dB	< 2.0
IN-MO	Insertion loss	dB	< 2.0
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 2.0
	Isolation	dB	> 15
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the CWDM system, the MR4S supports adding/dropping of four wavelengths in the same band of the same board. **Table 12-72** shows the rules of wavelength distribution.

Table 12-72 Wavelength distribution rules of the MR4S in a CWDM system

Wavelength (nm)			
A1/D1	**A2/D2**	**A3/D3**	**A4/D4**
1471	1491	1511	1531
1551	1571	1591	1611

The wavelength that is received by each optical port should comply with the following rules:

- The add wavelength and drop wavelength of each channel are the same. In addition, the wavelengths are incremented from the first channel to the fourth channel. (A1 = D1 < A2 = D2 < A3 = D3 < A4 = D4)
- The 1310 nm wavelength should be used to carry the input supervisory signal (SI) and output supervisory signal (SO).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.58 kg (1.28 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.13 MR8

MR8: Eight Channel Optical Add/drop Multiplexing Board

12.13.1 Version Description

The available hardware version for the MR8 is TNF1.

Version

Table 12-73 describes the version mapping of the MR8 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-73 Version description of the MR8

Item	Description
Board hardware version	TNF1

The system provides five types of the MR8, **Table 12-74** lists the types of the MR8.

Table 12-74 Type description of the MR8

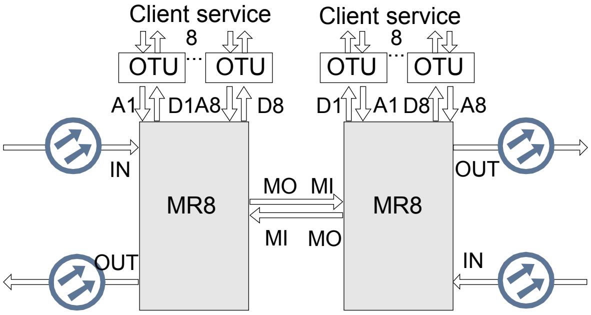
Board Name	Description
MR801	The allowable frequencies at each optical port are 192.1 THz, 192.2 THz, 192.3 THz, 192.4 THz, 192.5 THz, 192.6 THz, 192.7 THz, and 192.8 THz.
MR802	The allowable frequencies at each optical port are 192.9 THz, 193.0 THz, 193.1 THz, 193.2 THz, 193.3 THz, 193.4 THz, 193.5 THz, and 193.6 THz.
MR803	The allowable frequencies at each optical port are 193.7 THz, 193.8 THz, 193.9 THz, 194.0 THz, 194.1 THz, 194.2 THz, 194.3 THz, and 194.4 THz.
MR804	The allowable frequencies at each optical port are 194.5 THz, 194.6 THz, 194.7 THz, 194.8 THz, 194.9 THz, 195.0 THz, 195.1 THz, and 195.2 THz.
MR805	The allowable frequencies at each optical port are 195.3 THz, 195.4 THz, 195.5 THz, 195.6 THz, 195.7 THz, 195.8 THz, 195.9 THz, and 196.0 THz.

12.13.2 Application

The MR8 board mainly serves to add/drop eight channels of wavelength signals to/from the multiplexed signals in a direction.

The MR8 supports two-fiber bidirectional transmission. **Figure 12-40** shows the MR8 board application in the WDM system.

Figure 12-40 MR8 board application in the WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.13.3 Functions and Features

The main functions and features supported by the MR8 are adding/dropping and multiplexing.

For detailed functions and features, see **Table 12-75**.

Table 12-75 Functions and features of the MR8 board

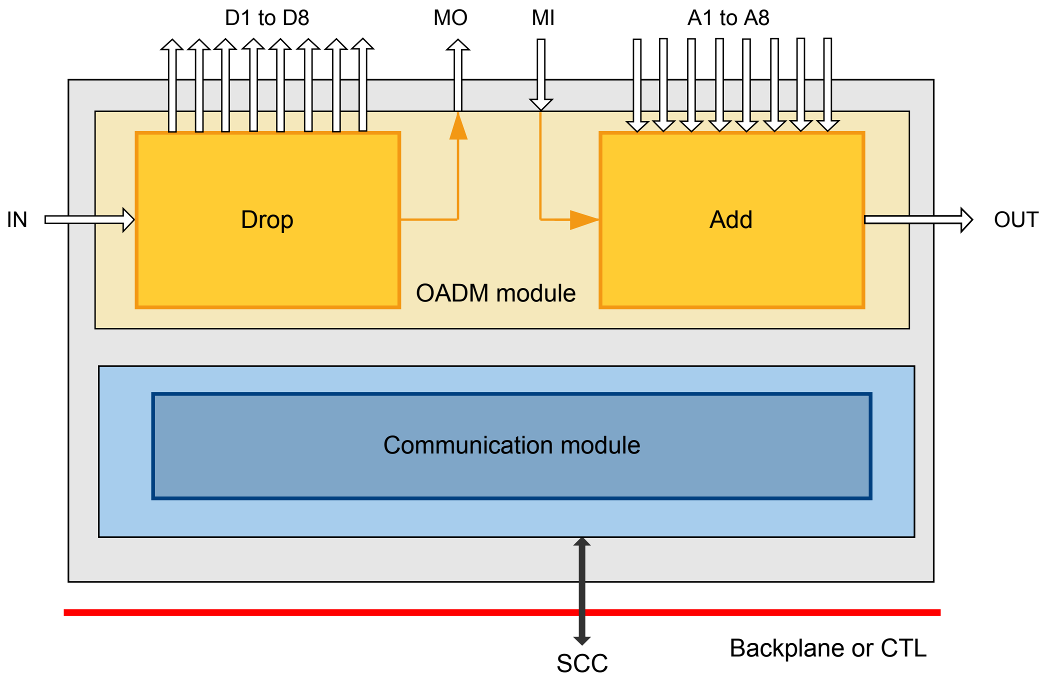
Functions and Features	Description
Basic Function	Adds/drops and multiplexes eight channels of signals from the multiplexed signals. Provides the optical port to concatenate other OADM boards.
WDM specifications	Supports the DWDM specifications.

12.13.4 Working Principle and Signal Flow

The MR8 unit consists of two parts: the OADM module, and communication module.

Figure 12-41 shows the principle block diagram of the MR8.

Figure 12-41 Principle block diagram of the MR8



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the IN optical port. The drop optical module drops eight wavelengths from the multiplexed signals through the D1 to D8 optical ports. The remaining wavelengths are output through the MO optical port.

The board receives the signals that travel over the main optical path through the MI optical port. The add module multiplexes the signals with the eight wavelengths added through the A1 to A8 optical ports. The multiplexed optical signals are output through the OUT optical port.

Module Function

- Optical module
  - Performs the add/drop multiplexing of eight wavelengths.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer (OADM) units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

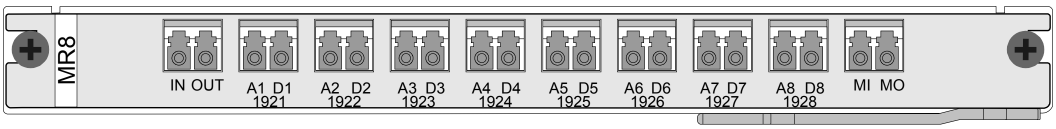
12.13.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-42 shows the front panel of the MR8.

Figure 12-42 Front panel of the MR8



NOTE

The number under the optical port indicates one of the frequencies that is supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The MR8 board does not have indicators.

Ports

There are twenty optical ports on the front panel of the MR8 board, **Table 12-76** lists the type and function of each port.

Table 12-76 Types and functions of the MR8 ports

Optical Port	Port Type	Function
IN/OUT	LC	Receive or transmit the multiplexed signal.
A1 to A8	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1 to D8	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
MI/MO	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of others channel in the multiplexed signal.

12.13.6 Valid Slots

The MR8 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.13.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-77 lists the sequence number displayed in an NMS system of the optical port on the MR8 board front panel.

Table 12-77 Display of the MR8 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN/OUT	9
A1/D1	1
A2/D2	2
A3/D3	3
A4/D4	4
A5/D5	5
A6/D6	6
A7/D7	7
A8/D8	8
MI/MO	10

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

12.13.8 MR8 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-78 lists the optical specifications of the MR8.

Table 12-78 TNF1MR8 board specifications

Correspondi ng interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100
IN-D1 IN-D2 IN-D3 IN-D4 IN-D5	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	≤ 4.0
	Adjacent channel isolation	dB	> 30

Corresponding interfaces	Item	Unit	Value
IN-D6 IN-D7 IN-D8	Non-adjacent channel isolation	dB	> 40
A1-OUT A2-OUT A3-OUT A4-OUT A5-OUT A6-OUT A7-OUT A8-OUT	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	≤ 4.0
IN-MO	Insertion loss	dB	< 3.0
	Isolation	dB	> 13
MI-OUT	Insertion loss	dB	< 3.0
	Isolation	dB	> 15
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

In the DWDM system, the MR8 supports adding/dropping of eight wavelengths in the same band of the same board. **Table 12-79** shows the rules of wavelength distribution.

Table 12-79 Wavelength distribution rules of the MR8 in a DWDM system

Band Group	Frequency (THz)							
	A1/D1	A2/D2	A3/D3	A4/D4	A5/D5	A6/D6	A7/D7	A8/D8
1	192.1	192.2	192.3	192.4	192.5	192.6	192.7	192.8
2	192.9	193.0	193.1	193.2	193.3	193.4	193.5	193.6
3	193.7	193.8	193.9	194.0	194.1	194.2	194.3	194.4
4	194.5	194.6	194.7	194.8	194.9	195.0	195.1	195.2
5	195.3	195.4	195.5	195.6	195.7	195.8	195.9	196.0

The wavelength that is received by each optical port should comply with the following rules:

The frequencies of add wavelength and drop wavelength of each channel are the same. In addition, the frequencies are incremented from the first channel to the eighth channel. (A1 = D1 < A2 = D2 < A3 = D3 < A4 = D4< A5 = D5< A6 = D6 < A7 = D7 < A8 = D8)

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.62 kg (1.37 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.14 SBM1

SBM1: Single Fiber Bidirectional Single Channel Optical Add/drop Multiplexing Configuration Board

12.14.1 Version Description

The available hardware version for the SBM1 is TNF1.

Version

Table 12-80 describes the version mapping of the SBM1 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-80 Version description of the SBM1

Item	Description
Board hardware version	TNF1

Type

The system provides two types of the SBM1, **Table 12-81** lists the types of the SBM1.

Table 12-81 Type description of the SBM1

Board Name	Description
SBM1M01	Used in CWDM system, the wavelength of optical port A1 is longer than the wavelength of optical port D1.

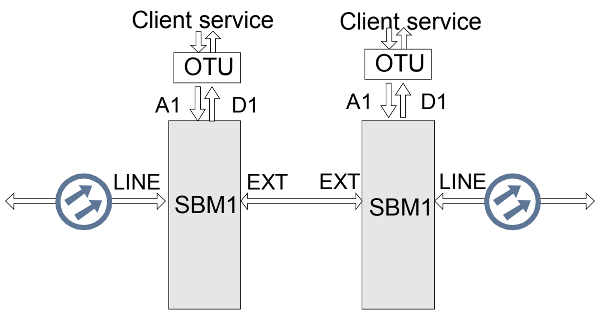
Board Name	Description
SBM1M02	Used in CWDM system, the wavelength of optical port A1 is shorter than the wavelength of optical port D1.
SBM1M03	Used in DWDM system, the frequency of optical port A1 is lower than the frequency of optical port D1.
SBM1M04	Used in DWDM system, the frequency of optical port A1 is higher than the frequency of optical port D1.

12.14.2 Application

The SBM1 is mainly used to drop one channel of signal from the multiplexed signals and add another channel into the multiplexed signals.

The SBM1 supports single-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-43**.

Figure 12-43 Application of the SBM1 in WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.14.3 Functions and Features

The main functions and features supported by the SBM1 is to drop one channel of signal from the multiplexed signals and add another channel into the multiplexed signals.

For detailed functions and features, see **Table 12-82**.

Table 12-82 Functions and features of the SBM1

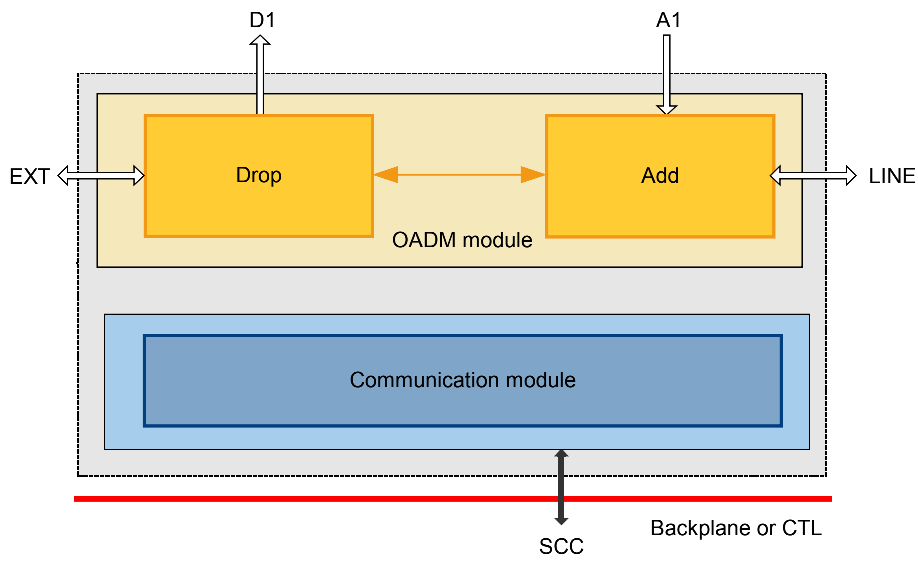
Functions and Features	Description
Basic function	Drops one channel of signal from the multiplexed signals and adds another channel into the multiplexed signals. The demultiplexed signals and the multiplexed signals must be at different wavelengths. Provides the optical port to concatenate other OADM boards.
WDM specification	Supports both the DWDM and CWDM specifications.

12.14.4 Working Principle and Signal Flow

The SBM1 consists of two parts: the OADM module and the communication module.

Figure 12-44 is the functional block diagram of the SBM1.

Figure 12-44 Functional block diagram of the SBM1



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the LINE optical port. The drop optical module drops one channel of single-wavelength signals from the multiplexed signals through the D1 optical port. The add module multiplexes the passthrough signals with the one channel of single-wavelength signal added through the A1 optical port. The multiplexed optical signals are output through the LINE optical port.

The EXT port is used as a cascade port. It transmits the multiplexed signals to other single-fiber bidirectional OADM boards to add/drop the other channels of the multiplexed signals.

Module Function

- Optical module
  - Performs the add/drop multiplexing of one wavelength.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

12.14.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

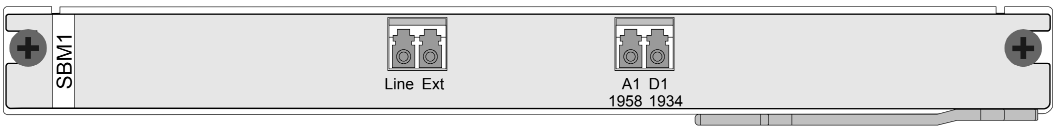
Figure 12-45, **Figure 12-46**, **Figure 12-47** and **Figure 12-48** show the front panel of the SBM1.

Figure 12-45 Front panel of the SBM1M01

Figure 12-46 Front panel of the SBM1M02

Figure 12-47 Front panel of the SBM1M03

Figure 12-48 Front panel of the SBM1M04



NOTE

The number under the optical port on the SBM1M01 and SBM1M02 boards indicates one of the wavelengths that are supported by the optical port, and the number under the optical port on the SBM1M03 and SBM1M04 boards indicates one of the frequencies that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The SBM1 board does not have indicators.

Ports

There are four optical ports on the front panel of the SBM1 board, **Table 12-83** lists the type and function of each port.

Table 12-83 Types and functions of the SBM1 ports

Optical Port	Port Type	Function
LINE	LC	Single fiber bidirectional port, used to receive and transmit the multiplexed signal.
A1	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel.
D1	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel.
EXT	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signal.

12.14.6 Valid Slots

The SBM1 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.14.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-84 lists the sequence number displayed in an NMS system of the optical port on the SBM1 board front panel.

Table 12-84 Display of the SBM1 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
Line	3
Ext	4
A1	1
D1	2

12.14.8 SBM1 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-85 and **Table 12-86** list the optical specifications of the SBM1.

Table 12-85 TNF1SBM1 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00
-	Adjacent channel spacing	GHz	100

Corresponding interfaces	Item	Unit	Value
LINE-D1	1.0 dB spectral width	nm	≥ 0.2
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-LINE	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 1.5
LINE-EXT	Insertion loss	dB	< 1.4
-	reflectance	dB	< -40

Table 12-86 TNF1SBM1 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
LINE-D1	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 1.5
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-LINE	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 1.5
LINE-EXT	Insertion loss	dB	< 1.4
-	reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

The SBM1 board can add/drop one fixed wavelength signals to/from the multiplexed signal in a DWDM/CWDM system. For the signal frequencies supported by each optical port on the SBM1 port, see **12.14.5 Front Panel**.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.52 kg (1.15 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.15 SBM2

SBM2: Single Fiber Bidirectional Double Channel Optical Add/drop Multiplexing Configuration Board

12.15.1 Version Description

The hardware version available for the SBM2 is TNF1.

Version

Table 12-87 describes the version mapping of the SBM2 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-87 Version description of the SBM2

Item	Description
Board hardware version	TNF1

Type

The system provides two types of the SBM2, **Table 12-88** lists the types of the SBM2.

Table 12-88 Type description of the SBM2

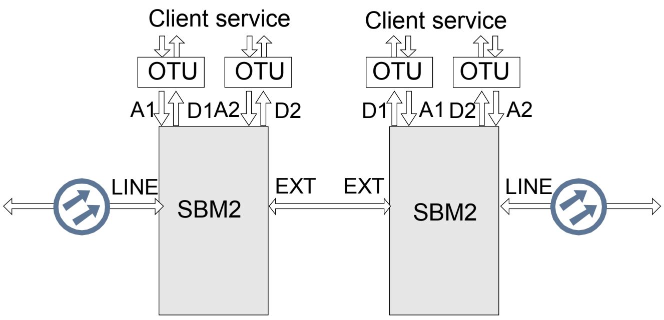
Board Name	Description
SBM2M01	Used in CWDM system, the wavelength of optical ports A1-A2 is longer than the corresponding wavelength of optical ports D1-D2.
SBM2M02	Used in CWDM system, the wavelength of optical ports A1-A2 is shorter than the corresponding wavelength of optical ports D1-D2.
SBM2M03	Used in DWDM system, the frequency of optical ports A1-A2 is lower than the frequency of optical ports D1-D2.
SBM2M04	Used in DWDM system, the frequency of optical ports A1-A2 is higher than the frequency of optical ports D1-D2.

12.15.2 Application

The SBM2 is mainly used to drop two channels of signal from the multiplexed signals and add another two channels into the multiplexed signals.

The SBM2 supports single-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-49**.

Figure 12-49 Application of the SBM2 in WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.15.3 Functions and Features

The main functions and features supported by the SBM2 is to drop two channels of signal from the multiplexed signals and add another two channels into the multiplexed signals.

For detailed functions and features, see **Table 12-89**.

Table 12-89 Functions and features of the SBM2

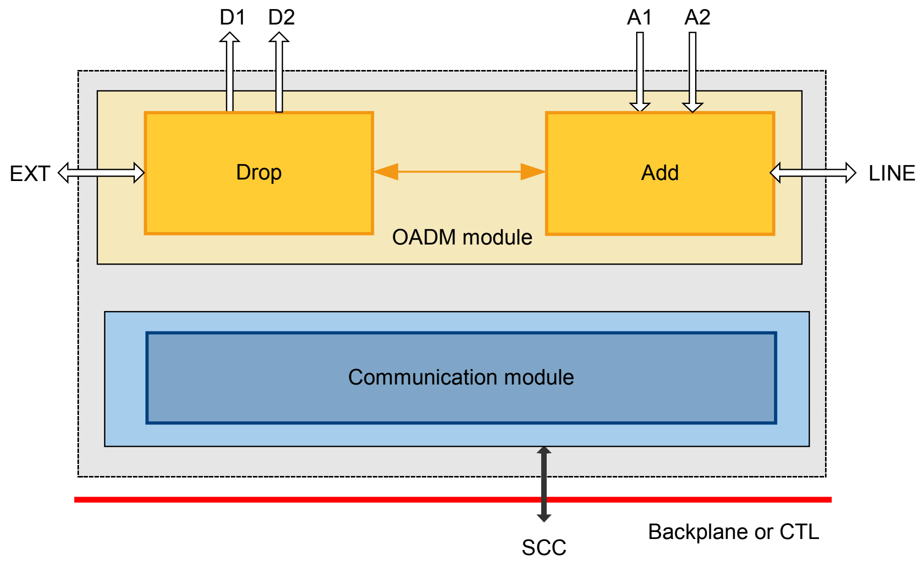
Functions and Features	Description
Basic function	Drops two channels of signals from the multiplexed signals and adds another two channels into the multiplexed signals. The demultiplexed signals and the multiplexed signals must be at different wavelengths. Provides the optical port to concatenate other OADM boards.
WDM specification	Supports both the DWDM and CWDM specifications.

12.15.4 Working Principle and Signal Flow

The SBM2 consists of two parts: the OADM module and the communication module.

Figure 12-50 is the functional block diagram of the SBM2.

Figure 12-50 Functional block diagram of the SBM2



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the LINE optical port. The drop optical module drops two channels of single-wavelength signals from the multiplexed signals through the D1 and D2 optical ports. The add module multiplexes the passthrough signals with the two channels of single-wavelength signal added through the A1 and A2 optical ports. The multiplexed optical signals are output through the LINE optical port.

The EXT port is used as a cascade port. It transmits the multiplexed signals to other single-fiber bidirectional OADM boards to add/drop the other channels of the multiplexed signals.

Module Function

- Optical module
  - Performs the add/drop multiplexing of two wavelengths.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

12.15.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-51, Figure 12-52, Figure 12-53 and Figure 12-54 show the front panel of the SBM2.

Figure 12-51 Front panel of the SBM2M01

Figure 12-52 Front panel of the SBM2M02

Figure 12-53 Front panel of the SBM2M03

Figure 12-54 Front panel of the SBM2M04

NOTE

The number under the optical port on the SBM2M01 and SBM2M02 boards indicates one of the wavelengths that are supported by the optical port, and the number under the optical port on the SBM2M03 and SBM2M04 boards indicates one of the frequencies that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The SBM2 board does not have indicators.

Ports

There are six optical ports on the front panel of the SBM2 board, **Table 12-90** lists the type and function of each port.

Table 12-90 Types and functions of the SBM2 ports

Optical Port	Port Type	Function
LINE	LC	Single fiber bidirectional port, used to receive and transmit the multiplexed signal.
A1/A2	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1/D2	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
EXT	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signal.

12.15.6 Valid Slots

The SBM2 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.15.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-91 lists the sequence number displayed in an NMS system of the optical port on the SBM2 board front panel.

Table 12-91 Display of the SBM2 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
Line	5
Ext	6
A1	1
D1	2
A2	3
D2	4

12.15.8 SBM2 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-92 and **Table 12-93** list the optical specifications of the SBM2.

Table 12-92 TNF1SBM2 board specifications in DWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating frequency range	THz	192.10 to 196.00

Corresponding interfaces	Item	Unit	Value
-	Adjacent channel spacing	GHz	100
LINE-D1 LINE-D2	1.0 dB spectral width	nm	≥0.2
	Drop channel insertion loss	dB	<2.0
	Adjacent channel isolation	dB	>30
	Non-adjacent channel isolation	dB	>40
A1-LINE A2-LINE	1.0 dB spectral width	nm	≥0.2
	Add channel insertion loss	dB	<2.0
LINE-EXT	Insertion loss	dB	<1.8
-	reflectance	dB	< -40

Table 12-93 TNF1SBM2 board specifications in CWDM system

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
LINE-D1 LINE-D2	1.0 dB spectral width	nm	≥13
	Drop channel insertion loss	dB	<2.0
	Adjacent channel isolation	dB	>30
	Non-adjacent channel isolation	dB	>40
A1-LINE A2-LINE	1.0 dB spectral width	nm	≥13
	Add channel insertion loss	dB	<2.0
LINE-EXT	Insertion loss	dB	<1.8
-	reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

The SBM2 board can add/drop two fixed wavelength signals to/from the multiplexed signal in a DWDM/CWDM system. For the signal frequencies supported by each optical port on the SBM2 port, see **12.15.5 Front Panel**.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.54 kg (1.19 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.16 SBM4

SBM4: Single Fiber Bidirectional Four Channel Optical Add/drop Multiplexing Configuration Board

12.16.1 Version Description

The available hardware version for the SBM4 is TNF1.

Version

Table 12-94 describes the version mapping of the SBM4 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-94 Version description of the SBM4

Item	Description
Board hardware version	TNF1

Type

The system provides two types of SBM4 boards, **Table 12-95** lists the types of the SBM4.

Table 12-95 Type description of the SBM4

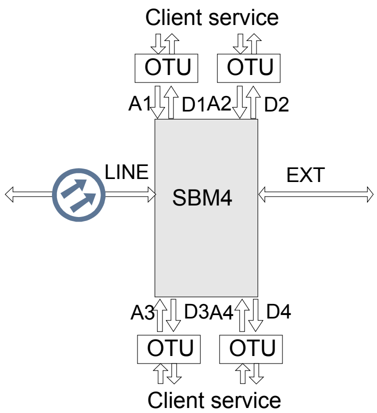
Board Name	Description
SBM401	The wavelength of optical port A is longer than the corresponding wavelength of optical port D.
SBM402	The wavelength of optical port A is shorter than the corresponding wavelength of optical port D.

12.16.2 Application

The SBM4 is mainly used to drop four channels of signal from the multiplexed signals and add another four channels into the multiplexed signals.

The SBM4 supports single-fiber bidirectional transmission. For the application of the board in WDM systems, see **Figure 12-55**.

Figure 12-55 Application of the SBM4 in WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.16.3 Functions and Features

The main functions and features supported by the SBM4 is to drop four channels of signal from the multiplexed signals and add another four channels into the multiplexed signals.

For detailed functions and features, see **Table 12-96**.

Table 12-96 Functions and features of the SBM4

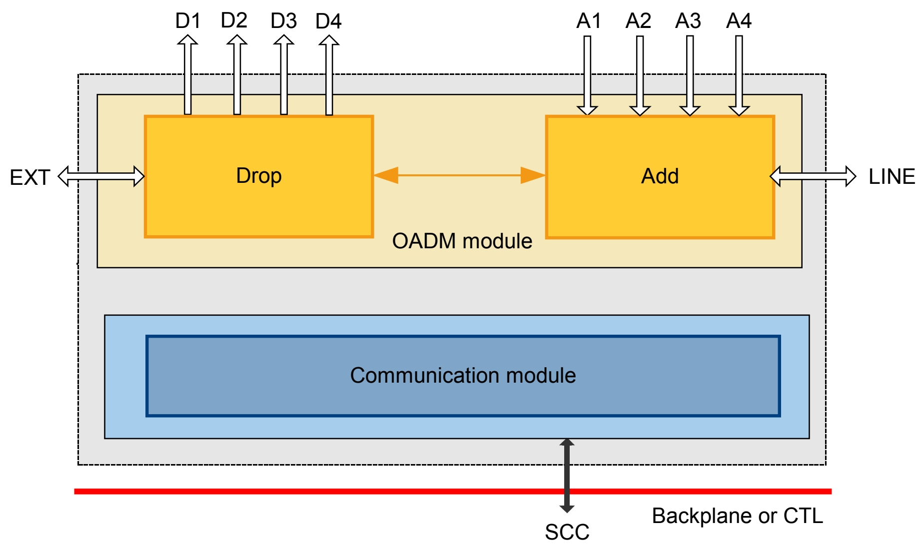
Functions and Features	Description
Basic function	Drops four channels of signals from the multiplexed signals and adds another four channels into the multiplexed signals. The demultiplexed signals and the multiplexed signals must be at different wavelengths. Provides the optical port to concatenate other OADM boards.
WDM specification	Supports the CWDM specifications.

12.16.4 Working Principle and Signal Flow

The SBM4 consists of two parts: the OADM module and the communication module.

Figure 12-56 is the functional block diagram of the SBM4.

Figure 12-56 Functional block diagram of the SBM4



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the LINE optical port. The drop optical module drops four channels of single-wavelength signals from the multiplexed signals through the D1, D2, D3 and D4 optical ports. The add module multiplexes the passthrough signals with the four channels of single-wavelength signals added through the A1, A2, A3 and A4 optical ports. The multiplexed optical signals are output through the LINE optical port.

The EXT port is used as a cascade port. It transmits the multiplexed signals to other single-fiber bidirectional OADM boards to add/drop the other channels of the multiplexed signals.

Module Function

- Optical module
  - Performs the add/drop multiplexing of four wavelengths.
  - Provides an intermediate cascade port for cascading to other optical add/drop multiplexer units, so that the system can add/drop more wavelengths at the local station.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

12.16.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-57 and **Figure 12-58** show the front panel of the SBM4.

Figure 12-57 Front panel of the SBM401

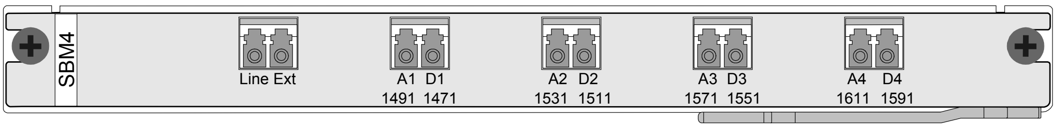
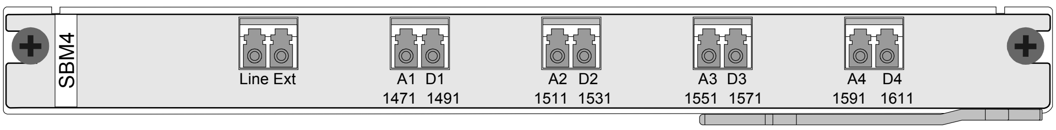


Figure 12-58 Front panel of the SBM402



NOTE

The number under the optical port indicates the wavelength that supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The SBM4 board does not have indicators.

Ports

There are ten optical ports on the front panel of the SBM4 board, **Table 12-97** lists the type and function of each port.

Table 12-97 Types and functions of the SBM4 ports

Optical Port	Port Type	Function
LINE	LC	Single fiber bidirectional port, used to receive and transmit the multiplexed signal.
A1 to A4	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1 to D4	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.
Ext	LC	Cascade input/output ports; used to concatenate other OADM boards, implement the adding/dropping of other channels in the multiplexed signal.

12.16.6 Valid Slots

The SBM4 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.16.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-98 lists the sequence number displayed in an NMS system of the optical port on the SBM4 board front panel.

Table 12-98 Display of the SBM4 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
Line	9
Ext	10
A1	1
D1	2
A2	3
D2	4
A3	5
D3	6
A4	7
D4	8

12.16.8 SBM4 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-99 lists the optical specifications of the SBM4.

Table 12-99 TNF1SBM4 board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating wavelength range	nm	1471 to 1611
-	Adjacent channel spacing	nm	20
LINE-D1 LINE-D2 LINE-D3 LINE-D4	1.0 dB spectral width	nm	≥ 13
	Drop channel insertion loss	dB	< 2.8
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40

Corresponding interfaces	Item	Unit	Value
A1-LINE A2-LINE A3-LINE A4-LINE	1.0 dB spectral width	nm	≥ 13
	Add channel insertion loss	dB	< 2.8
LINE-EXT	Insertion loss	dB	< 2.8
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

The SBM4 board can add/drop four fixed wavelength signals to/from the multiplexed signal in a CWDM system. For the signal frequencies supported by each optical port on the SBM4 port, see **12.16.5 Front Panel**.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.58 kg (1.28 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

12.17 SBM8

SBM8: Single Fiber Bidirectional Eight Channel Optical Add/drop Multiplexing Configuration Board

12.17.1 Version Description

The available hardware version for the SBM8 is TNF1.

Version

Table 12-100 describes the version mapping of the SBM8 board. The mapping version of the equipment is V100R001C01 or later.

Table 12-100 Version description of the SBM8

Item	Description
Board hardware version	TNF1

Type

The system provides two types of the SBM8, **Table 12-101** lists the types of the SBM8.

Table 12-101 Type description of the SBM8

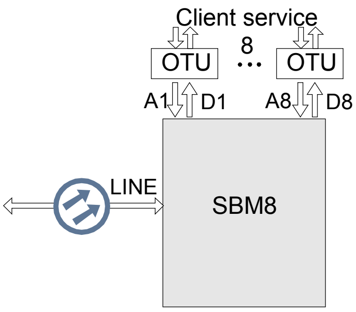
Board Name	Description
SBM803	Used in the DWDM system. The frequency of optical port A is lower than the frequency of optical port D.
SBM804	Used in the DWDM system. The frequency of optical port A is higher than the frequency of optical port D.

12.17.2 Application

The SBM8 is mainly used to drop eight channels of signal from the multiplexed signals and add eight channels into the multiplexed signals.

The SBM8 supports single-fiber bidirectional transmission. **Figure 12-59** shows the SBM8 board application in a WDM system.

Figure 12-59 SBM8 board application in a WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

12.17.3 Functions and Features

The main functions and features supported by the SBM8 is to drop eight channels of signal from the multiplexed signals and add eight channels into the multiplexed signals.

For detailed functions and features, see **Table 12-102**.

Table 12-102 Functions and features of the SBM8

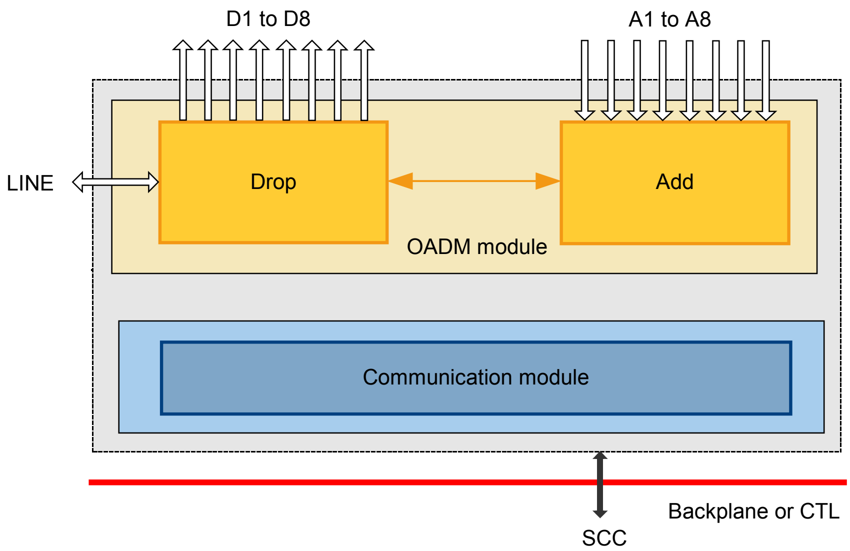
Function and Feature	Description
Basic Function	Drops eight channels of signals from the multiplexed signals and adds eight channels into the multiplexed signals.
WDM specifications	Supports the DWDM specifications.

12.17.4 Working Principle and Signal Flow

The SBM8 consists of two parts: the OADM module and the communication module.

Figure 12-60 is the functional block diagram of the SBM8.

Figure 12-60 Functional block diagram of the SBM8



Signal Flow

The board receives the multiplexed optical signals from the upstream station through the LINE optical port. The drop optical module drops eight channels of single-wavelength signals from the multiplexed signals through the D1 to D8 optical ports. The add module multiplexes the passthrough signals with the eight channels of single-wavelength signals added through the A1 to A8 optical ports. The multiplexed optical signals are output through the LINE optical port.

Module Function

- Optical module

  - Performs the add/drop multiplexing of eight wavelengths.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

12.17.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 12-61 and Figure 12-62 show the front panel of the SBM8.

Figure 12-61 Front panel of the SBM803

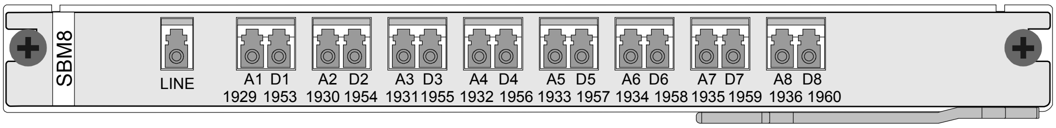
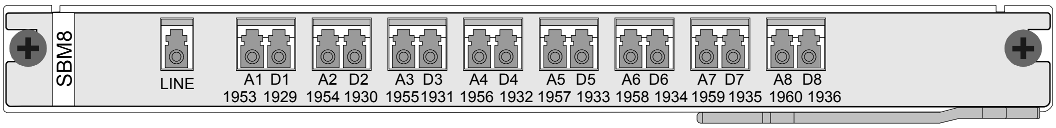


Figure 12-62 Front panel of the SBM804



NOTE

The number under the optical port on the boards indicates one of the frequencies that are supported by the optical port.

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The SBM8 board does not have indicators.

Ports

There are seventeen optical ports on the front panel of the SBM8 board, Table 12-103 lists the type and function of each port.

Table 12-103 Types and functions of the SBM8 ports

Optical Port	Port Type	Function
LINE	LC	Single fiber bidirectional port, used to receive and transmit the multiplexed signal.

Optical Port	Port Type	Function
A1 to A8	LC	Receive the optical signals from the OTU or integrated client-side equipment, thus adding one channel respectively.
D1 to D8	LC	Transmit optical signals to the OTU or integrated client-side equipment, thus dropping one channel respectively.

12.17.6 Valid Slots

The SBM8 occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
  - If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

12.17.7 Optical Interfaces

This section describes the display of optical ports on the board.

Display of Optical Ports

Table 12-104 lists the sequence number displayed in an NMS system of the optical port on the SBM8 board front panel.

Table 12-104 Display of the SBM8 ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
A1	1

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
D1	2
A2	3
D2	4
A3	5
D3	6
A4	7
D4	8
A5	9
D5	10
A6	11
D6	12
A7	13
D7	14
A8	15
D8	16
LINE	17

12.17.8 SBM8 Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 12-105 lists the optical specifications of the SBM8.

Table 12-105 TNF1SBM8 board specifications

Corresponding interfaces	Item	Unit	Value
-	Operating frequency/ wavelength range	THz	192.90 to 193.60 195.30 to 196.00
-	Adjacent channel spacing	GHz	100
LINE-D1 LINE-D2	1.0 dB spectral width	nm	≥ 0.2

Corresponding interfaces	Item	Unit	Value
LINE-D3 LINE-D4 LINE-D5 LINE-D6 LINE-D7 LINE-D8	Drop channel insertion loss	dB	< 3.0
	Adjacent channel isolation	dB	> 30
	Non-adjacent channel isolation	dB	> 40
A1-LINE A2-LINE A3-LINE A4-LINE A5-LINE A6-LINE A7-LINE A8-LINE	1.0 dB spectral width	nm	≥ 0.2
	Add channel insertion loss	dB	< 3.0
-	Reflectance	dB	< -40

Rules of Adding/Dropping Wavelengths

The SBM8 board can add/drop eight fixed wavelength signals to/from the multiplexed signal in a DWDM system. For the signal frequencies supported by each optical port on the SBM8 port, see **12.17.5 Front Panel**.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.65 kg (1.43 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

13 Optical Amplifying Board

About This Chapter

Describes the functions and the working principle of optical amplifier boards.

13.1 OBU

OBU: Optical Booster Board

13.1.1 Version Description

The available hardware version of the OBU is TNF1.

Version

Table 13-1 describes the version mapping of the OBU board. The mapping version of the equipment is V100R003C01 or later.

Table 13-1 Version description of the OBU

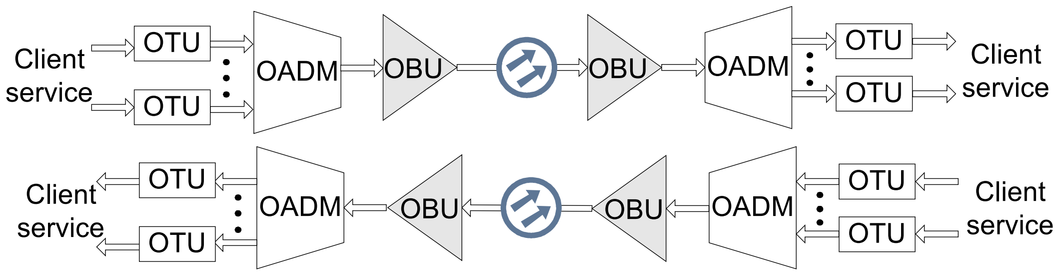
Item	Description
Board hardware version	TNF1

13.1.2 Application

The OBU board is used at the transmit or receive end to amplify optical signals in the C band.

For the application of the board in WDM system, see **Figure 13-1**.

Figure 13-1 Application of the OBU in WDM system



13.1.3 Functions and Features

The main functions and features supported by the OBU are optical signals amplifying, online optical performance monitoring, gain lock function and alarms and performance events monitoring.

For detailed functions and features, see **Table 13-2**.

Table 13-2 Functions and features of the OBU

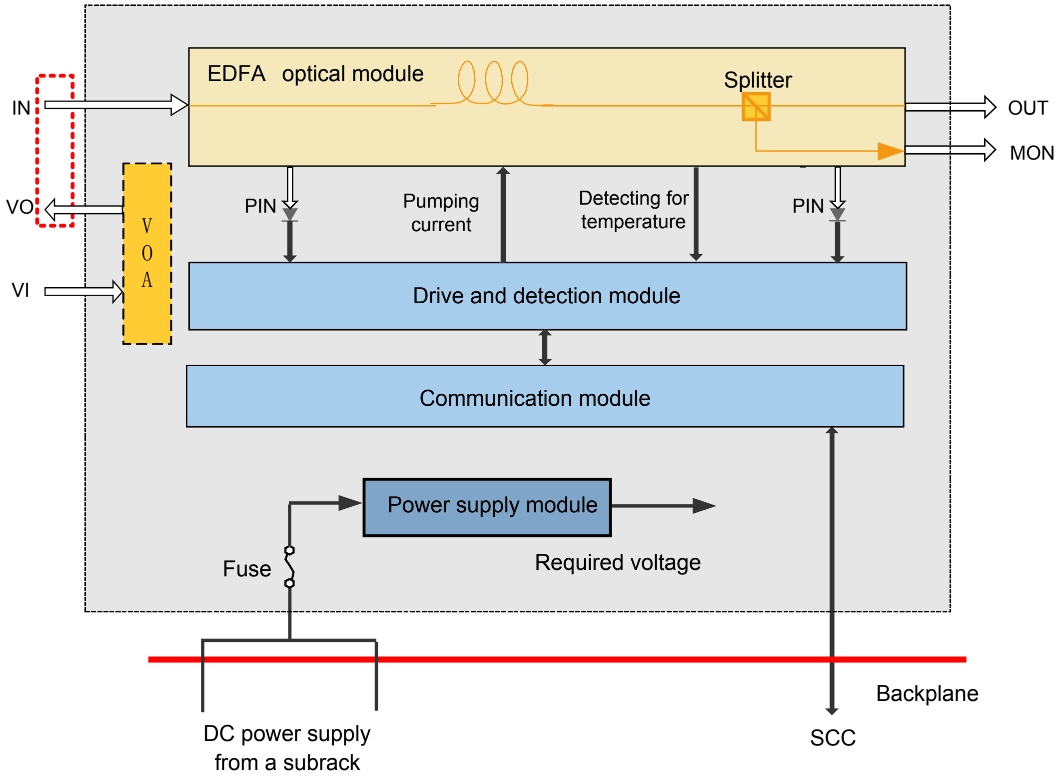
Functions and Features	Description
Basic function	Simultaneously amplifies optical signals on a maximum of 40 channels with 100 GHz channel spacing in the C band. Features small noise figure.
Nominal Gain	The nominal gain is 23 dB. **NOTE** The nominal gain of the OBU board is 23 dB. Actual gain includes the noise, and the value is bigger than that of nominal gain.
Gain lock function	Supports automatic gain control. Adding or deleting channels has no impact on online services.
Transient control function	When channels are added or dropped, the unit can suppress the fluctuation of the optical power in the path so as to achieve a smooth upgrade and expansion.
Online optical performance monitoring	The MON port is provided for online performance monitoring. A small volume of optical signals is output at the optical port to the optical spectrum analyzer or spectrum analysis board. The optical spectrum analyzer or spectrum analysis board monitors the multiplexed optical signals and optical performance without interrupting services.
Automatic shutdown of output optical power	When no light is received, the board automatically shuts down the transmission of lights on the EDFA module so that relevant personnel can be protected.
Variable Optical attenuator	The VO/VI port on the board is used to insert the SFP EVOA module. The board uses the SFP VOA module to adjust the transmission optical power or receive optical power in the range of 0 dB to 20 dB.
Alarms and performance events monitoring	Monitors performance indexes, including ● The input power and the output power of the board ● Pump driving current ● Back facet current ● Pump cooling current ● The temperature of the pump laser and the board
WDM specifications	Supports the DWDM specification only.

13.1.4 Working Principle and Signal Flow

The OBU unit consists of five parts: the EDFA optical module, the drive and detection module, the variable optical attenuator, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Figure 13-2 is the functional block diagram of the OBU unit.

Figure 13-2 Functional block diagram of the OBU unit



NOTE

An EVOA can be configured on this board if required to adjust the signal power. You can either attach the EVOA to the OUT optical port on this board to adjust the transmit optical power of this board or attach the EVOA to the IN optical port on this board to adjust the receive optical power of this board.

Signal Flow

One multiplexed optical signal received through the IN port is input to the erbium-doped fiber amplifier (EDFA) optical module. The EDFA optical module amplifies the optical power of the signal and locks the gain of the signal. Then, the amplified multiplexed signal is output through the OUT port

The multiplexed signal can also be input from the VI optical port, and output from the VO optical port after the optical power is adjusted, and then received by the IN optical port.

Functional Modules

- EDFA optical module
  - Multiplexed signal light and pump light enter the erbium-doped fiber for amplification. The erbium-doped fiber that is excited by the pump laser can amplify the optical signal to implement the optical power amplification function.
  - The optical splitter splits some optical signals from the main optical path and provides them to the MON port for detection.
- Drive and detection module
  - Detects in real time the optical power of service signals.

  - Detects in real time the drive current, back facet current, cooling current, and operating temperature and ambient temperature of the pump laser inside the EDFA optical module.
  - Drives the pump laser inside the EDFA optical module.
  - Reports alarms and performance events to the communication module.
- Variable optical attenuator (can be selected)
  - Adjust the receive optical power.
  - After the board is powered on, the default attenuation of the EVOA retains the maximum value 20 dB, ensuring that the board is not overloaded.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

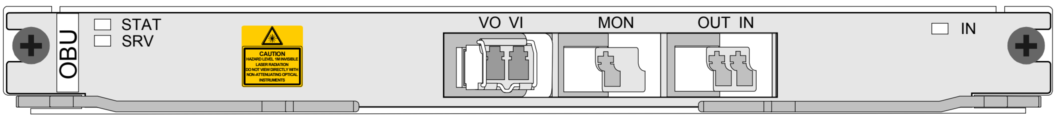
13.1.5 Front Panel

There are indicators, ports and laser safety label on the OBU front panel.

Appearance of the Front Panel

Figure 13-3 shows the front panel of the OBU board.

Figure 13-3 Front panel of the OBU board



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

There are five optical ports on the front panel of the OBU, **Table 13-3** lists the type and function of each port.

Table 13-3 Ports on the front panel of the OBU

Port	Connector type	Description
VO	LC	Transmit the attenuated signal.
VI	LC	Receive the signal to be attenuated.
IN	LC	Receive the signal to be amplified.
OUT	LC	Transmit the amplified signal.
MON	LC	Achieves the in-service monitoring of optical spectrum. The MON port is a 1/99 tap of the total composite signal at the OUT port (20dB lower than the actual signal power).

13.1.6 Valid Slots

The OBU occupies one slot.

Valid Slot in Subrack

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

13.1.7 Optical Interfaces

This section introduces the display of ports on the board.

Display of Optical Ports

Table 13-4 lists the sequence number displayed in an NM system of the optical port on the OBU board front panel.

Table 13-4 Display of the OBU optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN	1
OUT	2
VI/VO	3

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
MON	4

13.1.8 OBU Parameters on the NMS

Field	Value	Description
Optical Interface Attenuation Ratio (dB)	0 to 20 Default: 20	parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range.
Max. Attenuation Ratio (dB)	20 Default: 20	parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board.
Min. Attenuation Ratio (dB)	0 Default: 0	parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board.
Channel Use Status	Used, Unused Default: Used	• Set this parameter to **Unused** when a channel that is not used. • Set this parameter to **Used** when a channel that is used.
Laser Status	ON, OFF Default: OFF	parameter provides an option to set and query the laser status of a board.
Gain (dB)	19.0 to 40.0 Default: /	parameter provides an option to query the gain of an optical amplifier board, namely, the difference of the output power (dBm) to the input power (dBm).
Nominal Gain (dB)	23 Default: /	parameter specifies the desired gain of the signal optical power. This parameter is used to indicate the relative value between the optical power of output signals and the optical power of input signals, namely, the amplifying multiple of the signal optical power.
Optical Interface/Channel	-	-

Field	Value	Description
Optical Interface Name	-	-

13.1.9 OBU Specifications

OBU board specifications include specifications of optical module on the client and WDM sides, laser level, mechanical specifications and power consumption.

Optical Specifications

Table 13-5 shows the details about the optical specifications of the OBU.**Table 13-6** shows the details about the optical specifications of the SFP EVOA module.

Table 13-5 OBU board specifications

Item	Unit	Value
Operating wavelength range	nm	1529 to 1561
Total input power range	dBm	-32 to -3
Total output power range	dBm	-9 to 20.5
Input power range per channel	dBm	-32 to -19
Nominal single-wavelength input optical power	dBm	-19
Maximum output power of single wavelength	dBm	4
Noise figure	dB	≤6
Channel gain	dB	23
Gain flatness	dB	<2.0
Pump leakage at input	dBm	<-20
Input reflectance	dB	<-40
Output reflectance	dB	<-40
Maximum reflectance tolerance at input	dB	27
Maximum reflectance tolerance at output	dB	27

Table 13-6 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1M (The maximum output optical power of each optical interface ranges from 10 dBm (10 mW) to 22.15 dBm (136 mW)).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.7 kg (1.54 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F):5.6W
- Maximum Power Consumption at 55°C (131°F): 7.6W

13.2 OPU

OPU: Optical Preamplifier Unit

13.2.1 Version Description

The available hardware version of the OPU is TNF1.

Version

Table 13-7 describes the version mapping of the OPU board. The mapping version of the equipment is V100R001C02 or later.

Table 13-7 Version description of the OPU

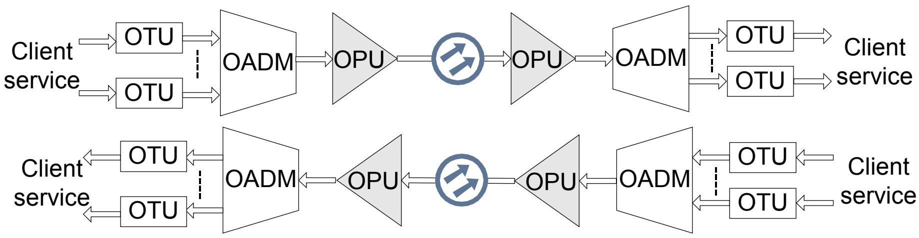
Item	Description
Board hardware version	TNF1

13.2.2 Application

The OPU is mainly used to amplify C-band signals. The OPU is usually used in the receiving direction.

For the application of the board in WDM system, see **Figure 13-4**.

Figure 13-4 Application of the OPU in WDM system



13.2.3 Functions and Features

The main functions and features supported by the OPU are optical signals amplifying, online optical performance monitoring, gain lock function and alarms and performance events monitoring.

For detailed functions and features, see **Table 13-8**.

Table 13-8 Functions and features of the OPU

Functions and Features	Description
Basic function	Amplifies 40 channels, 32 channels, or 16 channels of optical signals with channel spacing of 100 GHz at the same time, the wavelength range is 1529 nm to 1561 nm. Features small noise figure.
Nominal Gain	The nominal gain is 20 dB. **NOTE** The nominal gain of the OPU board is 20 dB. Actual gain includes the noise, and the value is bigger than that of nominal gain.
Gain lock function	Adding or dropping one or more channels or optical signal fluctuation does not affect the signal gain of other channels.
Transient control function	When channels are added or dropped, the unit can suppress the fluctuation of the optical power in the path so as to achieve a smooth upgrade and expansion.
Online optical performance monitoring	Provides an online monitoring port "MON", so that the optical performance of optical signals can be checked online through the optical spectrum analyzer.

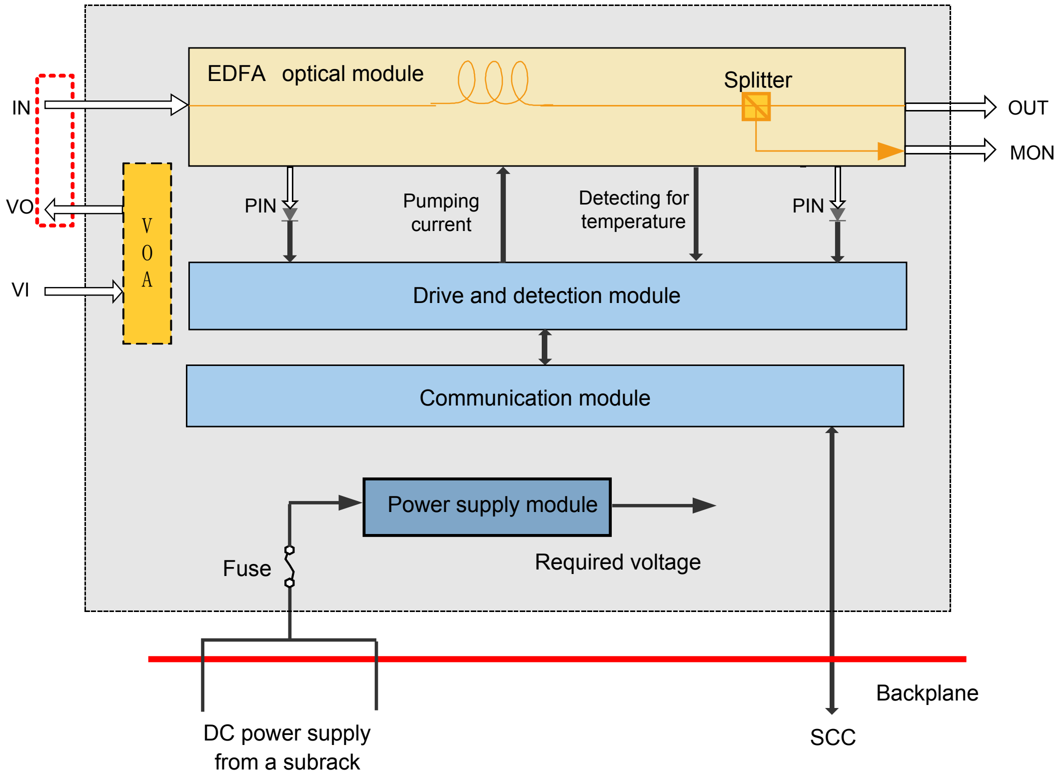
Functions and Features	Description
Automatic shutdown of output optical power	When no light is received, the board automatically shuts down the transmission of lights on the EDFA module so that relevant personnel can be protected.
Variable Optical attenuator	The VO/VI port on the board is used to insert the SFP EVOA module. The board uses the SFP VOA module to adjust the transmission optical power or receive optical power in the range of 0 dB to 20 dB.
Alarms and performance events monitoring	Monitors performance indexes, including ● The input power and the output power of the board ● Pump driving current ● Back facet current ● Pump cooling current ● The temperature of the pump laser and the board
WDM specifications	Supports the DWDM specification only.

13.2.4 Working Principle and Signal Flow

The OPU unit consists of five parts: the EDFA optical module, the drive and detection module, the variable optical attenuator, the communication module, and the power supply module. The variable optical attenuator is the optional module. If you need this equipment, contact Huawei.

Figure 13-5 is the functional block diagram of the OPU unit.

Figure 13-5 Functional block diagram of the OPU unit



NOTE

An EVOA can be configured on this board if required to adjust the signal power. You can either attach the EVOA to the OUT optical port on this board to adjust the transmit optical power of this board or attach the EVOA to the IN optical port on this board to adjust the receive optical power of this board.

Signal Flow

One multiplexed optical signal received through the IN port is input to the erbium-doped fiber amplifier (EDFA) optical module. The EDFA optical module amplifies the optical power of the signal and locks the gain of the signal. Then, the amplified multiplexed signal is output through the OUT port.

Functional Modules

- EDFA optical module
  - Multiplexed signal light and pump light enter the erbium-doped fiber for amplification. The erbium-doped fiber that is excited by the pump laser can amplify the optical signal to implement the optical power amplification function.
  - The optical splitter splits some optical signals from the main optical path and provides them to the MON port for detection.
- Drive and detection module
  - Detects in real time the optical power of service signals.
  - Detects in real time the drive current, cooling current and operating temperature of the pump laser inside the EDFA.

- Drives the pump laser inside the EDFA optical module.
- Reports alarms and performance events to the communication module.

- Variable optical attenuator (can be selected)
  - Adjust the transmission optical power or receive optical power.
- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the DC power into the power required by each module of the unit.

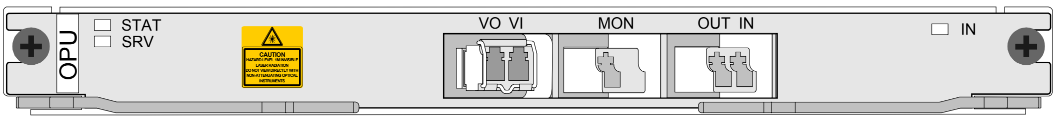
13.2.5 Front Panel

There are indicators, ports and laser safety label on the OPU front panel.

Appearance of the Front Panel

Figure 13-6 shows the front panel of the OPU board.

Figure 13-6 Front panel of the OPU board



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- WDM-side receive optical power status indicator (INn)- red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

There are five optical ports on the front panel of the OPU, **Table 13-9** lists the type and function of each port.

Table 13-9 Ports on the front panel of the OPU

Port	Connector type	Description
VO	LC	Transmit the attenuated signal.
VI	LC	Receive the signal to be attenuated.

Port	Connector type	Description
IN	LC	Receive the signal to be amplified.
OUT	LC	Transmit the amplified signal.
MON	LC	Achieves the in-service monitoring of optical spectrum. The MON port is a 1/99 tap of the total composite signal at the OUT port (20dB lower than the actual signal power).

13.2.6 Valid Slots

The OPU occupies one slot.

Valid Slot in Subrack

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

13.2.7 Optical Interfaces

This section introduces the display of ports on the board.

Display of Optical Ports

Table 13-10 lists the sequence number displayed in an NM system of the optical port on the OPU board front panel.

Table 13-10 Display of the OPU optical ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
IN	1
OUT	2
VI/VO	3
MON	4

13.2.8 OPU Parameters on the NMS

Field	Value	Description
Optical Interface Attenuation Ratio (dB)	0 to 20 Default: 20	parameter provides an option to set the optical power attenuation of a board channel so that the optical power of the output signals at the transmit end is within the preset range.
Max. Attenuation Ratio (dB)	20 Default: 20	parameter provides an option to query the maximum attenuation rate allowed by the current optical port of a board.
Min. Attenuation Ratio (dB)	0 Default: 0	parameter provides an option to query the minimum attenuation rate allowed by the current optical port of a board.
Channel Use Status	Used, Unused Default: Used	● Set this parameter to **Unused** when a channel that is not used. ● Set this parameter to **Used** when a channel that is used.
Laser Status	ON, OFF Default: OFF	parameter provides an option to set and query the laser status of a board.
Gain (dB)	19.0 to 40.0 Default: /	parameter provides an option to query the gain of an optical amplifier board, namely, the difference of the output power (dBm) to the input power (dBm).
Nominal Gain (dB)	20 Default: /	parameter specifies the desired gain of the signal optical power. This parameter is used to indicate the relative value between the optical power of output signals and the optical power of input signals, namely, the amplifying multiple of the signal optical power.
Optical Interface/Channel	-	-
Optical Interface Name	-	-

13.2.9 OPU Specifications

OPU board specifications include specifications of optical module on the client and WDM sides, laser level, mechanical specifications and power consumption.

Optical Specifications

Table 13-11 shows the details about the optical specifications of the OPU. **Table 13-12** shows the details about the optical specifications of the SFP EVOA module.

Table 13-11 OPU board specifications

Item		Unit	Value
Operating wavelength range	40 wavelengths	nm	1529 to 1561
	32 wavelengths	nm	1533 to 1561
	16 wavelengths	nm	1548 to 1561
Total input power range		dBm	-32 to -3
Total output power range		dBm	-12 to 17
Input power range per channel	40 wavelengths	dBm	-32 to -19
	32 wavelengths	dBm	-32 to -18
	16 wavelengths	dBm	-32 to -15
Nominal single-wavelength input optical power	40 wavelengths	dBm	-19
	32 wavelengths	dBm	-18
	16 wavelengths	dBm	-15
Maximum output power of single wavelength	40 wavelengths	dBm	1
	32 wavelengths	dBm	2
	16 wavelengths	dBm	5
Noise figure		dB	≤ 5.5
Channel gain		dB	20
Gain flatness	40 wavelengths	dB	< 4.0
	32 wavelengths	dB	< 2.0
	16 wavelengths	dB	< 1.5
Pump leakage at input		dBm	< -20
Input reflectance		dB	< -40
Output reflectance		dB	< -40
Maximum reflectance tolerance at input		dB	< -27
Maximum reflectance tolerance at output		dB	< -27

Table 13-12 Specifications of EVOA optical module

Item		Unit	Value
VI/VO	Inherent insertion loss	dB	≤ 1.5
	Dynamic attenuation range	dB	20
Adjustment accuracy		dB	0.7 (attenuation ≤ 10 dB) 1.5 (attenuation > 10 dB)

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1M (The maximum output optical power of each optical interface ranges from 10 dBm (10 mW) to 22.15 dBm (136 mW)).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.7 kg (1.54 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 4.9 W
- Maximum Power Consumption at 55°C (131°F): 5.9 W

14 System Control and Communication Board

About This Chapter

Describes the functions and the working principle of system control and communication boards.

14.1 CTL

CTL: OADM Control Board

14.1.1 Version Description

The available hardware version for the CTL is TNF1.

Version

Table 14-1 describes the version mapping of the CTL board. The mapping version of the equipment is V100R001C01 or later.

Table 14-1 Version description of the CTL

Item	Description
Board hardware version	TNF1

14.1.2 Functions and Features

The CTL board is used in the OptiX OSN 1800 OADM frame. The CTL board is connected to the SCC board in the equipment through cables to enable the communication between the equipment and the OADM frame.

For detailed functions and features, see **Table 14-2**.

Table 14-2 Functions and features of the CTL

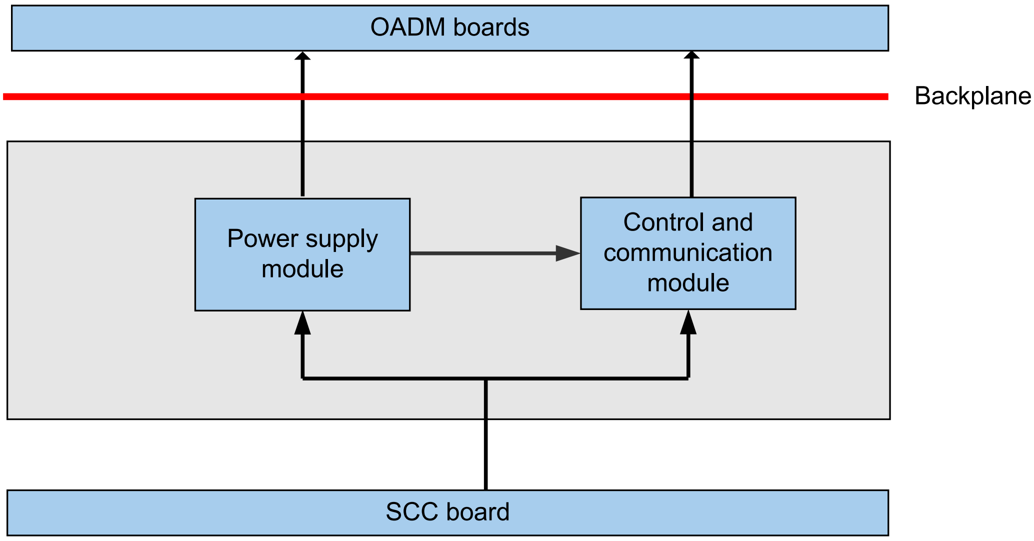
Functions and Features	Description
Basic function	It is used in the OptiX OSN 1800 OADM frame. It is connected to the SCC board in the equipment through cables to enable the communication between the equipment and the OADM frame. In this way, the U2000 is able to monitor and manage the OADM frame.

14.1.3 Working Principle and Signal Flow

The CTL board consists of two modules: the control and communication module, and the power supply module.

Figure 14-1 is the functional block diagram of the CTL board.

Figure 14-1 Functional block diagram of the CTL board



Signal Flow

NA

Module Function

- Control and communication module

  The indicators on the front panel indicate the state of the board.

  It communicates with the OADM boards in the OADM frame and reports the data of the boards to the SCC board in the equipment.
- Power supply module

  Converts the 12 V DC power into the power required by each module of the unit.

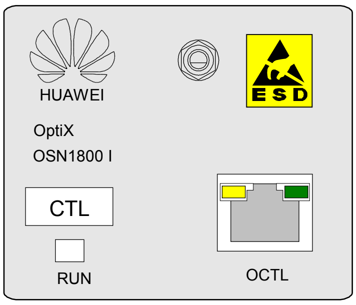
14.1.4 Front Panel

There are indicators and ports on the CTL front panel.

Appearance of the Front Panel

Figure 14-2 shows the front panel of the CTL.

Figure 14-2 Front panel of the CTL



Indicators

There is a green indicator named RUN on the front panel of the CTL board. The indicator indicates the running status of the board.

Ports

On the front panel of the CTL board, there is an OCTL port that connects to the OCTL port on the SCC to supply power to the CTL board. In addition, the U2000 can monitor and manage the OptiX OSN 1800 OADM frame through the OCTL port on the CTL board.

NOTE

The OCTL port must be connected to a straight-through cable.

The OCTL port supports power feeding and therefore can be connected only to an OCTL port. Otherwise, the SCC board may be damaged. When the OCTL port on the SCC board of the chassis and that on the OADM extended frame are correctly connected, the RUN indicator on the CTL board turns on green; if they are incorrectly connected, the RUN indicator does not turn on.

14.1.5 Valid Slots

The CTL occupies two slots.

Valid Slots in the Subracks

The CTL board occupies the SLOT5 and SLOT6 in the OptiX OSN 1800 OADM frame.

Display of Slots

The slot is not displayed in the U2000, Web LCT, and command line.

14.1.6 Interfaces

There is an OCTL port on the CTL front panel.

On the CTL board, there is an OCTL port that is used to connect to the OCTL port on the SCC board so that the SCC board can provide power supply to the CTL board. In addition, the U2000 is able to manage and monitor the OptiX OSN 1800 OADM frame by connecting the CTL board to the SCC board.

14.1.7 CTL Specifications

Specifications include mechanical specifications and power consumption.

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 41.0 mm x 48.0 mm x 208.7 mm (1.9 in. x 1.6 in. x 8.2 in.)
- weight: 0.15 kg (0.33 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.8 W
- Maximum Power Consumption at 55°C (131°F): 1.0 W

14.2 SCC

SCC: System Control & Communication Board with OSC

14.2.1 Version Description

The available hardware version for the SCC is TNF1.

Version

Table 14-3 describes the version mapping of the SCC board. The mapping version of the equipment is V100R001C01 or later.

Table 14-3 Version description of the SCC

Item	Description
Board hardware version	TNF1

Type

The system provides two types of the SCC, **Table 14-4** lists the types of the SCC.

Table 14-4 Type description of the SCC

Type	Description
Board type	Version B, Version D
Similarity	The SCC board of version B and the SCC board of version D work in the same way.
Difference	• The SCC board of version D supports the supervision and management of outdoor cabinet power, while the SCC board of version B does not. • The SCC board of version D can be set for the global market or for the North American market through J51, while the SCC board of version B cannot. • There is a latch on the SCC board of version D, and the number of indicators on the SCC board of version D and the SCC board of version B is different.

14.2.2 Application

The SCC works with the NMS to manage the boards and transmits various maintenance and management message.

14.2.3 Functions and Features

The main functions and features by the SCC are to manage the boards and transmits various maintenance and management message.

For detailed functions and features, see **Table 14-5**.

Table 14-5 Functions and features of the SCC

Functions and Features	Description
Basic function	● Works with the network management system to manage the boards in the equipment and enables the communication between equipment. ● Processes the related overheads. ● Processes two optical supervisory channels, and receives and transmits the OSC signals.
DCC communication	Supports data communication channel (DCC) communication with the NEs for network management.
L2 switch	Achieve IP communication between the subrack.

Ways of Board Acceptance

Before a board is delivered, it has been tested strictly. Thus, you need to test only the basic functions of the board on site as required.

- Insert the SCC board. Make sure that the board is powered on normally, the board is started normally, and the indicators on the board run normally.
- Press the LAMP button on the board. The indicators on the board run normally.
- Press the RST button on the board. The board is reset (cold) successfully.
- Connect the U2000 computer to the ETH1 or ETH2&OAM port on the board by using an Ethernet cable. Run a ping command. The returned result of the command shows that the reported IP address of the ETH1 or ETH2&OAM port is correct. In addition, the alarm indicator for each port blinks normally.
- On the U2000, view the alarms generated on the SCC board. No abnormal alarm is reported.
- On the U2000, perform a soft reset on the SCC board. The operation is successful.

Precautions

CAUTION

- In the case of the OptiX OSN 1800, the NE ID and IP address stored on the SCC board are set by using software. If the SCC board needs to be replaced in the software upgrade process, ensure that NE IDs and IP addresses are unique.
- In the software upgrade process, the communication between the U2000 and the GNE must be normal. Otherwise, the upgrade fails.
- The following operations cannot be performed on an NE at the same time: backing up or restoring the NE data, loading the NE software, and loading board software.
- In the process of copying or activating upgrade software, if the operation fails, the loading state is displayed as abnormal. In this case, the upgrade software needs to be reloaded. If loading the new software fails, you need to roll back the software to the original version.

NOTE

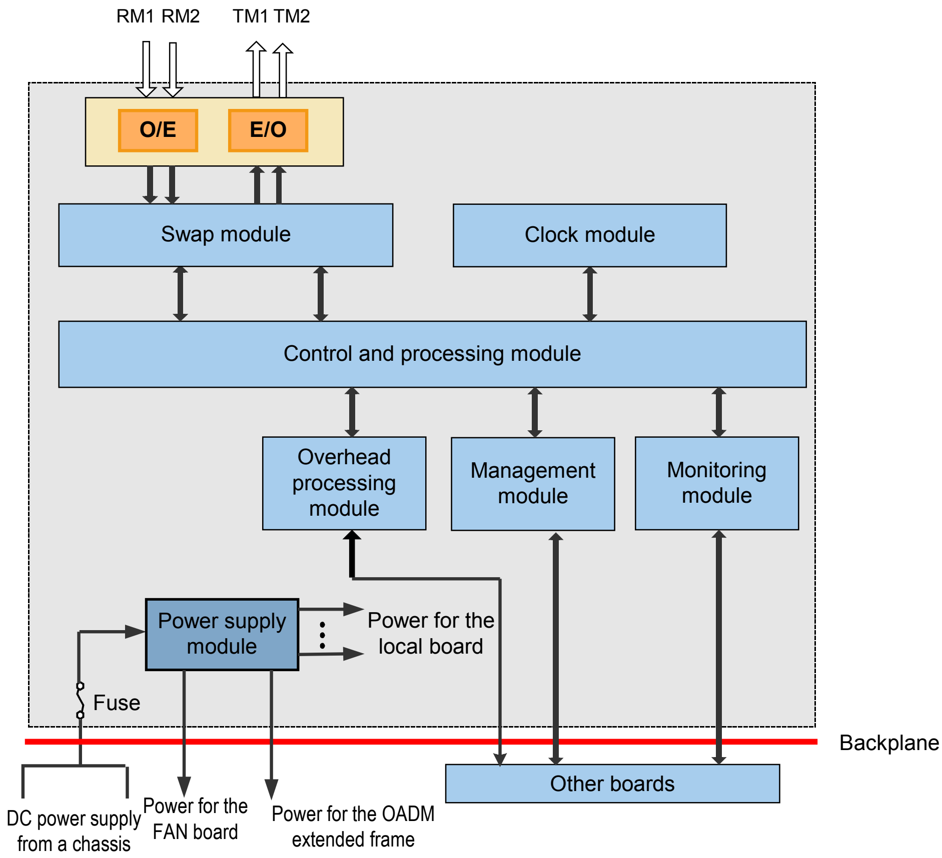
- Before replacing the SCC, back up the configuration to the NE database. After the new SCC is installed, issue the configuration to the SCC through the NMS. Replacement of the SCC does not interrupt the services.
- You can use the LAMP button on the SCC board to restore the default IP address of the equipment on site. Press the LAMP button on the SCC board and hold it for five to ten seconds. Then, release the button and wait for five to ten seconds. Press the button again and hold it for more than five seconds, and then release the button. In this manner, the IP address of the equipment can be restored. The default IP address is **129.9.191.240**.

14.2.4 Working Principle and Signal Flow

The SCC unit consists of parts: the control and processing module, the overhead processing module, the monitoring module, the clock module, the management module, the swap module and the power supply module.

Figure 14-3 shows the principle block diagram of the SCC.

Figure 14-3 Principle block diagram of the SCC



Signal Flow

NA

Module Function

- Control and processing module

  Controls, monitors, and manages each functional module of the unit.
- Swap module

  It is an Ethernet layer 2 switching chip and implements the switchover of internal data of the board.
- Overhead processing module
  - Receives the overhead signals from service units and processes the overhead signals.
  - Sends the processed overhead signals to service units.
- Monitoring module

  Provides the east optical supervisory channel and west optical supervisory channel. The module obtains information about the working status of each board through the serial management bus and then report the information to the NMS.
- Clock module

Provides a clock source for the system.

- Management module

  Communicates with each board and reports the data of the boards to the NMS.

- Power supply module

  Converts the DC power into the power required by each module of the board.

NOTE

SCC board supports the backup power.

14.2.5 DIP Switch and Jumper

This section describes how to set the DIP switch and jumpers on the SCC.

DIP Switch and Jumpers

Figure 14-4 and **Figure 14-5** show the positions of the DIP switch and jumpers on the SCC board.

Figure 14-4 Positions of the DIP switch and jumpers on the SCC board (version D)

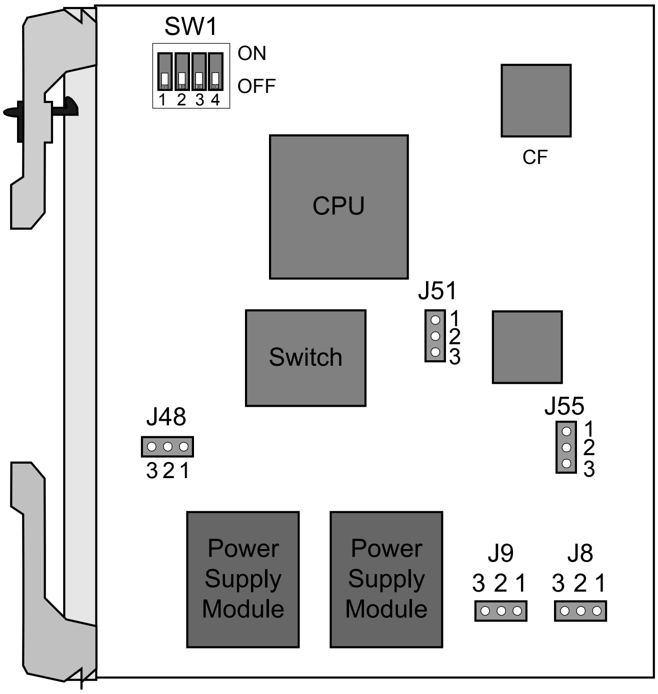
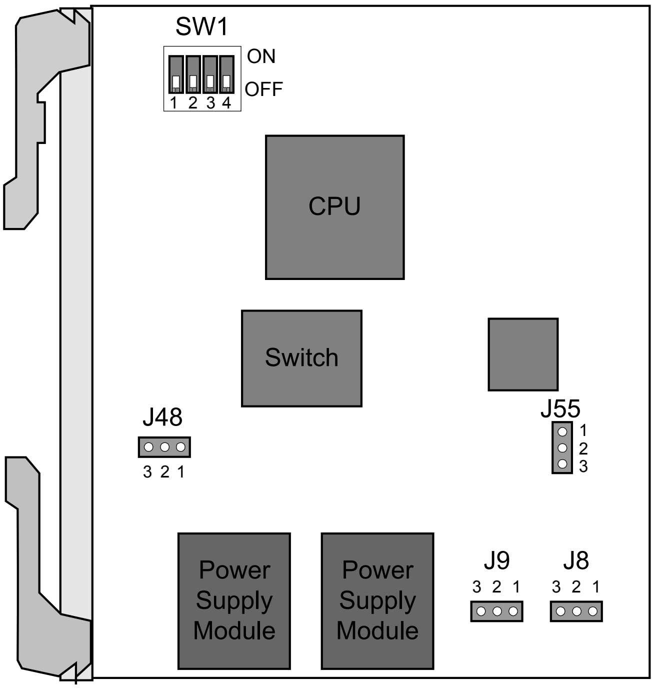


Figure 14-5 Positions of the DIP switch and jumpers on the SCC board (version B)



DIP Switch

The hardware configuration of the SCC board can be implemented through a four-bit DIP switch SW1 on the SCC board. See **Figure 14-6** and **Table 14-6**.

Figure 14-6 SW1 DIP switch diagram

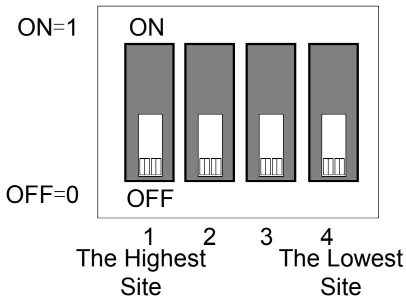


Table 14-6 States and functions of SW1 DIP switch

Value	DIP Switch Setting	Function Description
0	0000	When the value is 0, the SCC board runs with the watchdog enabled.

Value	DIP Switch Setting	Function Description
1	0001	When the value is 1, 2, or 3, the SCC board is in debugging state. **NOTE** When the SCC board is in debugging state with the watchdog disabled, the BIOS is running and the NE software is not started.
2	0010	
3	0011	
4	0100	When the value is 4, the SCC board runs with the hardware watchdog disabled.
5	0101	When the value is 5, the SCC board runs in BIOS state and the IP address is always 129.9.0.5. In addition, the NE software is not started.
6	0110	When the value is 6, the SCC board is in demonstration state. In this state, indicators on the board blink, the BIOS is running and the NE software is not started.
7	0111	The values 7, 8, 9, and 10 are reserved. When the value is 7, 8, 9, or 10, the SCC board runs with the hardware dog enabled.
8	1000	
9	1001	
10	1010	Erases the system parameter areas.
11	1011	When the value is 11, the SCC board deletes the NE database.
12	1100	When the value is 12, the SCC board deletes the NE software including the patch software.
13	1101	When the value is 13, the SCC board deletes the NE database and the NE software including the patch software.
14	1110	When the value is 14, the SCC board erases all the contents in the flash memory.
15	1111	When the value is 15, the SCC board deletes all the data in the flash memory except the board manufacturing information. The data includes the system data, system parameter areas, and extended BIOS data.

NOTE

By default, the factory DIP switch setting is 0000. The SCC board is normal state and the DIP switch setting does not need to be changed unless otherwise required.

Every time you change the DIP switch setting, perform a power-off reset on the SCC board to validate the new setting.

Jumpers

Jumpers are present on the SCC board and are preset at factory. You do not need to change the jumper setting.

- J8 and J9 are used to specify whether the equipment is powered by a -48 V or -60 V power source. When pins 1 and 2 are capped, the power supply is -48 V, when no pin is capped, the power supply is -60 V.
- J48 is used to specify whether the EEPROM, which saves the board manufacturing information, is write-protected. When pins 2 and 3 are capped, the EEPROM is write-protected; when pins 1 and 2 are capped, the EEPROM is not write-protected.
- If pins 1 and 2 of J51 are capped, it indicates that the SCC board is intended for the global market.

14.2.6 Front Panel

There are indicators, switches, and ports on the SCC front panel.

Appearance of the Front Panel

Figure 14-7 and **Figure 14-8** show the front panel of the SCC.

Figure 14-7 Front panel of the SCC (version B)

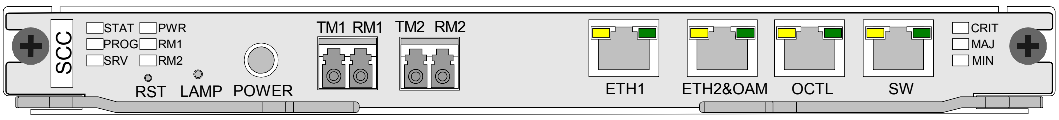
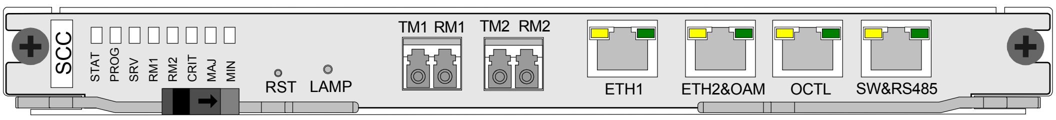


Figure 14-8 Front panel of the SCC (version D)



NOTE

- Except the OCTL port, which must be connected to a straight-through cable, other ports such as ETH1, and ETH2&OAM ports are adaptive to straight-through cables or crossover cables.

Indicators

There are nine indicators on the front panel of the SCC board of version B and eight indicators on the front panel of the SCC board of version D.

- Working status indicator (STAT)——red, green
- Software working status indicator (PROG)——red, green
- Service status indicator (SRV)——red, yellow, green
- System power-on status indicator (PWR)——green
- Optical supervisory channel module working status indicator (RM1/RM2)——red, yellow, green
- Critical alarm indicator (CRIT)——red
- Major alarm indicator (MAJ)——orange

- Minor alarm indicator (MIN) ——yellow

For details on the indicators, refer to **20.2 Board Indicators**.

Switches and Ports

There are three switches, four optical ports and four electrical ports on the front panel of the SCC board of version B, and two switches, four optical ports and four electrical ports on the front panel of the SCC board of version D, **Table 14-7** and **Table 14-8** list the type and function of each port.

Table 14-7 Types and functions of the SCC ports and switches

Switches and Ports	Port Type	Description
RST	-	Reset button, which is used to perform a warm reset on the board.
LAMP	-	Lamp button, which is used to test the lamps on this board.
ETH1	RJ-45	• Connects to the network port on the computer where the NMS is located using a network cable so that the NMS can manage the OptiX OSN 1800 equipment. • Connects to the ETH1/ETH2 port on another NE using a network cable to achieve communication between NEs. **NOTE** Authentication is required before this port is connected. To be specific, you must log in to the NE using the NE administrator account for authentication.
ETH2&OAM	RJ-45	• Connects to the network port on the computer where the NMS is located using a network cable so that the NMS can manage the OptiX OSN 1800 equipment. • Connects to the ETH1/ETH2 port on another NE using a network cable to achieve communication between NEs. • Provides serial NM and supports X.25 protocol. • Connects to the UPM (Uninterruptible Power Module) to monitor and manage the UPM. **NOTE** Authentication is required before this port is connected. To be specific, you must log in to the NE using the NE administrator account for authentication.

Switches and Ports	Port Type	Description
OCTL	RJ-45	Connects to the CTL board in the OptiX OSN 1800 OADM frame to enable the communication between the equipment and the OptiX OSN 1800 OADM frame. In this way, the U2000 is able to monitor and manage the boards on the OADM extended frame. **NOTE** The OCTL port supports power feeding and therefore can be connected only to an OCTL port. Otherwise, the SCC board may be damaged. When the OCTL port on the SCC board of the chassis and that on the OADM extended frame are correctly connected, the RUN indicator on the CTL board turns on green; if they are incorrectly connected, the RUN indicator does not turn on.
SW&RS485	RJ-45	• This port can function as an alarm input or output port or a communication port for an outdoor cabinet. The two port functions can be switched by using the NMS. • When this port functions as an alarm input or output port, the OptiX OSN 1800 uses this port to connect the equipment such as the audible and visual alarm box or smoke sensor to report alarms. One OptiX OSN 1800 chassis supports three housekeeping alarm inputs. When the OptiX OSN 1800 system is expected to support more than three housekeeping alarm inputs, use multiple OptiX OSN 1800 chassis. For example, to accept six housekeeping alarm inputs, use two OptiX OSN 1800 chassis. • When functioning as a communication port, this port is interconnected with the COM_IN port of an outdoor cabinet to monitor the OptiX OSN 1800.
TM1/RM1	LC	Connects to slave subrack 1 or the master subrack when the SCC board is used in the master subrack or in slave subrack 1, or sends/receives west supervisory signals when the SCC board is used in another slave subrack.
TM2/RM2	LC	Connects to slave subrack 1 or the master subrack when the SCC board is used in the master subrack or in slave subrack 1, or sends/receives east supervisory signals when the SCC board is used in another slave subrack.
CAUTION You can enable or disable the ETH1 or ETH2&OAM port, but do not disable the ETH1 and ETH2&OAM ports simultaneously; otherwise, the NE will be unreachable. In addition, the NE unreachability fault cannot be restored remotely if the DCN communication is interrupted and consequently services may be interrupted. **NOTE** ETH1 port, ETH2&OAM port, OCTL port and SW&RS485 port must use shielded cables.		

Table 14-8 Descriptions of the pins of SW&RS485 port

Pins	Description
1	The first channel of alarm input.
2	The first channel of BGND
3	The second channel of alarm input.
4	The third channel of alarm input.
5	The third channel of BGND
6	The second channel of BGND
7	The positive pole of alarm output.
8	The negative pole of alarm output.

14.2.7 Valid Slots

The SCC occupies one slot.

Valid Slots in the Subracks

- In the OptiX OSN 1800 I chassis, the valid slot of the board is SLOT2.
- In the OptiX OSN 1800 II chassis, the valid slot of the board is SLOT8.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

14.2.8 Optical Interfaces

This section introduces the display of optical ports on the board.

Display of Optical Ports

Table 14-9 lists the sequence number displayed in an NM system of the optical port on the SCC board front panel.

Table 14-9 Display of the SCC ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
TM1/RM1	1
TM2/RM2	2

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

14.2.9 SCC Parameters on the NMS

Parameter Description

Field	Value	Description
Channel Use Status	Used, Unused Default: Used	• If the OSC channel is not configured or used in the network planning, set the **Channel Use Status** field to **Unused** for the TM1/RM1 and TM2/RM2 optical ports. • If the OSC channel is configured and used in the network planning, set the **Channel Use Status** field to **Used** for the TM1/RM1 and TM2/RM2 optical ports.
Laser Status	ON, OFF Default: • WDM side: ON • Client side: OFF	• If the OSC channel is not configured or used in the network planning, set the **Laser Status** field to **OFF** for the TM1/RM1 and TM2/RM2 optical ports. • If the OSC channel is configured and used in the network planning, set the **Laser Status** field to **ON** for the TM1/RM1 and TM2/RM2 optical ports. **CAUTION** If the communication between NEs is achieved through only the OSC, the NEs are unreachable after the lasers at the TM1/RM1 and TM2/RM2 optical ports on the SCC board are disabled.
Band Type/ Wavelength No./ Wavelength (nm)/ Frequency (THz)	The parameter format is as follows: band type/wavelength No./ optical port wavelength/ frequency, for example, C/ 11/1471.00/208.170. Default: -	This parameter is for query only.
Band Type	C, CWDM Default: /	This parameter is for query only.
Optical Interface/ Channel	-	-

Field	Value	Description
Optical Interface Name	-	-

14.2.10 SCC Specifications

Specifications include optical specifications, laser safety level, mechanical specifications and power consumption.

Optical Specifications

Table 14-10 lists the specifications of the optical module on the SCC board when the board transmits optical supervisory signals.

Table 14-10 Specifications of the optical module on the SCC board

Item		Unit	Value
Signal rate		Mbit/s	125
Operating wavelength range of OSC		-	1310 nm wavelength
Signal coding		-	NRZ
Target distance	S-1.1	km	15
	L-1.1	km	40
Launched optical power	S-1.1	dBm	-15 to -8
	L-1.1	dBm	-5 to 0
Receiver sensitivity	S-1.1	dBm	-28
	L-1.1	dBm	-34
Minimum overload	S-1.1	dBm	-8
	L-1.1	dBm	-10

For specifications of the optical module on the SCC board when the SCC board transmits the DWDM standard wavelength signals, see **Table 14-11**.

Table 14-11 Specifications of 2400ps/nm-fixed-APD-eSFP optical module

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Line code format	-	NRZ

Item	Unit	Value
		2400ps/nm-fixed-APD-eSFP
Transmitter parameter specifications at point S		
Maximum mean launched power	dBm	3
Minimum mean launched power	dBm	-1
Minimum extinction ratio	dB	8.2
Central frequency	THz	192.10 to 196.00
Central frequency deviation	GHz	±10
Maximum -20 dB spectral width	nm	0.3
Minimum side mode suppression ratio	dB	30
Dispersion tolerance	ps/nm	2400
Eye pattern mask	-	G.957-compliant
Receiver parameter specifications at point R		
Receiver type	-	APD
Operating wavelength range	nm	1200 to 1650
Receiver sensitivity	dBm	-28
Minimum receiver overload	dBm	-8
Maximum reflectance	dB	-27

For specifications of the optical module on the SCC board when the SCC board transmits the CWDM standard wavelength signals, see **Table 14-12**

Table 14-12 Specifications of 2.5G-1600ps/nm-fixed-APD-eSFP, 2.5G-800ps/nm-fixed-PIN-eSFP, 155M-1600ps/nm-fixed-APD-eSFP and 155M-3000ps/nm-fixed-APD-eSFP optical modules

Item	Unit	Value			
		2.5G-1600ps/nm-fixed-APD-eSFP	2.5G-800ps/nm-fixed-PIN-eSFP	155M-1600ps/nm-fixed-APD-eSFP	155M-3000ps/nm-fixed-APD-eSFP
Maximum wavelength count	-	8	8	1	1
Line code format	-	NRZ	NRZ	NRZ	NRZ
Target distance	km	80	40	80	150

Item	Unit	Value			
		2.5G-1600ps/nm-fixed-APD-eSFP	2.5G-800ps/nm-fixed-PIN-eSFP	155M-1600ps/nm-fixed-APD-eSFP	155M-3000ps/nm-fixed-APD-eSFP
Transmitter parameter specifications at point S					
Maximum mean launched power	dBm	5	5	1	5
Minimum mean launched power	dBm	0	0	-4	0
Minimum extinction ratio	dB	10	8.2	9	10
Central wavelength	nm	1471 to 1611	1471 to 1611	1511	1511
Central wavelength deviation	nm	≤±6.5	≤±6.5	≤±6.5	≤±6.5
Maximum -20 dB spectral width	nm	1	1	N/A	N/A
Minimum side mode suppression ratio	dB	30	30	30	30
Dispersion tolerance	ps/nm	1600	800	1600	3000
Eye pattern mask	-	G.957-compliant			
Receiver parameter specifications at point R					
Receiver type	-	APD	PIN	APD	APD
Operating wavelength range	nm	1200 to 1650	1200 to 1650	1200 to 1650	1200 to 1650
Receiver sensitivity	dBm	-28	-19	-34	-41
Minimum receiver overload	dBm	-9	-3	-10	-10
Maximum reflectance	dB	-27	-27	N/A	N/A

Laser Level

The laser hazard level of the optical interface is HAZARD LEVEL 1 (The maximum output optical power of each optical interface is lower than 10 dBm (10 mW)).

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.55 kg (1.21 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 12.7 W
- Maximum Power Consumption at 55°C (131°F): 15.2 W

15 Optical Protection Board

About This Chapter

Describes the functions and the working principle of optical protection boards.

15.1 OLP

OLP: Optical Line Protection Board

15.1.1 Version Description

The available hardware version for the OLP is TNF1.

Version

Table 15-1 describes the version mapping of the OLP board. The mapping version of the equipment is V100R001C01 or later.

Table 15-1 Version description of the OLP

Item	Description
Board hardware version	TNF1

15.1.2 Application

The OLP board achieves the optical line protection, the intra-board wavelength protection and client 1+1 protection.

For the application of the board in WDM systems, see Figure 15-1, Figure 15-2 and Figure 15-3.

Figure 15-1 Application of the OLP in WDM systems (optical line protection)

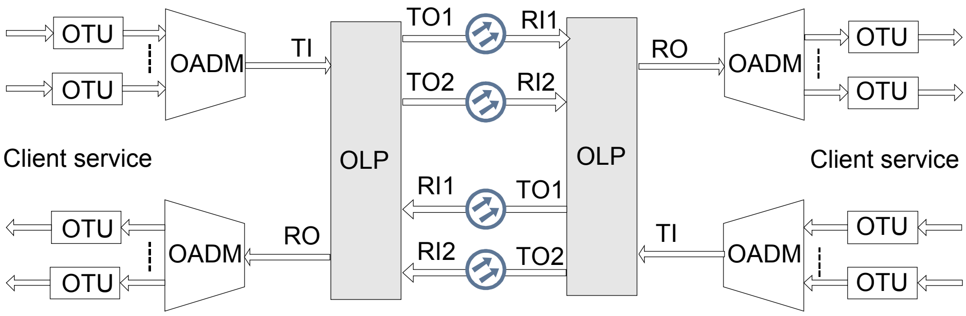


Figure 15-2 Application of the OLP in WDM systems (intra-board wavelength protection)

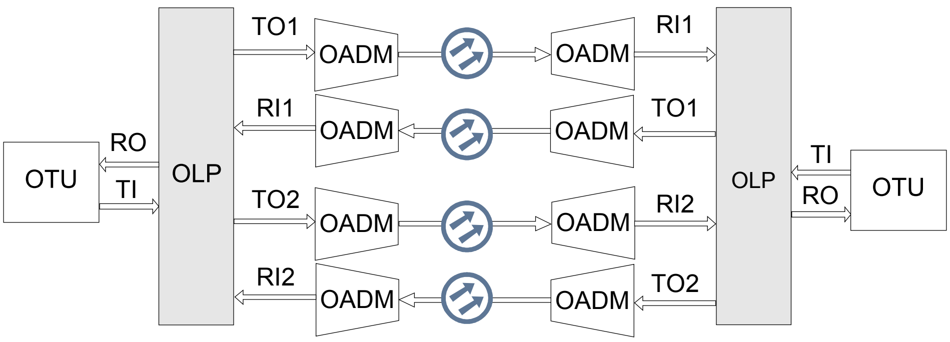
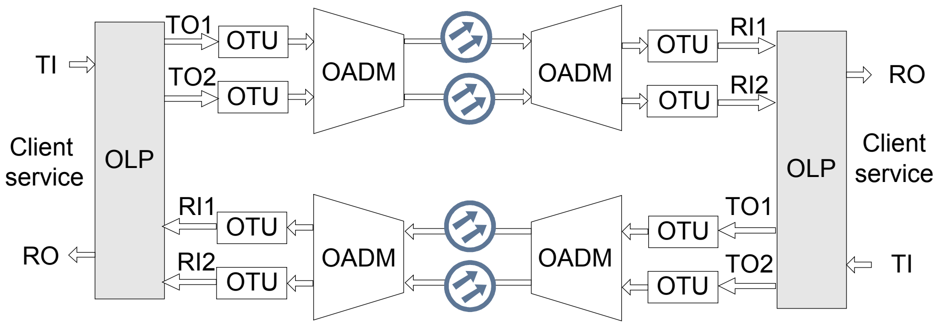


Figure 15-3 Application of the OLP in WDM systems (client 1+1 protection)



NOTE

When the OLP board is used for client 1+1 protection, the OLP board must be housed in the master subrack where the working OTU is located. In this manner, the OLP board can switch services normally when the equipment is powered off.

NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

15.1.3 Functions and Features

The OLP board achieves the optical line protection, the intra-board wavelength protection and client 1+1 protection.

For detailed functions and features, see **Table 15-2**.

Table 15-2 Functions and features of the OLP board

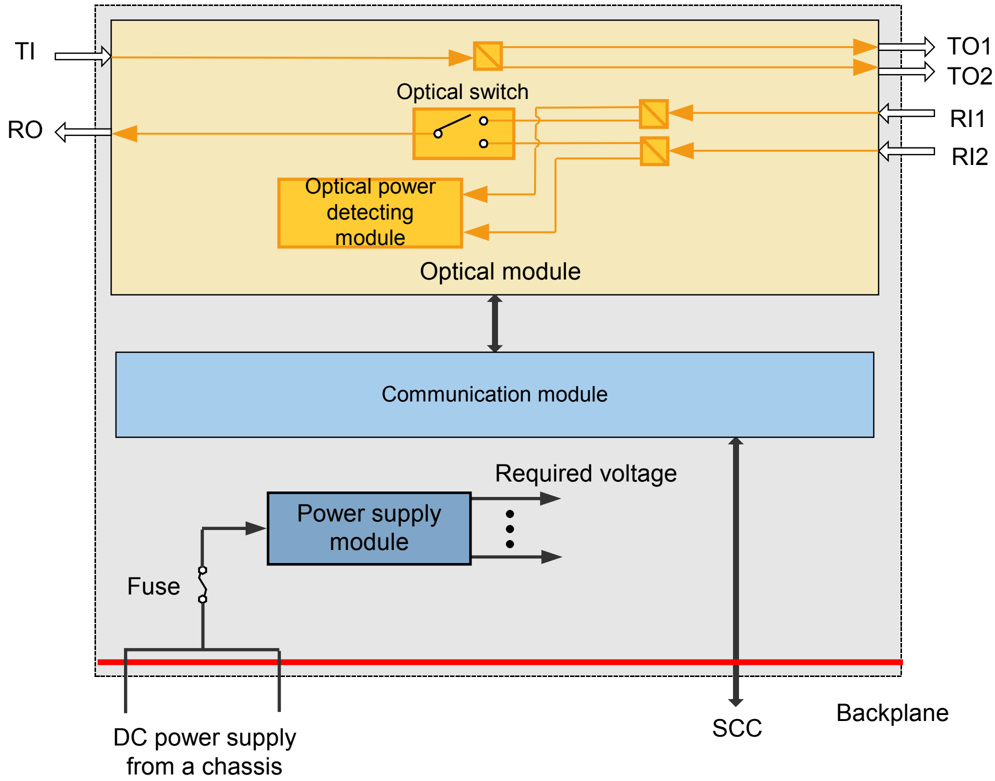
Functions and Features	Description
Basic Function	The OLP board achieves the optical line protection, the intra-board wavelength protection and client 1+1 protection.
Protection schemes	The protection mode is dual-fed and signal selection and single-end switching. When the performance of the working fiber declines, the system will automatically switch the service from the working path to the protection path.

15.1.4 Working Principle and Signal Flow

The OLP unit consists of three parts: the optical module, the communication module, and the power supply module.

Figure 15-4 is the functional block diagram of the OLP unit.

Figure 15-4 Functional block diagram of the OLP unit



Signal Flow

The OLP unit implements the dual-fed and selective receiving of one channel of signals.

- Transmit direction

  The TI optical port receives one channel of optical signal. After passing through the splitter, the signals are output to the working and the protection fibers (channels) through the TO1 and TO2 optical ports.

- Receive direction

  The signals in the working and the protection fibers (channels) are input through the RI1 and RI2 optical ports, and enter the optical switch. The optical switch selects one from the two channels of signals based on the optical power of the signals. In this way, the selection of signals from the working and the protection channels is achieved. The selected optical signals are output through the RO optical port.

  The optical power detecting module detects the detection signals that are extracted from the working and protection signals, and reports the detection results to the control and communication module. The control and communication module compares the optical power of the two channels of optical signals, and controls the operation of the optical switch based on the optical power. In this way, the selection of signals from the working and the protection channels is achieved.

Module Function

- Optical module

- The optical module consists of a signal dual-fed part and a signal selection part.
- The signal dual-fed part divides the one channel of optical signals into two channels of the same power, and outputs them to the working and protection channels.
- The signal selection part receives the optical signals from the working and protection channels. The optical power detecting module detects and compares the optical power of the two channels of optical signals. Based on the results, the signal selection part selects one channel of optical signals and outputs it.

- Communication module
  - Collects the information of alarms, performance events, and working states of each functional module of the unit.
  - Communicates with the SCC unit, to control and operate on each module of the unit.
- Power supply module
  - Converts the 3.3 V power supply from the backplane to the required voltage of each module on the board.

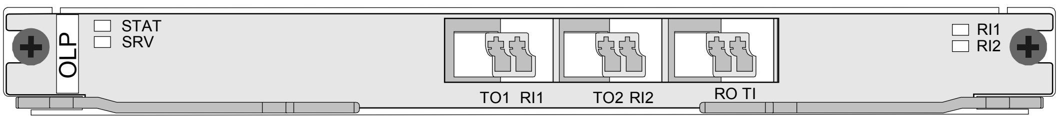
15.1.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 15-5 shows the front panel of the OLP.

Figure 15-5 Front panel of the OLP



Indicators

There are some indicators on the front panel.

- Working status indicator (STAT) -red, green, orange
- Service status indicator (SRV) - red, green, orange
- Working status of working path indicator (RI1)- red, green
- Working status of protection path indicator (RI2)—red, green

For details on the indicators, refer to **20.2 Board Indicators**.

Ports

There are six optical ports on the front panel of the OLP, **Table 15-3** lists the type and function of each port.

Table 15-3 Optical ports on the front panel of the OLP

Port	Connector type	Description
RO	LC	Transmit signals after selected.
TI	LC	Receive signals to be protected.
TO1	LC	Transmit working signals.
TO2	LC	Transmit protection signals.
RI1	LC	Receive working signals.
RI2	LC	Receive protection signals.

15.1.6 Valid Slots

The OLP occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT6.

Display of Slots

The board occupies one slot on the U2000. The slot number displayed on the U2000 or Web LCT represents the slot where the slot is installed.

15.1.7 Optical Interfaces

This section introduces the display of optical ports on the board.

Display of Optical Ports

Table 15-4 lists the sequence number displayed in an NM system of the optical port on the OLP board front panel.

Table 15-4 Display of the OLP ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
RI1/TO1	1
RI2/TO2	2
TI/RO	3

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

15.1.8 OLP Parameters on the NMS

Field	Value	Description
Initial Variance Value Between Primary and Secondary Input Power (dB)	-10.0 to 10.0 Default: 0	parameter provides an option to set the reference value of the optical power variance between the primary and secondary input optical ports of a board.
Optical Interface/Channel	-	-
Optical Interface Name	-	-

15.1.9 OLP Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 15-5 lists the optical specifications of the OLP.

Table 15-5 Optical port specifications of the TNF1OLP

Corresponding ports	Item	Unit	Value
TI-TO1 TI-TO2	Signal splitter insertion loss	dB	< 4.0
RI1-RO RI2-RO	Signal selection insertion loss	dB	< 1.5
Range of the input optical power		dBm	-35 to 7
Operating wavelength range		nm	1260 to 1640
Alarm threshold of optical power difference		dB	3
Switching threshold of optical power difference		dB	5

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.41 kg (0.90 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 1.2 W
- Maximum Power Consumption at 55°C (131°F): 1.4 W

15.2 SCS

SCS: Sync Optical Channel Separator Board

15.2.1 Version Description

The available hardware version for the SCS is TNF1.

Version

Table 15-6 describes the version mapping of the SCS board. The mapping version of the equipment is V100R001C01 or later.

Table 15-6 Version description of the SCS

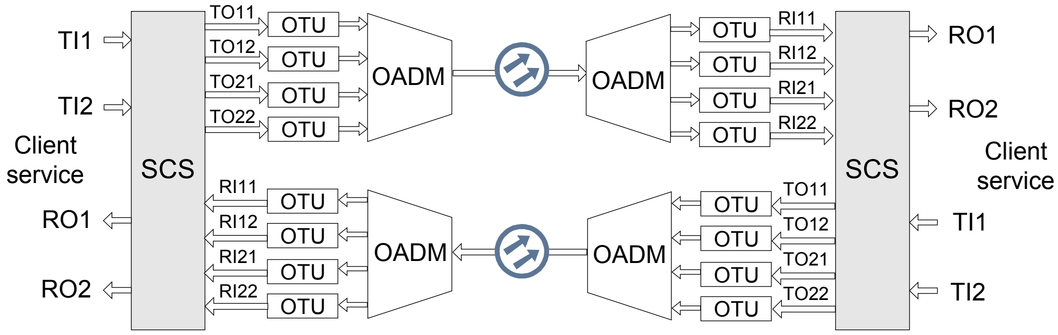
Item	Description
Board hardware version	TNF1

15.2.2 Application

The SCS board provides client 1+1 protection.

Figure 15-6 shows the SCS board application in the WDM system.

Figure 15-6 SCS board application in the WDM system



NOTE

An OTU is a transceiver that can process transmitting signals and receiving signals for the same wavelength at the same time.

15.2.3 Functions and Features

The SCS board provides client 1+1 protection.

For detailed functions and features, see **Table 15-7**.

Table 15-7 Functions and features of the SCS

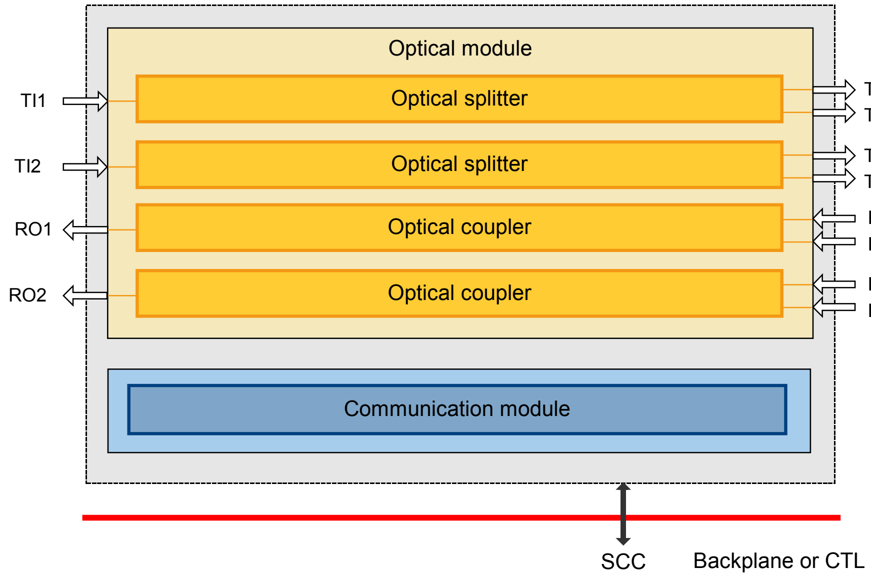
Functions and Features	Description
Basic function	The SCS board provides the client 1+1 protection. When the performance of the working fiber degrades, the signals switch automatically to the protection channel.
Protection schemes	The channel protection that is supported by the SCS board does not require any protocol. The SCS board triggers a channel protection switching after the SD or SF event is detected in the channel.

15.2.4 Working Principle and Signal Flow

The SCS unit consists of three parts: the optical module and the communication module.

Figure 15-7 is the functional block diagram of the SCS unit.

Figure 15-7 Functional block diagram of the SCS unit



Signal Flow

One SCS unit supports the dual-fed and dual receiving of two channels of optical signals. The SCS unit processes the two channels of optical signals in the same way. This section describes the service flow of only one channel of optical signals.

- Transmit direction

  The TI1 optical port receives one channel of optical signals. After passing through the splitter, the signals are output to the working and the protection channels through the TO11 and TO12 optical ports.

- Receive direction

  The signals in the working and the protection channels are input through the RI1 and RI2 optical ports, and enter the coupler. The system activates one of the two channels of optical signals based on the service quality. In this way, the selection of path optical signals is achieved. The selected optical signals are output through the RO1 optical port.

  Normally, the working OTU at the receive end is active, and the protection OTU is standby. Once a fault occurs in the services, an alarm triggers a protection switching. The system shuts down the working OTU, and activates the protection OTU.

Module Function

- Optical module
  - The optical module consists of splitters and couplers.
  - The splitter divides the one channel of optical signals into two channels of the same power, and outputs them to the working and protection channels.
  - The coupler receives the signals in the working and the protection channels. The system selects one channel of optical signals based on the service quality.
- Communication module
  - Communicates with the SCC unit, to control and operate on each module of the unit.

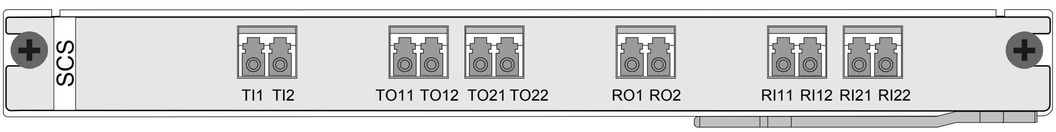
15.2.5 Front Panel

There are ports on the front panel of the board.

Appearance of the Front Panel

Figure 15-8 shows the front panel of the SCS.

Figure 15-8 Front panel of the SCS



NOTE

This board has two types of front panels. One type (old one) is developed earlier than the other type (new one) and has no ejector levers installed. When the board uses an old front panel, the board cannot have a fixed optical attenuator installed on it. Instead the fixed optical attenuator has to be installed on the associated OTU board. The appearance of the front panel depicts the new front panel.

Indicators

The SCS board does not have indicators.

Ports

There are 12 optical ports on the front panel of the SCS board, **Table 15-8** lists the type and function of each port.

Table 15-8 Types and functions of the SCS ports

Optical Port	Port Type	Function
TI1	LC	Transmit the first channel of optical signals.
RO1	LC	Receive the first channel of optical signals.
TI2	LC	Transmit the second channel of optical signals.
RO2	LC	Receive the second channel of optical signals.
TO11/TO12	LC	Transmit the first channel of signals to working and protection OTUs respectively.
TO21/TO22	LC	Transmit the second channel of signals to working and protection OTUs respectively.
RI11/RI12	LC	Receive the first channel of signals from working and protection OTUs respectively.
RI21/RI22	LC	Receive the second channel of signals from working and protection OTUs respectively.

15.2.6 Valid Slots

The SCS occupies one slot.

Valid Slots in the Subracks

In the OptiX OSN 1800 I chassis, the valid slots of the board are SLOT1, SLOT3, and SLOT4.

In the OptiX OSN 1800 II chassis, the valid slots of the board are SLOT1 to SLOT7.

In the OptiX OSN 1800 OADM frame, the valid slots of the board are SLOT1 to SLOT4.

Display of Slots

On the U2000, the board occupies one logical slot.

- When the board is installed in the OptiX OSN 1800 I chassis or OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line represents the slot where the board is installed.
- When the board is installed in the OptiX OSN 1800 OADM frame:

- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 I chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 7 to 10.
- If the OptiX OSN 1800 OADM frame works with the OptiX OSN 1800 II chassis, the slot number displayed on the U2000, Web LCT, or in the command line is a digit ranging from 12 to 15.

15.2.7 Optical Interfaces

This section introduces the display of optical ports on the board.

Display of Optical Ports

Table 15-9 lists the sequence number displayed in an NM system of the optical port on the SCS board front panel.

Table 15-9 Display of the SCS ports

Optical Ports on the Front Panel	Optical Port Displayed on the U2000
TI1/RO1	1
TI2/RO2	2
RI11/TO11	3
RI12/TO12	4
RI21/TO21	5
RI22/TO22	6

NOTE

An optical port number displayed on the U2000 indicates a pair of actual optical ports, one for transmitting signals, and the other for receiving signals.

15.2.8 SCS Specifications

Specifications include optical specifications, mechanical specifications and power consumption.

Optical Specifications

Table 15-10 list the optical specifications of the SCS.

Table 15-10 Optical interface parameter specifications of the SCS board specifications

Item		Unit	Value
Insertion loss	Single-mode	dB	< 4
	Multi-mode	dB	< 4.5

Item		Unit	Value
Operating wavelength range	Single-mode	nm	1260 to 1620
	Multi-mode	nm	830 to 870

Mechanical Specifications

The mechanical specifications of the board are as follows:

- Dimensions (Height x Width x Depth): 19.8 mm x 193.8 mm x 208.7 mm (0.8 in. x 7.6 in. x 8.2 in.)
- Weight: 0.7 kg (1.54 lb.)

Power Consumption

The power consumption of the board is as follows:

- Typical Power Consumption at 25°C (77°F): 0.5 W
- Maximum Power Consumption at 55°C (131°F): 0.5 W

16 Cables

About This Chapter

This chapter describes various equipment cables, including fibers, power cables, grounding cables, and management cables.

16.1 Optical Fibers

The OptiX OSN 1800 has several optical fibers with different length and connectors.

16.1.1 Classification

Select fiber connectors and fiber length according to the on-site survey.

The optical fibers used by the OptiX OSN 1800 equipment is classified as shown in **Table 16-1**.

Table 16-1 Classification of optical fibers

Type of Connectors at Both Ends	Fiber Type	
LC/PC-LC/PC	2.0 mm (0.08 in.) single-mode fiber	G.657A2 fiber
	2.0 mm (0.08 in.) multimode fiber	
LC/PC-FC/PC	2.0 mm (0.08 in.) single-mode fiber	G.657A2 fiber
	2.0 mm (0.08 in.) multimode fiber	
LC/PC-SC/PC	2.0 mm (0.08 in.) single-mode fiber	G.657A2 fiber
	2.0 mm (0.08 in.) multimode fiber	

NOTE

The G.657 optical fibers provided by Huawei are named G.657B optical fibers and G.657A2 optical fibers. The G.657B optical fibers are short-jacket optical fibers defined in ITU-T G.657 (12/2006). According to ITU-T G.657 (11/2009), these fibers are classified into G.657A1, G.657A2, G.657B2, and G.657B3 optical fibers. The G.657B optical fibers provided by Huawei and the G.657A2 optical fibers are fully compatible and can be interconnected. In addition, the G.657B and G.657A2 optical fibers are fully compatible with G.652D optical fibers. However, the compatibility between customer-purchased G.657B optical fibers and G.657A2 and G.652D optical fibers needs to be verified.

16.1.2 Connectors

All optical ports on the front panel of the boards for the system are the LC/PC type. LC/PC fiber connectors are used with these boards. The optical ports on the ODF in the equipment room are generally of the SC/PC or FC/PC type. SC/PC or FC/PC fiber connectors are used with them.

For detailed description of the two types of fiber connectors, see **Table 16-2**.

Table 16-2 Classification of fiber connectors

Type of fiber connectors	Description
LC/PC	Plug-in square fiber connector/protruding polished
SC/PC	Square fiber connector/protruding polished
FC/PC	Round fiber connector/protruding polished

Figure 16-1 shows the appearance of LC/PC optical connector.

Figure 16-1 LC/PC optical connector

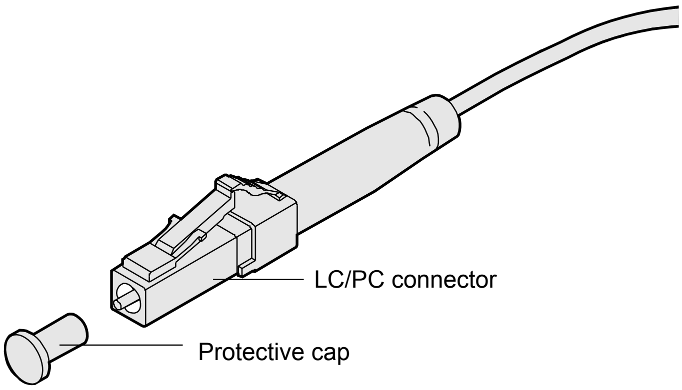


Figure 16-2 shows the appearance of SC/PC optical connector.

Figure 16-2 SC/PC optical connector

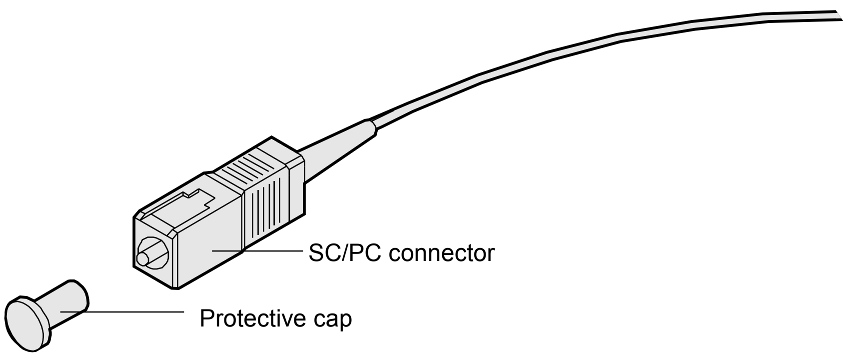
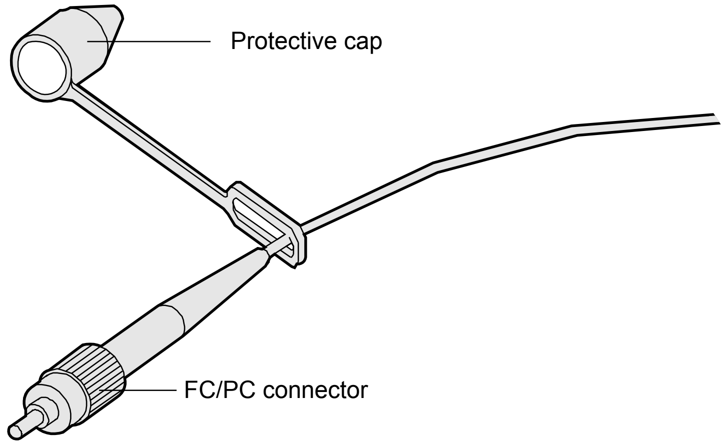


Figure 16-3 shows the appearance of FC/PC optical connector.

Figure 16-3 FC/PC optical connector



16.2 Signal Cable

The signal cables include the 75-ohm E1 cable and 120-ohm E1 cable.

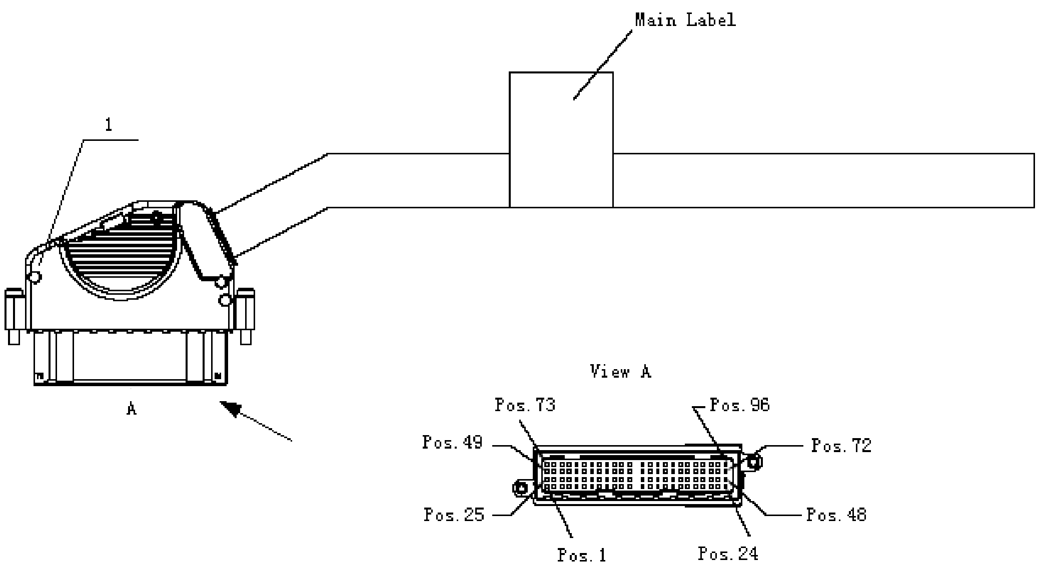
16.2.1 75-ohm 21xE1 Cable

The 75-ohm 21xE1 cable is used to receive and transmit E1 signals.

Structure

Figure 16-4 shows the structure of the 75-ohm 21xE1 cable.

Figure 16-4 Structure of the 75-ohm 21xE1 cable



1. Cable Connector - Anea - 96-pin - Female

Pin Assignments

Table 16-3 provides the pin assignments of the 75-ohm 21xE1 cable.

Table 16-3 Pin assignments of the 75-ohm 21xE1 cable

Connector	Cable W		Remarks	Connector	Cable W		Remarks
	Core	No.			Core	No.	
X1.1	Tip	1	R0	X1.45	Tip	22	T10
X1.2	Ring			X1.46	Ring		
X1.25	Tip	2	T0	X1.23	Tip	23	R11
X1.26	Ring			X1.24	Ring		
X1.3	Tip	3	R1	X1.47	Tip	24	T11
X1.4	Ring			X1.48	Ring		
X1.27	Tip	4	T1	X1.49	Tip	25	R12
X1.28	Ring			X1.50	Ring		
X1.5	Tip	5	R2	X1.73	Tip	26	T12
X1.6	Ring			X1.74	Ring		
X1.29	Tip	6	T2	X1.51	Tip	27	R13
X1.30	Ring			X1.52	Ring		
X1.7	Tip	7	R3	X1.75	Tip	28	T13
X1.8	Ring			X1.76	Ring		
X1.31	Tip	8	T3	X1.53	Tip	29	R14
X1.32	Ring			X1.54	Ring		
X1.9	Tip	9	R4	X1.77	Tip	30	T14
X1.10	Ring			X1.78	Ring		
X1.33	Tip	10	T4	X1.55	Tip	31	R15
X1.34	Ring			X1.56	Ring		
X1.11	Tip	11	R5	X1.79	Tip	32	T15
X1.12	Ring			X1.80	Ring		
X1.35	Tip	12	T5	X1.57	Tip	33	R16
X1.36	Ring			X1.58	Ring		

Connector	Cable W		Remarks	Connector	Cable W		Remarks
	Core	No.			Core	No.	
X1.13	Tip	13	R6	X1.81	Tip	34	T16
X1.14	Ring			X1.82	Ring		
X1.37	Tip	14	T6	X1.59	Tip	35	R17
X1.38	Ring			X1.60	Ring		
X1.15	Tip	15	R7	X1.83	Tip	36	T17
X1.16	Ring			X1.84	Ring		
X1.39	Tip	16	T7	X1.61	Tip	37	R18
X1.40	Ring			X1.62	Ring		
X1.17	Tip	17	R8	X1.85	Tip	38	T18
X1.18	Ring			X1.86	Ring		
X1.41	Tip	18	T8	X1.63	Tip	39	R19
X1.42	Ring			X1.64	Ring		
X1.19	Tip	19	R9	X1.87	Tip	40	T19
X1.20	Ring			X1.88	Ring		
X1.43	Tip	20	T9	X1.65	Tip	41	R20
X1.44	Ring			X1.66	Ring		
X1.21	Tip	21	R10	X1.89	Tip	42	T20
X1.22	Ring			X1.90	Ring		
Shell	External braided shield			Shell	External braided shield		

Technical Specifications

Table 16-4 lists the specifications of the 75-ohm E1 cable.

Table 16-4 Specifications of the 75-ohm E1 cable

Item	Description
Connector X	Cable Connector, Anea, 96PIN, Female Connector with Shielding Misc, IDC Type, For 28-30 AWG wire, 1A
Cable Type	Coaxial Cable - SYFVZP-MC 75-1-1x42 - 75 ohms - 13.60mm-1.1mm-0.26mm-Pantone Warm Gray 1U, For OEM

Item	Description
Number of cores	84 cores
Diameter of the shielding layer - diameter of the internal insulation layer - diameter of the internal conductor	13.60mm - 1.1mm - 0.26mm
Length	5m, 10m, 15m, 20m, 25m, 30m, 35m, 40m, 45m, 50m
Fireproof class	Complies with IEC60332-3C.

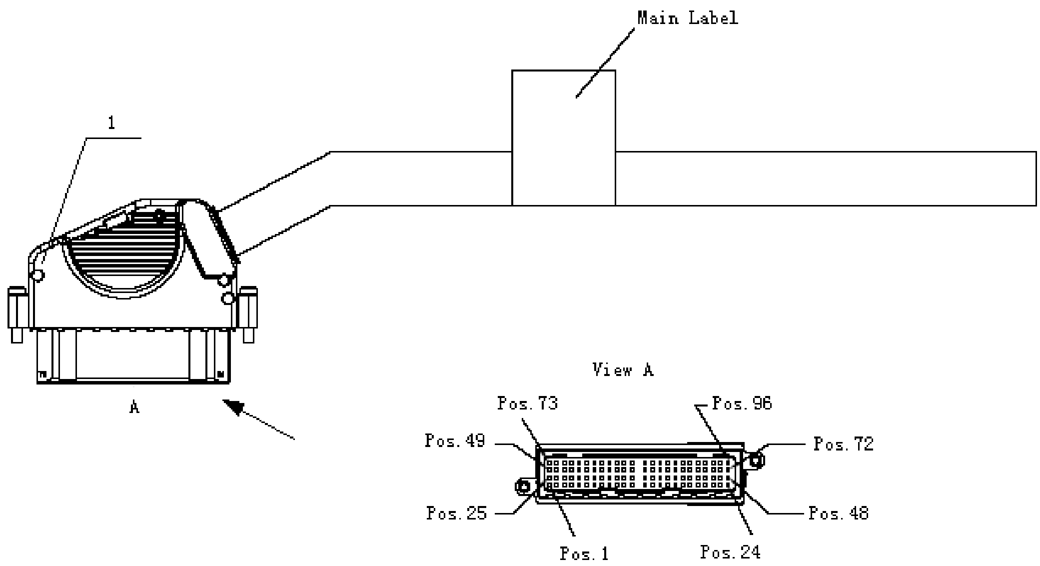
16.2.2 120-ohm 21xE1 Cable

The 120-ohm 21xE1 cable is used to receive and transmit E1 signals.

Structure

Figure 16-5 shows the structure of the 120-ohm 21xE1 cable.

Figure 16-5 Structure of the 120-ohm 21xE1 cable



1. Cable Connector - Anea - 96-pin - Female

Pin Assignments

Table 16-5 provides the pin assignments of the 120-ohm 21xE1 cable.

Table 16-5 Pin assignments of the 120-ohm 21xE1 cable

Connector	Color	Remark	Tape Color	Connector	Color	Remark	Tape Color
X1.1	White	R0	Blue	X1.45	Red	T10	Orange
X1.2	Blue			X1.46	Green		
X1.25	White	T0		X1.23	Red	R11	
X1.26	Orange			X1.24	Brown		
X1.3	White	R1		X1.47	Red	T11	
X1.4	Green			X1.48	Grey		
X1.27	White	T1		X1.49	Black	R12	
X1.28	Brown			X1.50	Blue		
X1.5	White	R2		X1.73	Black	T12	
X1.6	Grey			X1.74	Orange		
X1.29	Red	T2		X1.51	Black	R13	
X1.30	Blue			X1.52	Green		
X1.7	Red	R3		X1.75	Black	T13	
X1.8	Orange			X1.76	Brown		
X1.31	Red	T3		X1.53	White	R14	Green
X1.32	Green			X1.54	Blue		
X1.9	Red	R4		X1.77	White	T14	
X1.10	Brown			X1.78	Orange		
X1.33	Red	T4		X1.55	White	R15	
X1.34	Grey			X1.56	Green		
X1.11	Black	R5		X1.79	White	T15	
X1.12	Blue			X1.80	Brown		
X1.35	Black	T5		X1.57	White	R16	
X1.36	Orange			X1.58	Grey		
X1.13	Black	R6		X1.81	Red	T16	
X1.14	Green			X1.82	Blue		
X1.37	Black	T6		X1.59	Red	R17	
X1.38	Brown			X1.60	Orange		

Connector	Color	Remark	Tape Color	Connector	Color	Remark	Tape Color
X1.15	White	R7	Orange	X1.83	Red	T17	
X1.16	Blue			X1.84	Green		
X1.39	White	T7		X1.61	Red	R18	
X1.40	Orange			X1.62	Brown		
X1.17	White	R8		X1.85	Red	T18	
X1.18	Green			X1.86	Grey		
X1.41	White	T8		X1.63	Black	R19	
X1.42	Brown			X1.64	Blue		
X1.19	White	R9		X1.87	Black	T19	
X1.20	Grey			X1.88	Orange		
X1.43	Red	T9		X1.65	Black	R20	
X1.44	Blue			X1.66	Green		
X1.21	Red	R10		X1.89	Black	T20	
X1.22	Orange			X1.90	Brown		
Shell	External braided shield			Shell	External braided shield		

Technical Specifications

Table 16-6 lists the specifications of the 120-ohm E1 cable.

Table 16-6 Specifications of the 120-ohm E1 cable

Item	Description
Connector	Cable Connector, Anea, 96PIN, Vertical Female, Female Connector with Shielding Misc, IDC Type, For 24-26 AWG Wire, 1A
Cable type	Twisted-pair Cable, 120 ohm, SEYVP, 0.4mm, 26AWG, 42Pairs, PANTONE 430U, For OEM
Number of cores	84 cores
Diameter of the internal conductor	0.4mm
Length	5m, 10m, 15m, 20m, 25m, 30m, 35m, 40m, 45m, 50m

Item	Description
Fireproof class	Complies with IEC60332-3-24

16.3 Power Cables

The power cable should be made on site. The power cable consists of the 1 U or 2 U DC connector, single cord end terminal, and cable.

Figure 16-6 and **Figure 16-7** show the appearance of the power cable. **Table 16-7** lists the technical specifications.

The protection grounding cable consists of the cable and OT terminal. **Table 16-7** lists the technical specifications.

Figure 16-6 Appearance of the OptiX OSN 1800 I chassis power cable

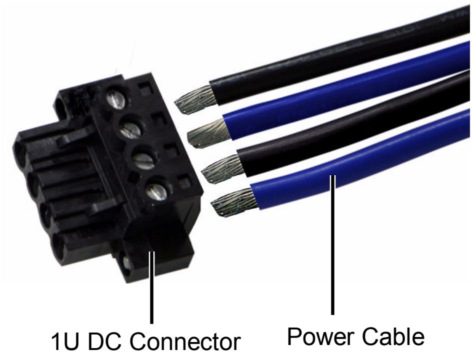


Figure 16-7 Appearance of the OptiX OSN 1800 II chassis power cable

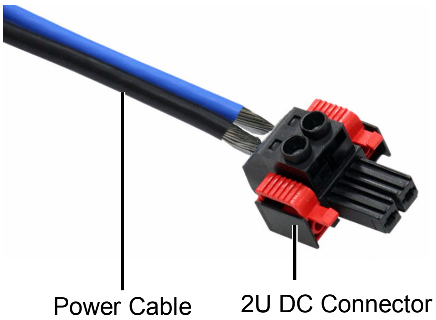


Table 16-7 Technical specifications of the power cable and grounding cable

Cabinet Type	Cable Parameter	Terminal Parameter
OptiX OSN 1800 I chassis	Electronic/electric cable-450 V/ 750 V-H07Z-K-2.5 mm^2 ($0.004in^2$.) blue/black-low-smoke halogen-free fireproof cable Electronic/electric cable-450 V/ 750 V-H07Z-K-4 mm^2 ($0.007in^2$.)/6 mm^2 ($0.01in^2$.) yellow and green-low-smoke halogen-free fireproof cable	● Power terminal: Bare pressure welding terminal-single cord end terminal-2.5 mm^2 ($0.004in^2$.) -12.5 A-tin plating-inserted 8 mm blue ● Grounding cable terminal: Bare pressure welding terminal-OT-4 mm^2 ($0.007in^2$.)/6 mm^2 ($0.01in^2$.) plating-insulated ring terminal-16-14 AWG-blue
OptiX OSN 1800 II chassis	Electronic/electric cable-450 V/ 750 V-H07Z-K-4 mm^2 ($0.007in^2$.) blue/black/yellow and green-low-smoke halogen-free fireproof cable	● Power terminal: Bare pressure welding terminal-single cord end terminal-4 mm^2 ($0.007in^2$.) -30 A-tin plating-inserted 12 mm black ● Grounding cable terminal: Bare pressure welding terminal-OT-4 mm^2 ($0.007in^2$.) plating-insulated ring terminal-12-10 AWG-yellow

NOTE

In the case of the OptiX OSN 1800 series chassis, the restrictions between the cross-sectional area and length of the cable are listed as follows:

- When the cross-sectional area is 2.5 mm^2 ($0.004in^2$.), the maximum extension distance of the cable is 52.3 m(171.6ft.).
- When the cross-sectional area is 6 mm^2 ($0.01in^2$.), the maximum extension distance of the cable is 71.1 m(233.3ft.).

16.4 Management Cables

The management cable consists of the cable for connecting the OADM extended frame to the primary NE, NM connection cable, and alarm output cable. The management cable for the OptiX OSN 1800 series is the straight-through network cable or crossover network cable, which is made on site.

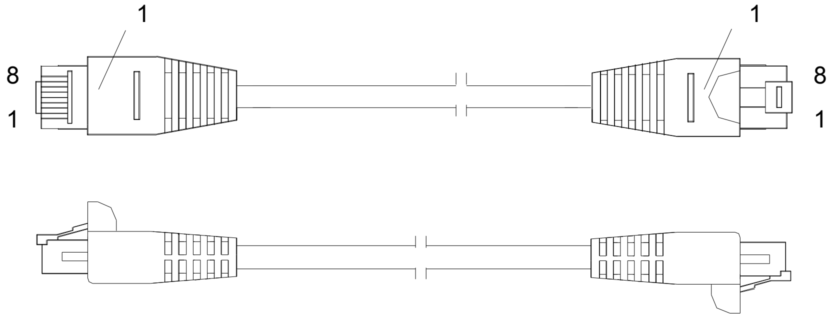
16.4.1 Straight-through Cable

In the case of the OptiX OSN 1800, the OCTL port on the SCC board must be connected to the OCTL port on the CTL board in the OADM frame only by using a straight-through cable. Other management ports of the OptiX OSN 1800 are adaptive to straight-through and crossover cables. Each end of a straight-through cable has an RJ-45 connector for connecting to equipment.

Structure

See **Figure 16-8**.

Figure 16-8 Straight-through cable



1. Network connector

Pin Assignment

The pin assignment of straight-through cable is shown in **Table 16-8**.

Table 16-8 Pin assignment of straight-through cable

Connector X1	Connector X2	Relationship
X1.2	X2.2	Pair
X1.1	X2.1	
X1.6	X2.6	Pair
X1.3	X2.3	
X1.4	X2.4	Pair
X1.5	X2.5	
X1.8	X2.8	Pair
X1.7	X2.7	

Technical Parameter

The technical parameters of straight-through cable are shown in **Table 16-9**.

Table 16-9 Technical parameters of straight-through cable

Item	Description
Connector X1/X2	Network interface connector-8 pins-8 bits-shielded-crystal model connector
Cable type	Symmetrical twisted pair cable-100 ohms-enhanced type 5 cable-0.52 mm (0.02 in.) -24 AWG-8 cores, four pairs-PANTONE 430U
Number of cores	8

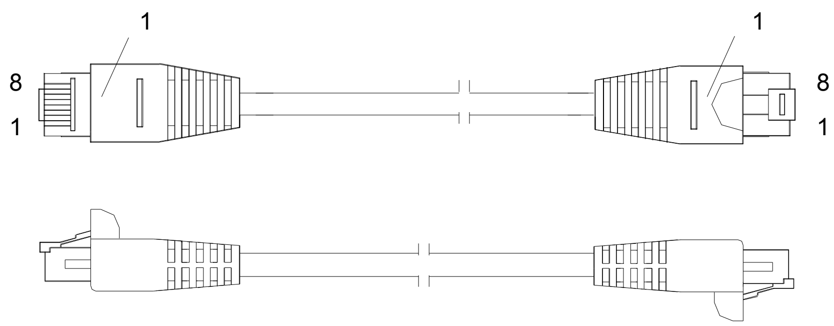
16.4.2 Crossover Cable

The management interfaces of the OptiX OSN 1800 are adaptive. Crossover cables can be used for connecting the OptiX OSN 1800 to the U2000. Each end of a crossover cable has an RJ-45 connector for connecting to equipment.

Structure

The structure of crossover cable is shown in **Figure 16-9**.

Figure 16-9 Structure of crossover cable



1. Network connector

Pin Assignment

The pin assignment of crossover network cable is shown in **Table 16-10**.

Table 16-10 Pin assignment of crossover network cable

Connector X1	Connector X2	Relationship
X1.6	X2.2	Pair
X1.3	X2.1	

Connector X1	Connector X2	Relationship
X1.2	X2.6	Pair
X1.1	X2.3	
X1.4	X2.4	Pair
X1.5	X2.5	
X1.8	X2.8	Pair
X1.7	X2.7	

Technical Parameter

The technical parameters of crossover network cable are shown in **Table 16-11**.

Table 16-11 Technical parameters of crossover network cable

Item	Description
Connector X1/X2	Network interface connector-8 pins-8 bits-shielded-crystal model connector
Cable type	Symmetrical twisted pair cable-100 ohms-enhanced type 5 cable-0.52 mm (0.02 in.) -24 AWG-8 cores, four pairs-PANTONE 430U
Number of cores	8

17 Optical Attenuator

About This Chapter

Optical attenuators are classified into fixed optical attenuators and mechanical variable optical attenuators (VOAs).

A fixed optical attenuator can reduce the optical power on an optical path by a fixed value. The common attenuation specifications of fixed optical attenuators are 2 dB, 5 dB, 7 dB, 10 dB, and 15 dB.

A mechanical variable optical attenuator (MVOA) can adjust the optical power on an optical path within a permitted range. The attenuation adjustment range of an MVOA is 2 dB to 30 dB.

An electrical variable optical attenuator (EVOA) module is used to adjust the optical power of signals.

17.1 Fixed Optical Attenuator

A fixed optical attenuator can reduce the optical power on an optical path by a fixed value. The common attenuation specifications of fixed optical attenuators are 2 dB, 5 dB, 7 dB, 10 dB, and 15 dB.

Figure 17-1 shows the appearance of a fixed optical attenuator.

Figure 17-1 Fixed optical attenuator

17.2 Mechanical Variable Optical Attenuator

A mechanical variable optical attenuator (MVOA) can adjust the optical power on an optical path within a permitted range. The attenuation adjustment range of an MVOA is 2 dB to 30 dB.

Figure 17-2 and **Figure 17-3** show the appearance of common MVOAs.

Figure 17-2 Dual-channel MVOA

Figure 17-3 Single-channel MVOA

17.3 EVOA Module

An electrical variable optical attenuator (EVOA) module is used to adjust the optical power of signals.

Functions

NOTE

As pluggable SFP optical modules, EVOA modules are optional. If you need to use EVOA modules, contact Huawei.

An EVOA module adjusts the optical power of signals by adjusting line attenuation. You can view the attenuation on the NMS.

You can connect the EVOA module to the IN port on the board where the EVOA module resides to adjust the receive optical power of the board. For details, see **Figure 17-4**. You can also connect the EVOA module to the OUT port on the board where the EVOA module resides to adjust the transmit optical power of the board. For details, see **Figure 17-5**.

Figure 17-4 Application of the EVOA module (adjusting the receive optical power of the board)

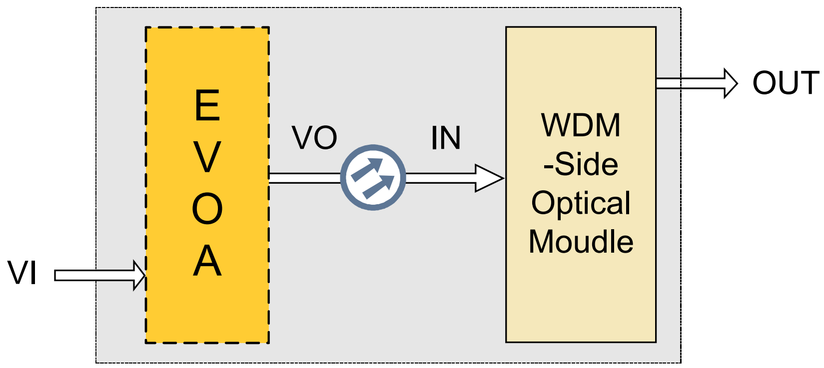
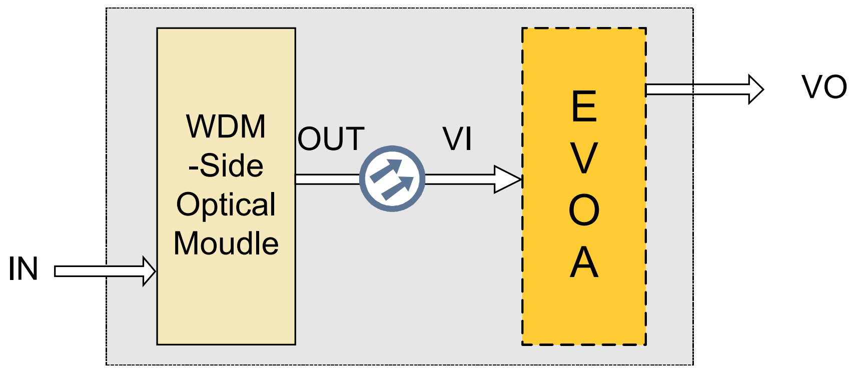


Figure 17-5 Application of the EVOA module (adjusting the transmit optical power of the board)



Boards Supporting EVOA Modules

Table 17-1 describes the boards supporting EVOA modules and the corresponding working modes and ports of the boards.

Table 17-1 Boards supporting EVOA modules, and corresponding working modes and ports

Board Supporting EVOA Modules	Working Mode	Available Port
ELOM(STND)	1*AP8 General Mode	RX1/TX1–RX8/TX8
	1*AP1 ODU2 Mode	RX7/TX7, RX8/TX8
	1*AP1 ODUflex Mode	RX7/TX7, RX8/TX8
ELQM	All modes	VO1/VI1 - VO2/VI2
TNF2LQM	All modes	VO1/VI1 - VO2/VI2
TNF2LQM2	All modes	RX1/TX1 - RX8/TX8
OBU	/	VO/VI
OPU	/	VO/VI

18 Pluggable Optical Modules

About This Chapter

18.1 Types of Pluggable Module

The OptiX OSN 1800 supports the small form-factor pluggable (SFP), 10 Gbit/s small form-factor pluggable (XFP), small form-factor pluggable plus (SFP+), tunable 10 Gbit/s small form-factor pluggable (TXFP) modules.

The client and WDM sides of the optical wavelength conversion boards of the OptiX OSN 1800 can use pluggable modules. When you need to adjust the type of accessed services or replace a faulty module, you only need to replace the module without replacing the board. **Figure 18-1** and **Figure 18-2** show the optical SFP and XFP modules.

Figure 18-1 Optical SFP module

Figure 18-2 XFP module

18.2 Service Types Supported by Modules

The section provides service type that each pluggable modules supports.

Module Name	Supported Service Type	Module Type
800ps/nm-tunable-PIN-TXFP	OTU2, OTU2e	TXFP
800ps/nm-fixed-PIN-XFP	OTU2, OTU2e	XFP
1600ps/nm-fixed-APD-XFP	OTU2, OTU2e	XFP
1400ps/nm-fixed-APD-XFP	OTU2, OTU2e	XFP

Module Name	Supported Service Type	Module Type
2400ps/nm-fixed-APD-eSFP	OTU1	eSFP
1600ps/nm-fixed-APD-eSFP	OTU1	eSFP
800ps/nm-fixed-PIN-eSFP	OTU1	eSFP
1400ps/nm-fixed-APD-eSFP	OTU5G, FEC5G, InfiniBand 5G	eSFP
10Gbit/s Single rate-0.3km	10GE LAN	XFP
10Gbit/s Multi-rate-10km	10GE LAN, 10GE WAN, STM-64, OTU2	XFP
10Gbit/s Multi-rate-40km	10GE LAN, 10GE WAN, STM-64, OTU2, OTU2e	XFP
10Gbit/s Multi-rate-80km	10GE LAN, 10GE WAN, STM-64, OTU2, OTU2e	XFP
1000BASE-SX-0.5km	FC200, FC100, GE, CPRI option2	eSFP
1000BASE-LX-10km	FC100, GE, CPRI option2, STM-4, ESCON, STM-1, FICON, FE, SDI, DVB-ASI	eSFP
1000BASE-LX-40km	FC100, GE, CPRI option2, STM-4, ESCON, STM-1, FICON, FE, SDI, DVB-ASI	eSFP
1000BASE-ZX-80km	FC100, GE, CPRI option2, STM-4, ESCON, STM-1, FICON, FE, SDI, DVB-ASI	eSFP
1000BASE-BX-10km (SM1310)	GE	eSFP
1000BASE-BX-10km (SM1490)	GE	eSFP
1000BASE-BX-40km (SM1310)	GE	eSFP
1000BASE-BX-40km (SM1490)	GE	eSFP
I-16	OTU1, STM-16, FC200, FC100, GE, CPRI option2, CPRI option3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, FE, SDI, HD-SDI, DVB-ASI	eSFP

Module Name	Supported Service Type	Module Type
S-16.1	OTU1, STM-16, FC200, FC100, GE, CPRI option2, CPRI option3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, FE, SDI, HD-SDI, DVB-ASI	eSFP
L-16.2	OTU1, STM-16, FC200, FC100, GE, CPRI option2, CPRI option3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, FE, SDI, HD-SDI, DVB-ASI	eSFP
S-4.1	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	eSFP
L-4.1	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	eSFP
L-4.2	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	eSFP
100BASE-FX	STM-1, FE, ESCON	SFP
S-1.1	STM-1, FE	eSFP
L-1.1	STM-1, FE	eSFP
L-1.2	STM-1, FE	eSFP
10G BASE-SR	FC800, FICON 8G	SFP+
10G BASE-LR	FC800, FICON 8G	SFP+
FC400 Multi-mode	FC400, FC200, FC100, FICON, FICON Express	eSFP
FC400 Single-mode	FC400, FC200, FC100, FICON, FICON Express	eSFP
Multi-rate-10km-SFP+	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G, CPRI option7	SFP+
CPRI option6-2km	CPRI option6	eSFP
CPRI option6-10km	CPRI option6	eSFP
3G-SDI	3G-SDI, SDI, HD-SDI	eSFP
GPON-ONU	GPON	LQPL: eSFP LSPL/LSPR: SFF
GPON-OLT	GPON	LQPU: eSFP LSPU/LSPR: SFF

Module Name	Supported Service Type	Module Type
EPON-OLT	EPON	eSFP
EVOA	-	eSFP
GE electrical module	GE	eSFP
FE electrical module	FE	eSFP

19 Filler Panels

About This Chapter

A filler panel is used to fill in a vacant slot.

19.1 Functions and Features

This chapter describes the functions and features of a filler panel.

A filler panel has the following functions:

- Prevents exposure of people to hazardous voltage and current in the chassis.
- Prevents foreign matter from entering the chassis.
- Maintains electromagnetic interference (EMI) compliance.
- Maintains proper air flow through the chassis.

19.2 Front Panel

There is no indicator or port on the filler panel.

Figure 19-1, **Figure 19-2** and **Figure 19-3** show the appearance of a filler panel.

Figure 19-1 Appearance of a common filler panel

Figure 19-2 Appearance of the PIU filler panel

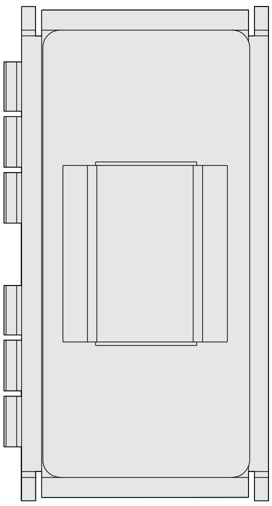
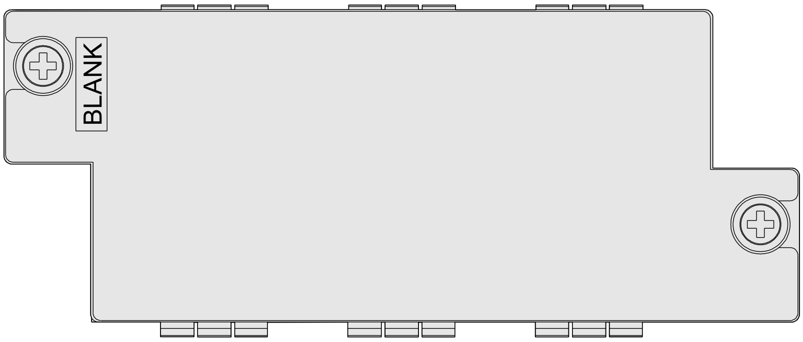


Figure 19-3 Appearance of the APIU filler panel



19.3 Valid Slots

This section describes the valid slots for a filler panel.

Table 19-1 lists the valid slots for a filler panel.

Table 19-1 Valid slots for a filler panel

Types of Filler Panel	Valid Slot in OptiX OSN 1800 I Chassis	Valid Slot in OptiX OSN 1800 II Chassis	Valid Slot in OptiX OSN 1800 OADM Frame
Common filler panel	SLOT1 to SLOT4	SLOT1 to SLOT8	SLOT1 to SLOT4
PIU filler panel	SLOT5	SLOT9, SLOT10	-
APIU filler panel	On the APIU board housed in SLOT1 and SLOT3	On the APIU board housed in SLOT2 and SLOT4, or in SLOT4 and SLOT6	-

19.4 Technical Specifications

This section describes the technical specifications of a filler panel.

Table 19-2 lists the technical specifications of a filler panel.

Table 19-2 Technical specifications of a filler panel

Types of filler panels	Dimension (Height x Width x Depth)
Common filler panel	19.8 mm x 193.8 mm x 15.3 mm
PIU filler panel	42.0 mm x 21.0 mm x 17.8 mm
APIU filler panel	40.1 mm x 101.9 mm x 18.8 mm

20 Indicators

About This Chapter

20.1 Cabinet Indicators

There are altogether four indicators in different colors on each cabinet: green, red, orange and yellow.

The corresponding messages of each indicator are listed in **Table 20-1**.

Table 20-1 Meanings of cabinet indicators

Indicator	Name	Status	Meaning
power	Power indicator	On (green)	The cabinet is powered on.
		Off	The cabinet is not powered on.
critical	Critical alarm indicator	On (red)	There is a critical alarm.
		Off	There is no critical alarm.
major	Major alarm indicator	On (Orange)	There is a major alarm.
		Off	There is no major alarm.
minor	Minor alarm indicator	On (Yellow)	There is a minor alarm.
		Off	There is no minor alarm.

20.2 Board Indicators

On the front panel of each board, there are indicators, indicating the alarm status and running status of the board.

The meanings of the board indicators are listed in **Table 20-2**, **Table 20-3**, and **Table 20-4**.

Table 20-2 Meanings of board indicators

Indicator	Meaning	Indicator Status	Description
STAT	Working status indicator	On (green)	The board works normally.
		On (orange)	Minor alarm occurs to service.
		On (red)	The hardware of the board is faulty.

Indicator	Meaning	Indicator Status	Description
		Flashing (red)	The logical board does not match the physical board.
		Off	The board does not work. The board is not created or powered on.
SRV	Service status indicator	On (green)	The services are normal and there is no alarm.
		On (orange)	Minor alarm occurs to service.
		On (red)	Critical or major alarm occurs to service.
		Flashing (red)	The logical module does not match the physical module.
		Off	No service is configured or the board is not powered on.
IN1/IN2	WDM-side receive optical power status indicator	On (red)	The optical power of local station is excessively low or no receive optical power.
		Flashing (red)	The optical power of local station is excessively high.
		On (green)	Normal
		Off	The module is offline or the board is not powered on.

Table 20-3 Indicators description of the SCC board

Indicator	Indicator Status	Description
STAT	On (green)	The board works properly.
	On (red)	The hardware of the board is faulty.
	Off	The board is not powered on.
PROG	On (red)	The memory self-check fails (when the board is powered on or reset). The loading of the upper-layer software fails (when the board is powered on or reset). The logic file is lost. The upper-layer software is lost.
	Flashing (red, 100 ms on and 100 ms off)	The BOOTROM self-check fails (when the board is powered on or reset).

Indicator	Indicator Status	Description
	Flashing (green, 100 ms on and 100 ms off)	The board is writing the FLASH or the software is being loaded (when the board is powered on or reset).
	Flashing (green, 300 ms on and 300 ms off)	The board is at BIOS booting stage (when the board is powered on or reset).
	On (green)	The software works properly.
SRV	On (green)	The services are normal and there is no service alarm.
	On (red)	A critical or major alarm occurs.
	On (orange)	A minor alarm occurs.
	Off	No service is configured or the board is not powered on.
PWR	On (green)	The system is powered on.
	Off	The system is not powered on.
RM1/RM2	On (red)	The optical power of local station is excessively low or no receive optical power.
	Flashing (red)	The optical power of local station is very high.
	On (green)	Normal
	Off	The module is offline or the board is not powered on.
CRIT	On (red)	A critical alarm occurs.
MAJ	On (orange)	A major alarm occurs.
MIN	On (yellow)	A minor alarm occurs.

Table 20-4 Descriptions of the indicators on OLP board

Indicator	Indicator Status	Description
STAT	On (green)	The board works normally.
	On (orange)	Minor alarm occurs to service.
	On (red)	The hardware of the board is faulty.
	Flashing (red)	The logical board does not match the physical board.
	Off	The board does not work. The board is not created or powered on.
SRV	On (green)	The services are normal and there is no alarm.

Indicator	Indicator Status	Description
	On (red)	Critical or major alarm occurs to service.
	On (orange)	Minor alarm occurs to service.
	Off	No service is configured or the board is not powered on.
RI1	On (red)	There is no optical power received in the working path.
	On (green)	Normal
RI2	On (red)	There is no optical power received in the protection path.
	On (green)	Normal

20.3 Fan Indicator

There is one indicator on the front panel of the FAN board, the descriptions of the indicator are shown in **Table 20-5**.

Table 20-5 Descriptions of the indicator on the FAN board

Indicator Status	Description
On (green)	The board works normally.
On (red)	The FAN_FAIL alarm occurs to the board.
Off	The board is not powered on.

20.4 APIU Indicator

There are two indicators on the front panel. For details on the indicators, refer to **Table 20-6**.

Table 20-6 Descriptions of the indicator on the APIU board

Indicator	Meaning	Indicator Status	Description
INPUT	Indicator of the input power status	On (green)	The input power voltage is normal.
		On (red)	The input power voltage is abnormal, under-voltage or over-voltage occurs.
OUTPUT	Indicator of the output power status	On (green)	The output power voltage is normal.

Indicator	Meaning	Indicator Status	Description
		On (red)	The output power voltage is abnormal, under-voltage or over-voltage occurs.

20.5 PIU Indicator

There are two indicators on the TNC1PIU front panel, the descriptions of the indicator are shown in **Table 20-7**.

Table 20-7 Descriptions of the indicator on the TNC1PIU board

Indicator	Indicator Status	Description
● The first power supply status indicator (PWRA) ● The second power supply status indicator (PWRB)	On (green)	The board is in working status.
	Off	The board is not powered on.

There is one indicator on the TND1PIU front panel, the descriptions of the indicator are shown in **Table 20-8**.

Table 20-8 Descriptions of the indicator on the TND1PIU board

Indicator	Indicator Status	Description
The power supply status indicator (PWR)	On (green)	The board is in working status.
	Off	The board is not powered on.

21 Quick Reference Table of the Boards

About This Chapter

Quick reference tables include those for specifications of optical transponder units, optical amplifier units and other boards, and also the functions of OTUs, tributary boards and line boards.

21.1 Specification of OTUs

The main client-side specifications of the optical transponder unit include the access service type, optical module specifications and optical module type.

Table 21-1 Quick reference table for the optical module at client-side specifications of optical transponder boards

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
ELOM	FC200, FC100, GE, CPRI option 2	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
	FC100, GE, CPRI option 2, STM-4, ESCON, STM-1, FICON, FE, SDI, DVB-ASI	1000BASE-LX-10km	-3	-9	-20	-3	
		1000BASE-LX-40km	0	-5	-22	-3	
		1000BASE-ZX-80km	5	-2	-23	-3	
	GE	1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
	OTU1, STM-16, FC200, FC100, GE, CPRI option 2, CPRI option 3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, FE, SDI, HD-SDI, DVB-ASI	I-16	-3	-10	-18	-3	
		S-16.1	0	-5	-18	0	
		L-16.2	3	-2	-28	-9	

Board Name	Access Service Type	Optical Module						Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)		
			Maximum (dBm)	Minimum (dBm)				
	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	S-4.1	-8	-15	-28	-8		
		L-4.1	2	-3	-28	-8		
		L-4.2	2	-3	-28	-8		
	STM-1, FE	S-1.1	-8	-15	-28	-8		
		L-1.1	0	-5	-34	-10		
		L-1.2	0	-5	-34	-10		
	STM-1, FE, ESCON	100BASE-FX	-14	-19	-30	-14		
	FC400 Multi-mode	-	-1.1	-9	-15	0		
	FC400 Single-mode	-	-1	-8.4	-18	0		
	FC800, FICON 8G	10G BASE-LR	0.5	-8.2	-14.4	0.5		SFP+
		10G BASE-SR	-1	-7.3	-11.1	-1		

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G, CPRI option 7	Multi-rate-10km-SFP+	-1	-6	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	0.5	
	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G, CPRI option 7	Multi-rate-40km-SFP+	2	-1	-16 (9.95Gbit/s) -15.8 (10.3Gbit/s)	-1	SFP+
	CPRI option 6	CPRI option6-2km	0.5	-8.2	-11	0.5	SFP
		CPRI option6-10km	0.5	-8.4	-13.8	0.5	
	3G-SDI	3G-SDI, SDI, HD-SDI	0	-7	0	-17	
ELQM	GE	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
	GE, STM-4, STM-1, FE	1000BASE-LX-10km	-3	-9	-20	-3	
		1000BASE-LX-40km	0	-5	-22	-3	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
		1000BASE-ZX-80km	5	-2	-23	-3	
	GE	1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
	OTU1, STM-16, GE, STM-4, STM-1, FE	I-16	-3	-10	-18	-3	
		S-16.1	0	-5	-18	0	
		L-16.2	3	-2	-28	-9	
	STM-4, STM-1, FE	S-4.1	-8	-15	-28	-8	
		L-4.1	2	-3	-28	-8	
		L-4.2	2	-3	-28	-8	
	STM-1, FE	S-1.1	-8	-15	-28	-8	
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
		100BASE-FX	-14	-19	-30	-14	
LDGF/LDGF2/LQG	GE	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
		1000BASE-LX-10km	-3	-9	-20	-3	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
		1000BASE-LX-40km	0	-5	-22	-3	
		1000BASE-ZX-80km	5	-2	-23	-3	
		1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
LDE/ LOE	GE	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
		1000BASE-LX-10km	-3	-9	-20	-3	
		1000BASE-LX-40km	0	-5	-22	-3	
		1000BASE-ZX-80km	5	-2	-23	-3	
	GE, EPON	1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	
	GE	1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
	EPON-OLT	-	7	2	-27	-6	
LEM18	GE	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
		1000BASE-LX-10km	-3	-9	-20	-3	
		1000BASE-LX-40km	0	-5	-22	-3	
		1000BASE-ZX-80km	5	-2	-23	-3	
		1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
	FE	S-1.1	-8	-15	-28	-8	
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
		100BASE-FX	-14	-19	-30	-14	
	10GE LAN	10Gbit/s Multi-rate-10km	0.5	-8.2	-14.4	0.5	SFP+
		10Gbit/s Single rate-0.3km	-1	-7.3	-11.1	-1	

Board Name	Access Service Type	Optical Module						Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)		
			Maximum (dBm)	Minimum (dBm)				
LQM/ LQM2	FC200, FC100, GE, CPRI option 2	1000BASE-SX-0.5km	-2.5	-9.5	-17	0		SFP
	FC100, GE, CPRI option 2, STM-4, ESCON, STM-1, FICON, SDI, DVB-ASI, FE	1000BASE-LX-10km	-3	-9	-20	-3		
		1000BASE-LX-40km	0	-5	-22	-3		
		1000BASE-ZX-80km	5	-2	-23	-3		
	GE	1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3		
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3		
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3		
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3		
	OTU1, STM-16,	I-16	-3	-10	-18	-3		
		S-16.1	0	-5	-18	0		

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	FC200, FC100, GE, CPRI option 2, CPRI option 3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, SDI, HD-SDI, DVB-ASI, FE	L-16.2	3	-2	-28	-9	
	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	S-4.1	-8	-15	-28	-8	
		L-4.1	2	-3	-28	-8	
		L-4.2	2	-3	-28	-8	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	STM-1, FE	S-1.1	-8	-15	-28	-8	
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
	STM-1, FE, ESCON	100BASE-FX	-14	-19	-30	-14	
LQPL	OTU1, STM-16	I-16	-3	-10	-18	-3	SFP
		S-16.1	0	-5	-18	0	
		L-16.2	3	-2	-28	-9	
	GPON-ONU	-	5	0.5	-27	-8	
LQPU	OTU1, STM-16	I-16	-3	-10	-18	-3	SFP
		S-16.1	0	-5	-18	0	
		L-16.2	3	-2	-28	-9	
	GPON-OLT	-	5	1.5	-28	-8	
LSPL	GPON-ONU	-	5	0.5	-27	-8	SFP
LSPU	GPON-OLT	-	5	1.5	-28	-8	SFP

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
LDX	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G	Multi-Rate SFP+ 10km	-1	-6	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	0.5	SFP+
	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G, CPRI option 7	Multi-rate-40km-SFP+	2	-1	-16 (9.95Gbit/s) -15.8 (10.3Gbit/s)	-1	
	FC800, FICON 8G	10G BASE-SR	-1	-7.3	-11.1	-1	
		10G BASE-LR	0.5	-8.2	-14.4	0.5	
TNF1LSX	10GE LAN, 10GE WAN, STM-64, OTU2	10Gbit/s Multi-rate-10km	0.5	-8.2	-11 (multirate) -14.4 (10GE LAN)	-1 (multirate) 0.5 (10GE LAN)	XFP

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	10GE LAN, STM-64, OTU2, OTU2e	10Gbit/s Multi-rate-40km	2	-1	-14 (multirate) -15.8 (10GE LAN)	-1 (multirate) -1 (10GE LAN)	
		10Gbit/s Multi-rate-80km	4	0	-24 (multirate) -24 (10GE LAN)	-7 (multirate) -7 (10GE LAN)	
	10GE LAN	10Gbit/s Single rate-0.3km	-1	-7.3	-7.5 (multirate) -7.5 (10GE LAN)	-1 (multirate) -1 (10GE LAN)	
	OTU2 / OTU2e	NRZ-40 channels tunable	2	-1	-16	0	TXFP
TNF2LSX	10GE LAN, STM-64, FC1200, FICON 10G	Multi-mode-10km-SFP+	-1	-6	-11 (9.95Gbit/s, 10.7Gbit/s) -14.4 (10.3Gbit/s, 10.5Gbit/s) -13.4 (11.1Gbit/s)	0.5	SFP+

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	10GE LAN, 10GE WAN, STM-64, FC1200, FICON 10G, CPRI option 7	Multi-rate-40km-SFP+	2	-1	-16 (9.95Gbit/s) -15.8 (10.3Gbit/s)	-1	SFP+
LWX2	FC200, FC100, GE, CPRI option 2	1000BASE-SX-0.5km	-2.5	-9.5	-17	0	SFP
	FC100, GE, CPRI option 2, STM-4, ESCON, STM-1, FICON, SDI, DVB-ASI, FE	1000BASE-LX-10km	-3	-9	-20	-3	
		1000BASE-LX-40km	0	-5	-22	-3	
		1000BASE-ZX-80km	5	-2	-23	-3	
	GE	1000BASE-BX-10km (SM1310)	-3	-9	-19.5	-3	

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
		1000BASE-BX-10km (SM1490)	-3	-9	-19.5	-3	
		1000BASE-BX-40km (SM1310)	3	-2	-23	-3	
		1000BASE-BX-40km (SM1490)	3	-2	-23	-3	
	OTU1, STM-16, FC200, FC100, GE, CPRI option 2, CPRI option 3, InfiniBand 2.5G, STM-4, ESCON, STM-1, FICON, FICON EXPRESS, SDI, HD-SDI, DVB-	I-16	-3	-10	-18	-3	
		S-16.1	0	-5	-18	0	

Board Name	Access Service Type	Optical Module						Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)		
			Maximum (dBm)	Minimum (dBm)				
	ASI, FE	L-16.2	3	-2	-28	-9		
	STM-4, STM-1, DVB-ASI, FE, ESCON, SDI	S-4.1	-8	-15	-28	-8		
		L-4.1	2	-3	-28	-8		
		L-4.2	2	-3	-28	-8		

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
	STM-1, FE	S-1.1	-8	-15	-28	-8	
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
	STM-1, FE, ESCON	100BASE-FX	-14	-19	-30	-14	
TSP	STM-1	S-1.1	-8	-15	-28	-8	SFP
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
		100BASE-FX	-14	-19	-30	-14	

Table 21-2 Quick reference table for the electrical module at client-side specifications of optical transponder boards

Board Name	Access Service Type	Electrical Module		
		Electrical port rate	Transmission distance (m)	Transmission bandwidth
LEM18/ELOM/ELQM/LDGF/LQM/LQM2/LWX2	FE	125 Mbit/s	100	98%
	GE	1.25 Gbit/s	100	98%
LDE/LOE/LDGF2/LQG	GE	1.25 Gbit/s	100	98%

Table 21-3 Quick reference table for the electrical module at tributary-side specifications of TSP boards

Board Name	Access Service Type	Electrical Module		
		Bit Rate (kbit/s)	Code Format	Port Impedance (Ω)
TSP	T1	1544	B8ZS	100
	E1	2048	HDB3	75/120

Table 21-4 Quick reference table for DWDM-side specifications of optical transponder boards

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
ELQM/LDE/LDGF/LDGF2/LQM/LQM2/LSPL/LSPU/LWX2	OTU1	2400ps/nm-2mW-APD	3	-1	-28	-8	SFP
LOE/LQPL/LQPU/LDX/LSX/ELOM/LEM18	OTU2	800ps/nm	2	-1	-16	0	XFP
		1600ps/nm	3	-1	-24	-9	
		800ps/nm	2	-1	-16	0	TXFP

Table 21-5 Quick reference table for CWDM-side specifications of optical transponder boards

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
ELQM/LDE/LDGF/LDGF2/LQM/LQM2/LSPL/LSPU/LWX2	OTU1	1600ps/nm	5	0	-28	-9	SFP
		800ps/nm	5	0	-19	-3	
LQG	OTU5G/FEC5G	1400ps/nm	8	3	-25.5	-9	SFP
LOE/LQPL/LQPU/TNF1LSX	OTU2	1600ps/nm-4mW	3	-3	-26	-9	XFP
ELOM/LEM18/LDX/TNF2LSX	OTU2	1400ps/nm	4 (1471 nm to 1571 nm) 3 (1591 nm to 1611 nm)	0	-23 (1471 nm to 1551 nm) -22 (1571 nm) -21 (1591 nm to 1611 nm)	-9	XFP

Table 21-6 Quick reference table for WDM-side specifications of TSP board

Board Name	Access Service Type	Optical Module					Optical Module Type
		Optical Port Type Supported	Mean Launched Optical Power		Receiver Sensitivity (dBm)	Minimum Overload Point (dBm)	
			Maximum (dBm)	Minimum (dBm)			
TSP	STM-4	S-4.1	-8	-15	-28	-8	SFP
		L-4.1	2	-3	-28	-8	
		L-4.2	2	-3	-28	-8	
	STM-1	S-1.1	-8	-15	-28	-8	
		L-1.1	0	-5	-34	-10	
		L-1.2	0	-5	-34	-10	
		100BASE-FX	-14	-19	-30	-14	

21.2 Specification of Optical Amplifier Boards

The main specifications of the optical amplifying boards include the operating wavelength range, channel gain, nominal input power range, nominal output power range and maximum output power of a single wavelength.

Table 21-7 Quick reference table for optical amplifying unit

Board Name	Channel Gain (dB)	Input Power Range		Output Power Range		Output Power Range per Channel (dBm)			Nominal single-wavelength input optical power (dBm)		
		Maximum (dBm)	Minimum (dBm)	Maximum (dBm)	Minimum (dBm)	16 Channels	32 Channels	40 Channels	16 Channels	32 Channels	40 Channels
OPU	20	-3	-32	17	-12	5	2	1	-15	-18	-19
OBU	23	-3	-32	20.5	-9	4			-19		

21.3 Specifications of Other Boards

The main specifications of other boards include the insertion loss values of each board.

Table 21-8 Quick reference table for specifications of other boards

Board Name	Insertion Loss (dB)	
DMD1	eIN-eD1 wIN-wD1	DWDM: <1.2 CWDM: <1.2
	eA1-eOUT wA1-wOUT	DWDM: <1.2 CWDM: <1.2
	wIN-eOUT eIN-wOUT	DWDM: <1.4 CWDM: <1.4
DMD1S	eIN-eD1 wIN-wD1	CWDM: <1.2
	eIN-eSO wIN-wSO	CWDM: <1.4
	eA1-eOUT wA1-wOUT	CWDM: <1.2
	eSI-eOUT wSI-wOUT	CWDM: <1.4
	wIN-eOUT eIN-wOUT	CWDM: <2.1
DMD2	eIN-eD1 eIN-eD2 wIN-wD1 wIN-wD2	DWDM: <1.5 CWDM: <1.5
	eA1-eOUT eA2-eOUT wA1-wOUT wA2-wOUT	DWDM: <1.5 CWDM: <1.5
	wIN-eOUT eIN-wOUT	DWDM: <2.2 CWDM: <2.2
DMD2S	eIN-eD1 eIN-eD2 wIN-wD1 wIN-wD2	CWDM: <1.5

Board Name	Insertion Loss (dB)	
	eIN-eSO wIN-wSO	CWDM: <2.0
	eA1-eOUT eA2-eOUT wA1-wOUT wA2-wOUT	CWDM: <1.5
	eSI-eOUT wSI-wOUT	CWDM: <2.0
	eIN-wOUT wIN-eOUT	CWDM: <3.0
FIU	IN-SO SI-OUT	DWDM: <1.0 CWDM: <1.0
	IN-TX RX-OUT	DWDM: <0.8 CWDM: <0.8
MD8	IN-Dx	CWDM: ≤2.0
	Ax-OUT	CWDM: ≤2.0
MD8S	IN-Dx	CWDM: ≤2.5
	IN-SO	CWDM: ≤1.0
	Ax-OUT	CWDM: ≤2.5
	SI-OUT	CWDM: ≤1.0
MR1	IN-D1	DWDM: <1.2 CWDM: <1.2
	A1-OUT	DWDM: <1.2 CWDM: <1.2
	IN-MO	DWDM: <0.7 CWDM: <1.2
	MI-OUT	DWDM: <0.7 CWDM: <1.2
MR1S	IN-D1	DWDM: <1.6 CWDM: <1.2
	IN-SO	DWDM: <1.0 CWDM: <1.2

Board Name	Insertion Loss (dB)	
	A1-OUT	DWDM: <1.6 CWDM: <1.2
	SI-OUT	DWDM: <1.0 CWDM: <1.2
	IN-MO	DWDM: <1.2 CWDM: <1.2
	MI-OUT	DWDM: <1.2 CWDM: <1.2
MR2	IN-D1 IN-D2	DWDM: <1.5 CWDM: <1.5
	A1-OUT A2-OUT	DWDM: <1.5 CWDM: <1.5
	IN-MO	DWDM: <1.0 CWDM: <1.0
	MI-OUT	DWDM: <1.0 CWDM: <1.0
MR2S	IN-D1 IN-D2	DWDM: <2.0 CWDM: <1.5
	IN-SO	DWDM: <1.0 CWDM: <1.5
	A1-OUT A2-OUT	DWDM: <2.0 CWDM: <1.5
	SI-OUT	DWDM: <1.0 CWDM: <1.5
	IN-MO	DWDM: <1.5 CWDM: <1.5
	MI-OUT	DWDM: <1.5 CWDM: <1.5
MR4	IN-Dx	DWDM: <2.0 CWDM: <1.5
	Ax-OUT	DWDM: <2.0 CWDM: <1.5
	IN-MO	DWDM: <1.5 CWDM: <1.5

Board Name	Insertion Loss (dB)	
	MI-OUT	DWDM: <1.5 CWDM: <1.5
MR4S	IN-Dx	CWDM: <1.5
	IN-SO	CWDM: <2.0
	Ax-OUT	CWDM: <1.5
	SI-OUT	CWDM: <2.0
	IN-MO	CWDM: <2.0
	MI-OUT	CWDM: <2.0
MR8	IN-Dx	DWDM: ≤4.0
	Ax-OUT	DWDM: ≤4.0
	IN-MO	CWDM: <3.0
	MI-OUT	CWDM: <3.0
OLP	TI-TO1 TI-TO2	<4.0
	RI1-RO RI2-RO	<1.5
SBM1	LINE-D1	DWDM: <1.5 CWDM: <1.5
	A1-LINE	DWDM: <1.5 CWDM: <1.5
	LINE-EXT	DWDM: <1.4 CWDM: <1.4
SBM2	LINE-D1 LINE-D2	DWDM: <2.0 CWDM: <2.0
	A1-LINE A2-LINE	DWDM: <2.0 CWDM: <2.0
	LINE-EXT	DWDM: <1.8 CWDM: <1.8
SBM4	LINE-Dx	CWDM: <2.8
	Ax-LINE	CWDM: <2.8
	LINE-EXT	CWDM: <2.8
SBM8	LINE-Dx	DWDM: <3.0

Board Name	Insertion Loss (dB)	
	Ax-LINE	DWDM: <3.0
SCS	Single-mode	<4.0
	Multi-mode	<4.5
X40	LINE-MDx	<6.5

21.4 Basic Functions of OTUs

The main functions and features supported by optical transponder boards are automatic laser shutdown, OTN ports, ESC and so on.

Table 21-9 Basic functions of optical transponder boards

Board Name	ESC Function	ALS Function	OTN Function	FEC Encoding	WDM Specification	Optical Module
ELOM	√	√	√	FEC/ AFEC-2	DWDM/ CWDM	Client side: SFP, SFP+ WDM side: XFP, TXFP
ELQM	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LDE	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LDGF	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LDGF2	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LDX	√	√	√	FEC/ AFEC-2	DWDM/ CWDM	Client side: SFP+ WDM side: XFP, TXFP

Board Name	ESC Function	ALS Function	OTN Function	FEC Encoding	WDM Specification	Optical Module
LEM18	√	x	√	FEC	DWDM/ CWDM	Client side: SFP, SFP+ WDM side: XFP, TXFP, SFP+
LOE	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: XFP, TXFP
LQG	√	√	√	FEC	CWDM	Client side: SFP WDM side: SFP
LQM	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LQM2	√	√	√	FEC	DWDM/ CWDM	Client side: SFP WDM side: SFP
LQPL	√	√	√	FEC/ AFEC-2	DWDM/ CWDM	Client side: SFP WDM side: XFP, TXFP
LQPU	√	√	√	FEC/ AFEC-2	DWDM/ CWDM	Client side: SFP WDM side: XFP, TXFP
LSPL	√	√	√	FEC	DWDM/ CWDM	WDM side: SFP
LSPR	x	x	x	-	-	-
LSPU	√	√	√	FEC	DWDM/ CWDM	WDM side: SFP

Board Name	ESC Function	ALS Function	OTN Function	FEC Encoding	WDM Specification	Optical Module
LSX	√	√	√	FEC/ AFEC-2	DWDM/ CWDM	TNF1LSX: ● Client side: XFP, TXFP ● WDM side: XFP, TXFP TNF2LSX: ● Client side: SFP+ ● WDM side: XFP, TXFP
LWX2	x	√	x	-	DWDM/ CWDM	Client side: SFP WDM side: SFP
TSP	√	x	x	-	DWDM/ CWDM	Client side: SFP WDM side: SFP

21.5 Loopback Function of OTUs

The optical transponder boards support different loopbacks.

Table 21-10 Loopback function of optical transponder boards

Board	WDM Side Inloop	WDM Side Outloop	Client-Side Inloop	Client-Side Outloop
ELOM	√	√	√	√
ELQM	√	√	√	√
LDE[a]	√	√	√	√
LDGF	√	√	√	√
LDGF2	√	√	√	√
LDX	√	√	√	√
LEM18[d]	√	√	√	√
LOE[a]	√	√	√	√
LQG	√	√	√	√

Board	WDM Side Inloop	WDM Side Outloop	Client-Side Inloop	Client-Side Outloop
LQM	√	√	√	√
LQM2	√	√	√	√
LQPL[b]	√	√	√	√
LQPU[b]	√	√	√	√
LSPL	x	x	x	x
LSPR	x	x	x	x
LSPU	x	x	x	x
LSX	√	√	√	√
LWX2	x	√	√	√
TSP[c]	Support loopback of VC-4 path	Support loopback of VC-4 path	Support loopback of VC-4 path	Support loopback of VC-4 path
a: When the LDE or LOE board accesses only GE services, the board supports different loopbacks. When the LOE board accesses both GE and EPON services at the same time, the ports for receiving GE services support client side inloop and client side outloop. b: When the LQPL or LQPU board accesses GPON services, the board does not support the WDM-side inloop and outloop. In addition, the optical ports that access GPON services do not support the client-side inloop and outloop. c: TSP board supports inloop and outloop on each tributary path (1-21 paths).				

21.6 Protection Mode of OTUs

The optical transponder boards support protection function.

Table 21-11 Protection mode of optical transponder boards

Board Name	Intra-Board 1+1 Protection	Client 1+1 Protection	ODUk SNCP Protection	SW SNCP Protection	Sub-network Connection Protection	ERPS Protection	VLAN SNCP Protection
ELOM	√	√	√	x	x	x	x
ELQM	√	√	√	x	x	x	x
LDE	√	√	x	x	x	x	x
LDGF	√	√	x	x	x	x	x

Board Name	Intra-Board 1 +1 Protection	Client 1+1 Protection	ODUk SNCP Protection	SW SNCP Protection	Sub-network Connection Protection	ERPS Protection	VLAN SNCP Protection
TNF1LDGF2	√	√	x	x	x	x	x
TNF2LDGF2	√	√	√	x	x	x	x
LDX	√	√	√	x	x	x	x
LEM18	x	x	x	x	x	√	√
LOE	√	√	x	x	x	x	x
LQG	√	√	x	√	x	x	x
TNF1LQM	√	√	x	x	x	x	x
TNF21LQM	√	√	√	x	x	x	x
TNF1LQM2	√	√	x	√	x	x	x
TNF2LQM2	√	√	√	x	x	x	x
LQPL	√	√	x	x	x	x	x
LQPU	√	√	x	x	x	x	x
LSPL	√	√	x	x	x	x	x
LSPR	x	x	x	x	x	x	x
LSPU	√	√	x	x	x	x	x
TNF1LSX	√	√	x	x	x	x	x
TNF2LSX	√	√	√	x	x	x	x
LWX2	√	√	x	x	x	x	x
TSP	x	x	x	x	√	x	x

22 Loopbacks for OTUs

About This Chapter

Loopbacks provide an effective means of troubleshooting a network, by verifying a service on a segment-by-segment basis.

22.1 Software Loopback

Loopbacks provide an effective means of troubleshooting a network, by verifying a service on a segment-by-segment basis.

CAUTION

A loopback will interrupt services. Therefore, it is generally used during deployment or fault location for service interruption.

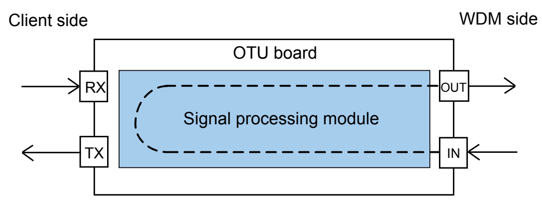
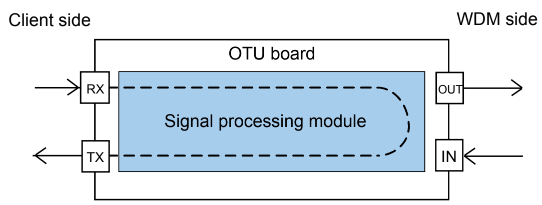
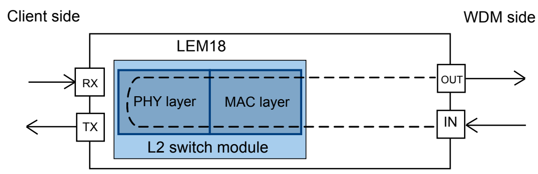
The ALS function has no impact on the loopback function.

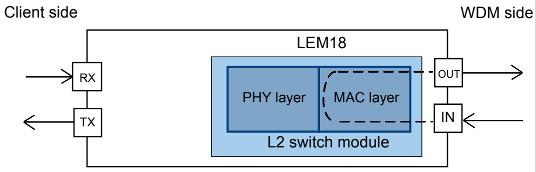
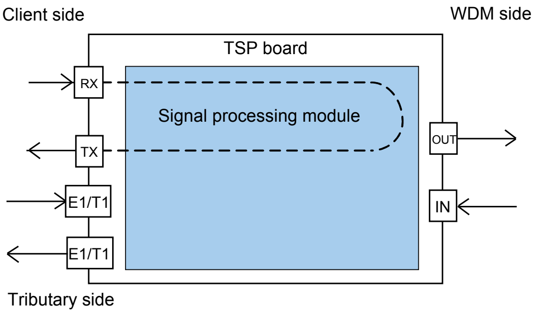
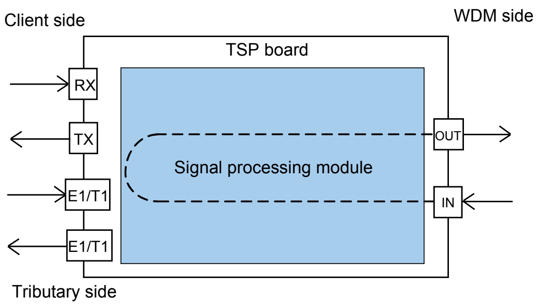
A software loopback can be configured using the NMS.

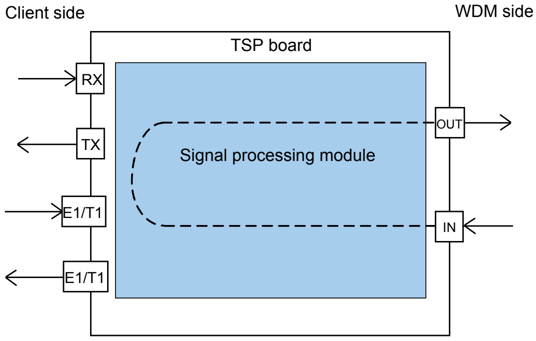
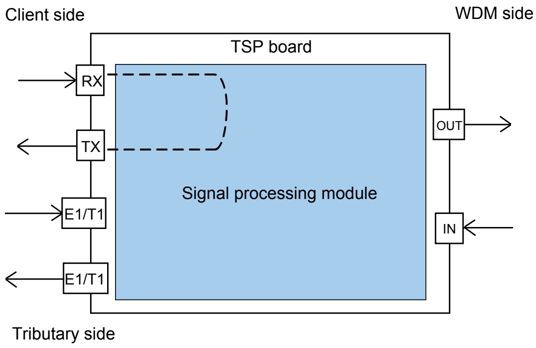
- Inloop

  Inloop is used to loop back a signal processed by a board from the receiving port of the board to the transmitting port of the board.

Table 22-1 Inloop

Loopback Type	Diagram	Description
Client side inloop		Used to determine whether a board can correctly process received signals.
WDM side inloop		Used to determine whether a board can correctly process received signals.
PHY inloop	● LEM18 board: 	Used to determine whether equipment runs normally by creating a looped path at the PHY layer and then sending and receiving signals over the path.

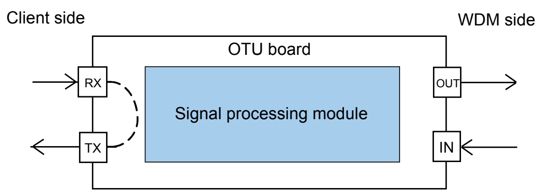
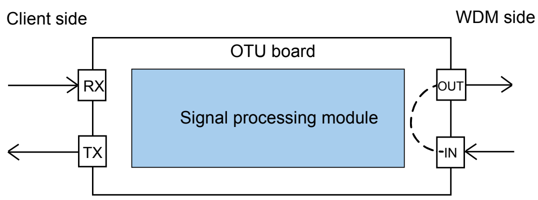
Loopback Type	Diagram	Description
MAC inloop	● LEM18 board:  	Used to determine whether equipment runs normally by creating a looped path at the MAC layer and then sending and receiving signals over the path.
WDM-side VC-4 path inloop	● TSP board:  	Used to determine whether a board can correctly process received signals.
Client-side VC-4 path inloop	● TSP board:  	Used to determine whether a board can correctly process received STM-1 signals.

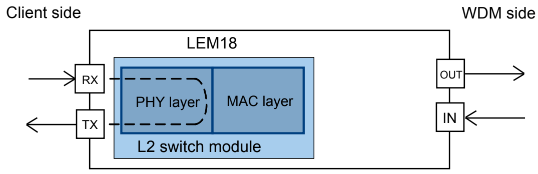
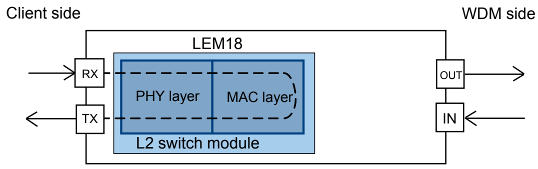
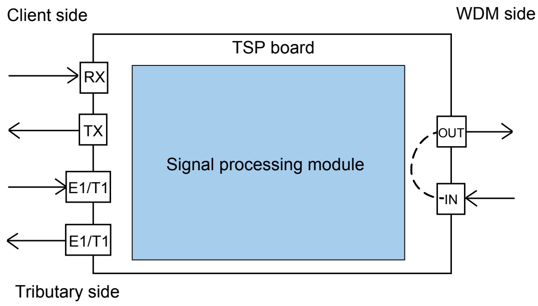
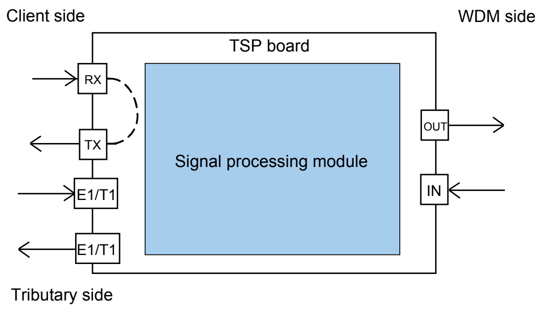
Loopback Type	Diagram	Description
tributary path (1-21 paths) inloop	● TSP board:  	Used to determine whether a board can correctly process received E1/T1 signals.

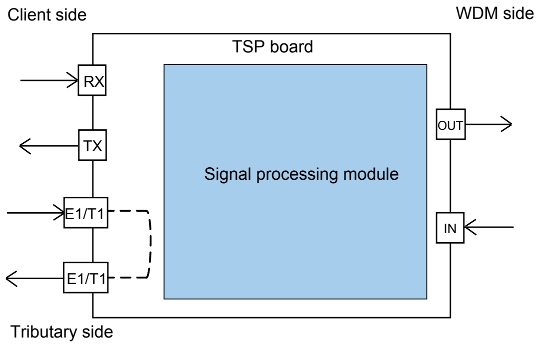
- Outloop

  Used to loop back signals from the receiving port to the transmitting port of the board before the board process the signals.

Table 22-2 Outloop

Loopback Type	Diagram	Description
Client-side outloop		Used to determine whether the fiber line and connectors are normal.
WDM-side outloop		Used to determine whether the fiber line and connectors are normal.

Loopback Type	Diagram	Description
PHY outloop	● LEM18 board: 	Used to determine whether equipment runs normally by creating a looped path at the PHY layer and then sending and receiving signals over the path.
MAC outloop	● LEM18 board: 	Used to determine whether equipment runs normally by creating a looped path at the MAC layer and then sending and receiving signals over the path.
WDM-side VC-4 path outloop	● TSP board: 	Used to determine whether the fiber line and connectors are normal.
Client-side VC-4 path outloop	● TSP board: 	Used to determine whether the fiber line and connectors are normal.

Loopback Type	Diagram	Description
tributary path (1-21 paths) outloop	● TSP board: 	Used to determine whether the cable line and connectors are normal.

22.2 Hardware Loopback

Loopbacks provide an effective means of troubleshooting a network, by verifying a service on a segment-by-segment basis.

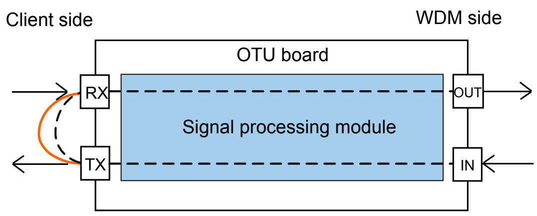
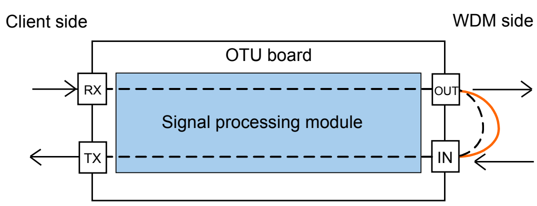
CAUTION

A loopback will interrupt services. Therefore, it is generally used during deployment or fault location for service interruption.

The ALS function has no impact on the loopback function.

A hardware loopback is performed on a physical port (optical port) using a fiber. It must be performed at the site.

Table 22-3 Hardware Loopback

Loopback Type	Diagram	Description
Client-side loopback		Used to determine whether the board where the loopback is performed is faulty.
WDM-side loopback		

A Glossary

Numerics

1+1 protection	An architecture that has one normal traffic signal, one working SNC/trail, one protection SNC/trail, and a permanent bridge. At the source end, the normal traffic signal is permanently bridged to both the working and protection SNC/trail. At the sink end, the normal traffic signal is selected from the better of the two SNCs/trails. Due to the permanent bridging, the 1+1 architecture does not allow an extra unprotected traffic signal to be provided.
3G-SDI	3G-serial digital interface

A

AC	See alternating current
access control list	A list of entities, together with their access rights, which are authorized to access a resource.
ACK	See acknowledgement
acknowledgement	A response sent by a receiver to indicate reception of information. Acknowledgements may be implemented at any level, including the physical level (using voltage on one or more wires to coordinate a transfer), link level (indicating transmission across a single hardware link), or higher levels.
ACL	See access control list
add/drop multiplexer	A device that provides access to all or some subset of the constituent signals contained within an STM-N signal. The constituent signals are added to (inserted) and/or dropped from (extracted) the STM-N signal as it passes through the ADM.
Add/drop wavelength	Wavelength that is added/dropped locally through OADM equipment.
Address Resolution Protocol (ARP)	An Internet Protocol used to map IP addresses to MAC addresses. ARP enables hosts and routers to determine link layer addresses through ARP requests and responses. The address resolution is a process by which the host converts the target IP address into a target MAC address before transmitting a frame. The basic function of ARP is to use the target equipment's IP address to query its MAC address.
ADM	See add/drop multiplexer

administrative unit	The information structure that enables adaptation between the higher order path layer and the multiplex section layer. The administrative unit consists of an information payload (the higher order VC) and an AU pointer, which indicates the offset of the payload frame start relative to the multiplex section frame start.
Administrator	A user who has authority to access all EMLCore product management domains. This user has access to the entire network and all management functions.
ADSL	See asymmetric digital subscriber line
AGC	See automatic gain control
AID	access identifier
AIS	See alarm indication signal
alarm	A message reported when a fault is detected by a device or by the network management system during the device polling process. Each alarm corresponds to a clear alarm. After a clear alarm is received, the corresponding alarm is cleared.
alarm cable	A cable to transmit visual or audio alarms.
alarm cascading	The method of cascading alarm signals from several subracks or cabinets.
alarm cause	The root cause of an alarm. A single fault or defect may lead to the generation of multiple alarms. Through a process of alarm correlation analysis, the root alarm cause can be identified.
alarm indication	A mechanism to indicate the alarm status of equipment. On the cabinet of an NE, four differently-colored indicators specify the current status of the NE. When the green indicator is on, the NE is powered on. When the red indicator is on, a critical alarm has been generated. When the orange indicator is on, a major alarm has been generated. When the yellow indicator is on, a minor alarm has been generated. The ALM alarm indicator on the front panel of a board indicates the current status of the board.
alarm indication signal	A code sent downstream in a digital network as an indication that an upstream failure has been detected and an alarm has been created. An alarm indication signal is associated with multiple transport layers.
alarm masking	A method to mask alarms for the alarm management purpose. Alarms that are masked are not displayed on the NMS or the NMS does not monitor unimportant alarms.
alarm severity	The significance of a change in system performance or events. According to ITU-T recommendations, an alarm can have one of the following severities: Critical, Major, Minor, Warning.
alarm suppression	A method to suppress alarms for the alarm management purpose. Alarms that are suppressed are no longer reported from NEs.
alarm type	The classification of alarms with different attributes. Six alarm types are available and are related to the following factors: 1. Communication: information transfer 2. Processing: software or information processing 3. Equipment: equipment faults 4. Service: QoS of the equipment 5. Environment: environment in which the equipment is located.
ALC	See automatic level control

ALC link	A piece of end-to-end configuration information, which exists in the equipment (single station) as an ALC link node. The ALC link on a line uses the ALC function of each node to control the line power.
ALC node	The ALC functional unit. In a network, the ALC node corresponds to an NE. The power detection unit, variable optical attenuator unit, and supervisory channel unit at the ALC node work together to achieve ALC.
ALS	See automatic laser shutdown
alternating current	Electric current that periodically reverses its direction of flow (polarity) according to a frequency measured in hertz, or cycles per second.
American National Standard Institute	An organization that defines U.S standards for the information processing industry.
American Standard Code for Information Interchange	The standard system for representing letters and symbols. Each letter or symbol is assigned a unique number between 0 and 127.
ANSI	See American National Standard Institute
APD	See avalanche photodiode
APE	automatic power equilibrium
APID	access point identifier
application-specific integrated circuit	A special type of chip that starts out as a nonspecific collection of logic gates. Late in the manufacturing process, a layer is added to connect the gates for a specific function. By changing the pattern of connections, the manufacturer can make the chip suitable for many different needs.
APS	See automatic protection switching
ARP	See Address Resolution Protocol
arrayed waveguide grating	A device, built with silicon planar lightwave circuits (PLC), that allows multiple wavelengths to be combined and separated in a dense wavelength-division multiplexing (DWDM) system.
ASCII	See American Standard Code for Information Interchange
ASE	amplified spontaneous emission
ASIC	See application-specific integrated circuit
ASON	See automatically switched optical network
asymmetric digital subscriber line	A technology that uses existing phone lines to transmit digital information at a high bandwidth to homes and businesses. Unlike regular dialup phone service, ADSL provides continuously available or "always on" connections. ADSL is asymmetric in that it uses most of the channel to transmit downstream to the user and only a small part to receive information from the user. ADSL simultaneously accommodates analog (voice) information on the same line. ADSL is generally offered at downstream data rates from 512 Kbps to about 6 Mbps.
Asynchronous Transfer Mode	A protocol that uses uniform 53 byte cells to transmit a variety of digital signals. A transfer mode in which the information is organized into cells; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate. Statistical and deterministic values may also be used to qualify the transfer mode.
ATAG	autonomously generated correlation tag

ATM	See Asynchronous Transfer Mode
AU	See administrative unit
auto-negotiation	An optional function of the IEEE 802.3u Fast Ethernet standard that enables devices to automatically exchange information about speed and duplex abilities over a link.
automatic gain control	A process or means by which gain is automatically adjusted in a specified manner as a function of a specified parameter, such as the received signal level.
automatic laser shutdown	A technique (procedure) to automatically shutdown the output power of laser transmitters and optical amplifiers to avoid exposure to hazardous levels.
automatic level control	A function that keeps output power of components in a system essentially constant, even when line attenuation in a section of the system increases.
automatic protection switching	The capability of a transmission system to detect when a working device fails, and to recover the traffic by switching to a standby device.
automatically switched optical network	A network which is based on technology enabling the automatic delivery of transport services. Specifically, an ASON can deliver not only leased-line connections but also other transport services such as soft-permanent and switched optical connections.
avalanche photodiode	A semiconductor photodetector with integral detection and amplification stages. Electrons generated at a p/n junction are accelerated in a region where they free an avalanche of other electrons. APDs can detect faint signals but require higher voltages than other semiconductor electronics.
AWG	See arrayed waveguide grating

B

background block error ratio	The ratio of background block errors (BBEs) to the total number of blocks during a fixed measurement interval. The total number of blocks excludes all blocks during SESs.
backup	A periodic operation performed on data stored in a database for the purposes of recovering the data if an error occurs. The backup also refers to the data synchronization between active and standby boards.
bandwidth	A range of transmission frequencies a transmission line or channel can carry in a network. In fact, the bandwidth is the difference between the highest and lowest frequencies in the transmission line or channel. The greater the bandwidth, the faster the data transfer rate.
BAS	See broadband access server
basic input/output system (BIOS)	Firmware stored on the computer motherboard that contains basic input/output control programs, power-on self test (POST) programs, bootstraps, and system setting information. The BIOS provides hardware setting and control functions for the computer.
bayonet-neill-concelman	A connector used for connecting two coaxial cables.
BBE	background block error
BBER	See background block error ratio
BC	See boundary clock
BDI	Backward Defect Indication
BEI	backward error indication

BER	See bit error rate
BIAE	backward incoming alignment error
bill of materials	Listing of all the subassemblies, parts, and raw materials that go into a product. The BOM shows the quantity of each raw material required to make the product. A variety of display formats are available for BOMS, including single level, indented, modular/planning, transient, matrix, and costed BOMs.
BIOS	See basic input/output system
BIP	See bit-interleaved parity
BIP-8	See bit interleaved parity order 8
bit error	An incompatibility between a bit in a transmitted digital signal and the corresponding bit in the received digital signal.
bit error rate	The ratio of received bits that contain errors. BER is an important index used to measure the communication quality of a network.
bit interleaved parity-8	A technique that uses an even parity byte to check for errors. BIP-8 divides a frame into parity units consisting of a byte each, and arranges the units into a matrix. A "1" or "0" is then added to the corresponding bit of a parity byte, which is transmitted with the frame, in order to keep even parity for each column in the matrix.
bit-interleaved parity	A method of error monitoring. With even parity, the transmitting equipment generates an X-bit code over a specified portion of the signal in such a manner that the first bit of the code provides even parity over the first bit of all X-bit sequences in the covered portion of the signal, the second bit provides even parity over the second bit of all X-bit sequences within the specified portion, and so forth. Even parity is generated by setting the BIP-X bits so that an even number of 1s exist in each monitored partition of the signal. A monitored partition comprises all bits in the same bit position within the X-bit sequences in the covered portion of the signal. The covered portion includes the BIP-X.
BITS	See building integrated timing supply
BMC	best master clock
BNC	See bayonet-neill-concelman
BOM	See bill of material
boundary clock	A clock with a clock port for each of two or more distinct PTP communication paths.
BPDU	See bridge protocol data unit
BPS	board-level protection switching
bridge protocol data unit	Data messages exchanged across switches within an extended LAN that uses a spanning tree protocol (STP) topology. BPDU packets contain information on ports, addresses, priorities, and costs, and they ensure that the data reaches its intended destination. BPDU messages are exchanged across bridges to detect loops in a network topology. These loops are then removed by shutting down selected bridge interfaces and placing redundant switch ports in a backup, or blocked, state.
bridging	The act of simultaneously transmitting identical traffic on the working and protection channels.

broadband access server A server that provides features such as user access, connection management, address allocation and authentication, authorization, and accounting. It can also provide features of a router, such as effective route management and high forwarding performance, and supports a wide range of services.

broadcast A means of delivering information to all members in a network. The broadcast range is determined by the broadcast address.

broadcast service A unidirectional service from one service source to multiple service sinks.

building integrated timing supply A device that provides precise timing signals to telecommunications equipment in a particular building, thereby synchronizing the equipment for signal transmission.

BWS Backbone WDM System

C

cable tie A tie used to bind cables.

capex See capital expenditure

capital expenditure Expenditure that creates future benefits. For carriers, capital expenditure generally consists of one-off purchases of network devices, computers, and other equipment.

CAR See committed access rate

CBS See committed burst size

CC See connectivity check

CCI connection control interface

CCM See continuity check message

CD chromatic dispersion

CDMA See Code Division Multiple Access

CE See customer edge

CENELEC See European Committee for Electrotechnical Standardization

central processing unit The computational and control unit of a computer. The CPU is the device that interprets and executes instructions. The CPU has the ability to fetch, decode, and execute instructions and to transfer information to and from other resources over the computer's main data-transfer path, the bus.

centralized alarm system The system that gathers all information about alarms into a specific terminal console.

CF See compact flash

CGMP Cisco Group Management Protocol

channel A telecommunication path of a specific capacity and/or speed between two or more locations in a network. The channel can be established through wire, radio (microwave), fiber, or any combination of the three. The amount of information transmitted per second in a channel is the information transmission speed, expressed in bits per second. For example, b/s (100 bit/s), kb/s (103 bit/s), Mb/s (106 bit/s), Gb/s (109 bit/s), and Tb/s (1012 bit/s).

channel spacing The center-to-center difference in frequencies or wavelengths between adjacent channels in a WDM device.

CIR	See committed information rate
CIST	Common and Internal Spanning Tree
CLEI	common language equipment identification
CLNP	connectionless network protocol
CLNS	connectionless network service
clock synchronization	A process of synchronizing clocks, in which the signal frequency traces the reference frequency, but the start points do not need to be consistent. This process is also known as frequency synchronization.
clock tracing	The method of keeping the time on each node synchronized with a clock source in the network.
CM	See configuration management
CMEP	connection monitoring end point
CMI	coded mark inversion
coarse wavelength division multiplexing (CWDM)	A signal transmission technology that multiplexes widely-spaced optical channels into the same fiber. CWDM spaces wavelengths at a distance of several nm. CWDM does not support optical amplifiers and is applied in short-distance chain networking.
Code Division Multiple Access (CDMA)	A communication scheme that uses frequency expansion technology to form different code sequences. When the CDMA scheme is used, subscribers with different addresses can use different code sequences for multi-address connection.
committed access rate	A traffic control method that uses a set of rate limits to be applied to a router interface. CAR is a configurable method by which incoming and outgoing packets can be classified into Quality of Service (QoS) groups and by which the input or output transmission rate can be defined.
committed burst size	A parameter used to define the capacity of token bucket C, that is, the maximum burst IP packet size when information is transferred at the committed information rate. This parameter must be greater than 0 but should be not less than the maximum length of an IP packet to be forwarded.
committed information rate	The rate at which a frame relay network agrees to transfer information under normal conditions. Namely, it is the rate, measured in bit/s, at which the token is transferred to the leaky bucket.
Common Object Request Broker Architecture (CORBA)	A specification developed by the Object Management Group in 1992 in which pieces of programs (objects) communicate with other objects in other programs, even if the two programs are written in different programming languages and are running on different platforms. A program makes its request for objects through an object request broker, or ORB, and therefore does not need to know the structure of the program from which the object comes. CORBA is designed to work in object-oriented environments.
compact flash	A type of data storage device used in portable electronic devices. A compact flash typically uses flash memory in a standardized enclosure.
concatenation	A process that combines multiple virtual containers, which can be used as a single capacity. Concatenation also maintains the integrity of bit sequences.
Configuration data	A command file defining hardware configurations of an NE. With this file, an NE can collaborate with other NEs in a network. Therefore, configuration data is the key factor that determines the operation of an entire network.

configuration management	A network management function defined by the International Standards Organization (ISO) that involves installing, reinitializing, and modifying hardware and software.
configure	To set the basic parameters of an operation object.
congestion	Extra intra-network or inter-network traffic resulting in decreased network service efficiency.
connecting plate	A metallic plate used to conjoin two cabinets.
connection point	A reference point where the output of a trail termination source or connection is bound to the input of another connection, or where the output of a connection is bound to the input of a trail termination sink or another connection. The connection point is characterized by the information that passes across it. A bidirectional connection point is formed by the association of a contradirectional pair.
connectivity check	An Ethernet connectivity fault management (CFM) method used to detect the connectivity between MEPs by having each MEP periodically transmit a Continuity Check Message (CCM).
continuity check message	An Ethernet operation, administration, and maintenance (OAM) message used to detect link connectivity failures.
convergence	A process in which multiple low-rate signals are multiplexed into one or several required signals.
convergence service	A service that provides enhancements to an underlying service to fulfill the specific requirements of a convergence service user.
Coordinated Universal Time	The world-wide scientific standard of timekeeping, which is kept accurate to within microseconds.
CORBA	See Common Object Request Broker Architecture
corrugated pipe	A tube that has a series of parallel ridges and grooves on its surface and is used to protect optical fibers.
CPLD	Complex Programmable Logical Device
CPU	See central processing unit
CRC	See cyclic redundancy check
CSA	Canadian Standards Association
CSES	consecutive severely errored second
CSMA	carrier sense multiple access
CST	Common Spanning Tree
current alarm	An alarm not handled or not acknowledged after being handled.
current performance data	Performance data currently stored in a register. An NE provides two types of registers, namely, a 15-minute register and a 24-hour register, to store the performance parameters of a performance monitoring entity. Both types of registers store performance data only in the specified monitoring period.
customer edge	A part of the BGP/MPLS IP VPN model that provides interfaces for directly connecting to the Service Provider (SP) network. A CE can be a router, switch, or host.
CWDM	See coarse wavelength division multiplexing

cyclic redundancy check	A procedure used to check for errors in data transmission. CRC error checking uses a complex calculation to generate a number based on the data transmitted. The sending device performs the calculation before performing the transmission and includes the generated number in the packet it sends to the receiving device. The receiving device then repeats the same calculation. If both devices obtain the same result, the transmission is considered to be error free. This procedure is known as a redundancy check because each transmission includes not only data but extra (redundant) error-checking values.

D

DAPI	destination access point identifiers
Data backup	A method of copying key data to the backup storage area to prevent data loss in case the original storage area is damaged or a failure occurs.
data communication network	A communication network used in a TMN or between TMNs to support the data communication function.
data communications channel	The data channel that uses the D1-D12 bytes in the overhead of an STM-N signal to transmit information on the operation, management, maintenance, and provisioning (OAM&P) between NEs. The DCC channel composed of bytes D1-D3 is referred to as the 192 kbit/s DCC-R channel. The other DCC channel composed of bytes D4-D12 is referred to as the 576 kbit/s DCC-M channel.
DBPS	distributed board protect system
DCC	See data communications channel
DCF	See dispersion compensation fiber
DCM	See dispersion compensation module
DCM frame	A frame that is used to hold one or two dispersion compensation modules (DCMs).
DCN	See data communication network
DDF	See digital distribution frame
DDN	See digital data network
demultiplexer	A device that separates signals that have been combined by a multiplexer into a single signal to be transmitted over a communications channel.
dense wavelength division multiplexing	A technology that enables multiple wavelengths with specific channel spacing to be multiplexed onto a single fiber. DWDM uses denser channel spacing, giving it a greater capacity than WDM.
device set	A group of multiple managed devices. Devices in a management domain can be managed more easily by dividing them into different device sets. If a user or user group is assigned authority over a device set, that user or user group has authority over all the devices in the device set. Therefore, separately setting the authority for each device is unnecessary. The device set can be configured using criteria such as geographical region, network level, or device type.
DHCP	See Dynamic Host Configuration Protocol
diamond-shaped nut	A type of nut used to fasten a wiring frame to a cabinet.
digital data network	A data transmission network that is designed to transmit data on digital channels (such as the fiber channel, digital microwave channel, or satellite channel).

digital distribution frame	A frame that connects transmission equipment at a rate of 2 to 155 Mbit/s to a switch.
digital subscriber line access multiplexer	A network device, usually situated in the main office of a telephone company, that receives signals from multiple customer Digital Subscriber Line (DSL) connections and uses multiplexing techniques to put these signals on a high-speed backbone line.
dispersion compensation fiber	A type of fiber that uses negative dispersion to compensate for the positive dispersion of the transmitting fiber to maintain the original shape of the signal pulse.
dispersion compensation module	A type of module that contains dispersion compensation fibers to compensate for the dispersion of the transmitting fiber.
Distance Vector Multicast Routing Protocol (DVMRP)	An Internet gateway protocol based primarily on the RIP. The DVMRP protocol implements a typical dense mode IP multicast solution and uses IGMP to exchange routing datagrams with its neighbors.
distributed link aggregation group	A board-level port protection technology that detects unidirectional fiber cuts and negotiates with the opposite port. In the case of a link down failure on a port or hardware failure on a board, services are automatically switched to the slave board, thereby achieving 1+1 protection for the inter-board ports.
DLAG	See distributed link aggregation group
DMUX; DEMUX	See demultiplexer
DNI	Dual Node Interconnection
domain	A logical subscriber group based on which subscriber rights are controlled.
DQPSK	differential quadrature phase shift keying
DRDB	dynamic random database
DRZ	differential phase return to zero
DSCP	Differentiated Services Code Point
DSCR	dispersion slope compensation rate
DSLAM	See digital subscriber line access multiplexer
DSP	Digital Signal Processing
DTE	Data Terminal Equipment
DTMF	See dual tone multiple frequency
DTR	data terminal ready
dual tone multiple frequency	Multi-frequency signaling technology for telephone systems. According to this technology, standard set combinations of two specific voice band frequencies, one from a group of four low frequencies and the other from a group of four high frequencies, are used.
dual-ended switching	A protection method in which switching is performed at both ends of a protected entity, such as a connection or path, even if a unidirectional failure occurs.
DVB	Digital Video Broadcasting
DVB-ASI	digital video broadcast-asynchronous serial interface
DVMRP	See Distance Vector Multicast Routing Protocol
DWDM	See dense wavelength division multiplexing

Dynamic Host Configuration Protocol (DHCP)	A client-server networking protocol. A DHCP server provides configuration parameters specific to the DHCP client host requesting information the host requires to participate on the Internet network. DHCP also provides a mechanism for allocating IP addresses to hosts.

E

E2E	End to End
EAPE	enhanced automatic power pre-equilibrium
EBS	See excess burst size
ECC	See embedded control channel
EDFA	See erbium doped fiber amplifier
eDQPSK	enhanced differential quadrature phase shift keying
EFM	See Ethernet in the first mile
ejector lever	A lever located on the front panel of a circuit board to help latch the board in a subrack/chassis or to help free the board from the subrack/chassis.
electric supervisory channel	A channel used to transmit supervisory data on an optical transmission network. The monitoring data is transmitted on the data communications channel as part of the overhead of the service signal.
electromagnetic compatibility	A condition which prevails when telecommunications equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment.
electromagnetic interference	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the performance of electronics/electrical equipment.
electrostatic discharge	A sudden and temporary electric current, caused by direct contact or induced by an electrostatic field, that flows between two objects with different electrical potentials.
element management system (NMS)	ITU-T compliant software that is used to manage one or more specific types of network element (NE). An EMS enables a user to individually manage all the features of each NE, but not the communication between NEs. This communication is managed by the NMS.
embedded control channel	A logical channel that uses a data communications channel (DCC) as its physical layer to enable the transmission of operation, administration, and maintenance (OAM) information between NEs.
EMC	See electromagnetic compatibility
EMI	See electromagnetic interference
EMS	See element management system
enterprise system connection	A path protocol that connects the host to various control units in a storage system. Enterprise system connection is a serial bit stream transmission protocol that operates a rate of 200 Mbit/s.
EoO	Ethernet over OTN
EoW	Ethernet over WDM

ePDM-BPSK	enhanced polarization division multiplexing-binary phase shift keying
ePDM-QPSK	enhanced polarization division multiplexing-quadrature phase shift keying
EPL	See Ethernet private line
EPLAN	See Ethernet private LAN service
erbium doped fiber amplifier	An optical device that amplifies optical signals. This device uses a short optical fiber doped with the rare-earth element, Erbium. The signal to be amplified and a pump laser are multiplexed into the doped fiber, and the signal is amplified by interacting with doping ions. When the amplifier passes an external light source pump, it amplifies the optical signals in a specific wavelength range.
ESC	See electric supervisory channel
ESCON	See enterprise system connection
ESD	See electrostatic discharge
ESD floor	A floor that quickly releases the static electricity of the object in contact with it to prevent accumulated static electricity.
ESD jack	A socket on a cabinet or shelf to which an ESD wrist strap can connect.
eSFP	enhanced small form-factor pluggable
Ethernet	A LAN technology that uses the carrier sense multiple access with collision detection (CSMA/CD) media access control method. The Ethernet network is highly reliable and easy to maintain. The speed of an Ethernet interface can be 10 Mbit/s, 100 Mbit/s, 1000 Mbit/s, or 10,000 Mbit/s.
Ethernet in the first mile (EFM)	Last mile access from the broadband device to the user community from the access network's point of view. EFM combines the advantages of the G.SHDSL.b and Ethernet technologies. EFM provides both traditional voice service and high-speed Internet access service. In addition, EFM meets high definition television system (HDTV) and Video On Demand (VOD) user requirements.
Ethernet private LAN service	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over dedicated bandwidth between multipoint-to-multipoint connections.
Ethernet private line	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over dedicated bandwidth between point-to-point connections.
Ethernet virtual private LAN service	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over shared bandwidth between multipoint-to-multipoint connections.
Ethernet virtual private line	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over shared bandwidth between point-to-point connections.
ETS	European Telecommunication Standards
ETSI	European Telecommunications Standards Institute
ETSI 300 mm cabinet	A cabinet that is 600 mm wide and 300 mm deep, which complies with the ETS 300-119 standard.

European Committee for Electrotechnical Standardization	A committee, established in Brussels, responsible for European standardization in the area of electrical engineering.
EVOA	electrical variable optical attenuator
EVPL	See Ethernet virtual private line
EVPLAN	See Ethernet virtual private LAN service
excess burst size	A parameter related to traffic. In the single rate three color marker (srTCM) mode, traffic control is achieved by token buckets C and E. The excess burst size parameter defines the capacity of token bucket E, that is, the maximum burst IP packet size when the information is transferred at the committed information rate. This parameter must be greater than 0 but should be not less than the maximum length of an IP packet to be forwarded.
Extended ID	The number of the subnet to which an NE belongs, used to identify different network segments in a wide area network (WAN). Together, the ID and extended ID form the physical ID of the NE.
eye pattern	An oscilloscope display in which a digital data signal from a receiver is repetitively sampled and applied to the vertical input, while the data rate is used to trigger the horizontal sweep. It is so called because, for several types of coding, the pattern looks like a series of eyes between a pair of rails.

F

F1 byte	The user path byte, which belongs to the family of regenerator section overhead bytes. F1 bytes are reserved for network providers, who use them primarily as a temporary data or voice channel to transmit maintenance information.
fast Ethernet	Ethernet that supports a transmission rate of 100 Mbit/s, which is 10 times faster than standard Ethernet.
fault	A failure to operate correctly. A fault does not include failures caused by preventative maintenance, insufficient external resources, or intentional settings.
FBG	fiber Bragg grating
FC	See fiber channel
FDB	flash database
FDDI	See fiber distributed data interface
FE	See fast Ethernet
FEC	See forward error correction
fiber channel	A high-speed transport technology used to build SANs. FC is primarily used for transporting SCSI traffic from servers to disk arrays, but it can also be used on networks carrying ATM and IP traffic. FC supports single-mode and multi-mode fiber connections, and can run on twisted-pair copper wires and coaxial cables. FC provides both connection-oriented and connectionless services.
fiber connect	A new generation connection protocol that connects the host to various control units. It carries a single byte command protocol through the physical path of fiber channel, and provides a higher transmission rate and better performance than ESCON.

fiber distributed data interface	A standard developed by the American National Standards Institute (ANSI) for high-speed fiber-optic LANs. FDDI provides specifications for transmission rates of 100 megabits per second on token ring networks.
fiber management tray	A tray that can be installed inside a chassis and used to coil up excess optical fiber.
fiber patch cord	A length of fiber used for connections between a subrack and an ODF, connections between subracks, and connections inside a subrack.
fiber spool	A spool that is mounted on a subrack and used to coil up excess optical fiber.
fiber trough	A trough used for routing fibers.
FICON	See fiber connect
field programmable gate array	A semi-customized circuit that is used in the Application Specific Integrated Circuit (ASIC) field and developed based on programmable components. FPGA remedies many of the deficiencies of customized circuits, and allows the use of many more gate arrays.
FIFO	See first in first out
File Transfer Protocol	A member of the TCP/IP suite of protocols that is used to copy files between two computers on the Internet. Both computers must support their respective FTP roles: one must be an FTP client and the other an FTP server.
first in first out	A stack management method in which data that is stored first in a queue is also read and invoked first.
flow	A group of packets that have the same characteristics. On a board, a flow is a group of packets that perform the same QoS operation.
FMT	See fiber management tray
FOADM	fixed optical add/drop multiplexer
FOAs	fixed optical attenuator
forced switching	The action of switching traffic signals between a working channel and protection channel. The switching occurs even if the channel to which traffic is being switched is faulty or an equal or higher priority switching command is in effect.
forward error correction	A bit error correction technology that adds the correction information to the payload at the transmit end. Based on the correction information, the bit errors generated during transmission are corrected at the receive end.
four-wave mixing	A phenomenon that occurs when the interaction of two or three optical waves at different wavelengths generates new optical waves, called mixing products or sidebands, at other wavelengths.
FPGA	See field programmable gate array
frame	A unit of data transmission that consists of a header followed by a packet. The header allows the receiver to detect the beginning and end of a packet.
frame alignment signal	A distinctive signal inserted into every frame or once into every n frames, always occupying the same relative position within the frame, and used to establish and maintain frame alignment.
FTP	See File Transfer Protocol

full-duplex	A transmission mode that supports communication in both directions simultaneously. For example, telephone networks are full-duplex, since they allow both callers to speak and listen at the same time. In contrast, half-duplex only allows communication in one direction at a time.

G

gain	A measure of the strength of optical amplification. Gain is calculated as the difference between the output power and input power of an optical amplifier, expressed in dB.
gain flattening filter (GFF)	A device for making unequal signal intensities flatter over a specified wavelength range. Typically, GFFs are used in conjunction with gain amplifiers to ensure that the amplified channels all have the same gain.
gateway IP address	The IP address of a gateway. A gateway is a node that forwards packets between networks. Packets are sent to the gateway IP address when the destination network address resides in a different network to the sender.
gateway network element	An NE that serves as a gateway for other NEs to communicate with a network management system.
Gb	See gigabit
GCC	general communication channel
GCP	See GMPLS control plan
GE	See gigabit Ethernet
GE ADM	A technique that improves the transmission of GE services on a metropolitan area network. Using this technique, equipment configured with a high-speed backplane can separately transmit, aggregate, or divert GE services over electrical-layer wavelengths or sub-wavelengths. This achieves cross-connections of wavelengths and end-to-end management of sub-wavelengths over a single device. GE ADM enables GE convergence and cross-connections at the same time, thereby ensuring that network resources are used effectively.
generic framing procedure	A framing and encapsulated method that can be applied to any data type. GFP is defined by ITU-T G.7041.
GFF	See gain flattening filter
GFP	See generic framing procedure
gigabit	One billion (1,000,000,000) bits.
gigabit Ethernet	Ethernet that supports a transmission rate of 1 Gbit/s, which is 10 times faster than Fast Ethernet.
Global Positioning System	A global navigation satellite system that provides reliable positioning, navigation, and timing services to users worldwide.
GMPLS	generalized multiprotocol label switching
GMPLS control plan (GCP)	ASON software developed by Huawei for the OptiX OSN product series. GCP allows a traditional network to evolve into an ASON network.
GNE	See gateway network element
GPS	See Global Positioning System

graphical user interface	A visual computer environment that represents programs, files, and options with graphical images, such as icons, menus, and dialog boxes, on the screen.
grounding	The connection of an electrical circuit to a common conductor, called the ground, which serves as a reference for the other voltages in the circuit.
GSSP	General Snooping and Selection Protocol
GUI	See graphical user interface

H

hardware loopback	A connection mode in which a fiber jumper is used to connect the input optical interface of a board to the output optical interface of the board to achieve signal loopback.
HCS	See hierarchical cell structure
HDB	high density bipolar code
HDLC	See high level data link control
HD-SDI	See high definition-serial digital interface signal
hierarchical cell structure	A term that describes the priority of cells within a mixed environment. That is, when Macro, Micro, and Pico cells may be viewed as candidates for cell reselection the priority described by the HCS will be used in the associated calculations.
high definition-serial digital interface signal	An interface for 1.5 Gbit/s transmission of uncompressed high-definition video signals.
high level data link control	A general purpose protocol that operates at the data link layer of the OSI reference model. Each unit of data is encapsulated in an HDLC frame by adding a header and trailer before it is sent across the network. HDLC ensures that data passed up to the next layer is received exactly as transmitted, that is, error free, without loss, and in the correct order.
historical alarm	An alarm that has been acknowledged and cleared.
historical performance data	Performance data that is stored in the history register or that has been automatically reported and stored in the NMS.

I

IAE	incoming alignment error
IC	See integrated circuit
ICC	ITU carrier code
ICMP	See Internet Control Message Protocol
ID	See identity
identity	The collective aspect of the set of characteristics by which a thing is definitively recognizable or known.
Idle resource optical NE	An NE displayed on the topology view of the U2000, which contains idle board and subrack resources. These resources can be used to create an optical NE.
IE	See Internet Explorer
IEC	See International Electrotechnical Commission

IEEE	See Institute of Electrical and Electronics Engineers
IETF	See Internet Engineering Task Force
IGMP	See Internet Group Management Protocol
Input jitter tolerance	The measure of a receiver's ability to tolerate jitter on an incoming waveform.
Institute of Electrical and Electronics Engineers	A professional association of electrical and electronics engineers based in the United States, but with membership from numerous other countries. The IEEE focuses on electrical, electronics, and computer engineering, and produces many important technology standards.
integrated circuit	A combination of inseparable associated circuit elements that are formed in place and interconnected on or within a single base material to perform a microcircuit function.
integrated services digital network	A high-speed digital communications network evolving from existing telephone services. The goal in developing ISDN was to replace the current telephone network, which requires digital-to-analog conversions, with facilities totally devoted to digital switching and transmission, yet advanced enough to replace traditionally analog forms of data, ranging from voice to computer transmissions, music, and video.
intelligent power adjustment	A technology that reduces the optical power of all the amplifiers in an adjacent regeneration section in the upstream to a safe level if the system detects the loss of optical signals on the link. IPA helps ensure that maintenance engineers are not injured by the laser escaping from a broken fiber or a connector that is not plugged in properly.
internal spanning tree	A segment of a Common and Internal Spanning Tree (CIST) in an MST region. An IST is a special multiple spanning tree instance (MSTI) whose ID is 0.
International Electrotechnical Commission	An international organization that prepares and publishes International Standards for electrical, electronic, and related technologies.
International Organization for Standardization	An international organization that develops voluntary International Standards. Among its accomplishments is the widely accepted ISO/OSI reference model, which defines standards for the interaction of computers connected by communications networks.
International Telecommunication Union	A United Nations agency, one of the most important and influential recommendation bodies, responsible for recommending standards for telecommunication (ITU-T) and radio networks (ITU-R).
International Telecommunication Union-Telecommunication Standardization Sector	A sector of ITU that develops worldwide standards for telecommunications technologies.
Internet Control Message Protocol	A network layer protocol that provides message control and error reporting between a host server and an Internet gateway.
Internet Engineering Task Force	A worldwide organization interested in networking and the Internet. The IETF published the specifications that led to the TCP/IP protocol standard.
Internet Explorer	Widely-used Web browsing software developed by Microsoft.
Internet Group Management Protocol	One of the TCP/IP protocols for managing the membership of Internet Protocol multicast groups. It is used by IP hosts and adjacent multicast routers to establish and maintain multicast group memberships.

Internet Protocol	Part of the Internet protocol suite commonly known as TCP/IP. IP breaks up data messages into packets, routes the packets from sender to destination network and station, and reassembles the packets into the original data messages at the destination. IP runs at the internetwork layer in the TCP/IP model, which is equivalent to the network layer in the ISO/OSI reference model.
IP	See Internet Protocol
IP address	A 32-bit (4-byte) binary number that uniquely identifies a host connected to the Internet. An IP address is expressed in dotted decimal notation, consisting of the decimal values of its 4 bytes, separated with periods; for example, 127.0.0.1. The first three bytes of the IP address identify the network to which the host is connected, and the last byte identifies the host itself.
IP over DCC	A technology that enables a DCC channel to carry TCP/IP packets without using any extra overheads or service resources.
IPA	See intelligent power adjustment
IPG	inter-packet gap
ISDN	See integrated services digital network
ISO	See International Organization for Standardization
IST	See internal spanning tree
ITU	See International Telecommunication Union
ITU-T	See International Telecommunication Union-Telecommunication Standardization Sector

J

Jitter	The measure of short waveform variations caused by vibration, voltage fluctuations, and control system instability.
Jitter transfer	The measure of jitter on a device's output signal that is attributable to the jitter received on its input signal.

L

label switched path	A sequence of hops (R0...Rn) in which a packet travels from R0 to Rn through label switching mechanisms. A label-switched path can be chosen dynamically, based on normal routing mechanisms, or through configuration.
LACP	See Link Aggregation Control Protocol
LAG	See link aggregation group
LAN	See local area network
LAPD	link access procedure on the D channel
LAPS	link access protocol-SDH
laser	A component that generates directional optical waves of narrow wavelengths. The laser light has better coherence than ordinary light. Semi-conductor lasers provide the light used in a fiber system.

layer	A concept used to allow transport network functionality to be described hierarchically as successive levels; each layer being solely concerned with the generation and transfer of its characteristic information.
LB	See loopback
LCAS	See link capacity adjustment scheme
LCD	See liquid crystal display
LCN	local communication network
LCT	local craft terminal
LED	See light emitting diode
LHP	long hop
light emitting diode	A display and lighting technology used in almost every electrical and electronic product on the market, from a tiny on/off light to digital readouts, flashlights, traffic lights, and perimeter lighting. LEDs are also used as the light source in multimode fibers, optical mice, and laser printers.
Link Aggregation Control Protocol	A protocol that dynamically bundles a group of physical interfaces as a logical interface to increase bandwidth and reliability.
link aggregation group	Two or more network links bundled together. A MAC client treats a LAG as if it were a single link.
link capacity adjustment scheme	A control mechanism to hitlessly increase or decrease the capacity of a link to meet the bandwidth needs of the application. It also provides a means of removing member links that have experienced failure.
Link Control Protocol	A traffic controller in the Point-to-Point Protocol (PPP) that establishes, configures, and tests data-link Internet connections.
linktrace message	A multicast frame sent by the source MEP to trace the path to a destination MEP. Each receiving MEP sends a linktrace reply to the originating MEP, and then regenerates the linktrace message.
linktrace reply	A response message that the destination MEP sends to the source MEP after it receives an LTM.
liquid crystal display	A type of display that uses a liquid compound with a polar molecular structure that is sandwiched between transparent electrodes.
LLC	See logical link control
LMP	link management protocol
LOC	loss of clock
local area network	A network formed by the computers and workstations within the coverage of a few square kilometers or within a single building, featuring high speed and low error rate. Current LANs are generally based on switched Ethernet or Wi-Fi technology and run at 1,000 Mbit/s (that is, 1 Gbit/s).
locked switching	A function that disables the service from being switched from the working channel to the protection channel when the switching condition is satisfied. When the service has been switched, it allows service restoration from the protection channel to the working channel.

logical link control	The upper sublayer of the data link layer in the OSI model. The other sublayer is the MAC layer. The LLC sublayer manages traffic (flow and error control) over the physical medium and acts as an interface between the MAC sublayer and the network layer.
logical port	A logical number assigned to every application.
loopback	A troubleshooting technique that returns a transmitted signal to its source so that the signal or message can be analyzed for errors.
LOP	See loss of pointer
LOS	See loss of signal
loss of pointer	A state in which the receiver cannot detect the pointer indicating the start of a VC in the payload. LOP helps monitor service performance at the PHY layer.
loss of signal	An indication that the incoming signal has no transitions. That is, the signal level drops below a certain threshold.
LP	See logical port
LPT	link-state pass through
LSP	See label switched path
LT	linktrace
LTM	See linktrace message
LTR	See linktrace reply

M

MA	maintenance association
MAC	See media access control
MADM	multiple add/drop multiplexer
main distribution frame	A device at a central office, on which all local loops are terminated.
main path interface at the transmitter	A reference point in the main optical path behind the OM/OA output optical connector at the transmitter.
main topology	A basic component of a human-machine interface. It is the default client interface of the NMS and intuitively displays the structure of a network, NEs on the network, subnets in the network as well as the NE communication and running status, reflecting the overall network running status.
maintenance domain	The network or the part of the network for which connectivity is managed by connectivity fault management (CFM). The devices in a maintenance domain are managed by a single Internet service provider (ISP).
maintenance point	A term that collectively refers to MEPs and MIPs.
MAN	See metropolitan area network
managed object	An abstract representation of physical or logical resources that are managed on a network. Managed objects form an important part of the Telecommunication Management Network (TMN).

management information	The information that is used for network management in a transport network.
management information base	A type of database used for managing the devices in a communications network. It comprises a collection of objects in a (virtual) database used to manage entities (such as routers and switches) in a network.
manual switching	The action of manually switching a traffic signal between a working channel and a protection channel. Manual switching fails if the channel to which traffic is being switched is faulty or an equal or higher priority switch command is in effect.
mapping	A procedure by which tributaries are adapted into virtual containers at the boundary of an SDH network.
marking-off template	A piece of quadrate cardboard with four holes. It is used to mark the positions of the installation holes for the cabinet.
MD	See maintenance domain
MDB	memory database
MDF	See main distribution frame
MDP	message dispatch process
MDS	message distribution service software
ME	maintenance entity
mean launched power	The average power of a pseudo-random data sequence coupled into the fiber by the transmitter.
mean time between failures	The average time between consecutive failures of a piece of equipment. It is a measure of the reliability of the system.
media access control	The lower sublayer of the data link layer in the OSI model. The upper sublayer is the LLC layer. The MAC sublayer is an interface between the LLC sublayer and the network's physical layer, and governs protocol access to the physical network medium.
MEP	maintenance end point
metropolitan area network	A medium-scale computer network with area larger than that covered by a LAN and smaller than that covered by a WAN. It interconnects multiple LAN networks in a geographic region of a city.
MFAS	See multiframe alignment signal
MIB	See management information base
MIP	maintenance intermediate point
MLD	See multicast listener discovery
MLM laser	See multi-longitudinal mode laser
MO	See managed object
mother board	A printed board assembly that is used for interconnecting arrays of plug-in electronic modules.
mounting ear	A piece of angle plate on a rack. The mounting ear has holes that can be used to fix network elements or components.
MP	See maintenance point

MPI	main path interface
MPI-R	main path interface at the receiver
MPI-S	See main path interface at the transmitter
MPLS	See Multiprotocol Label Switching
MS	multiplex section
MSA	multiplex section adaptation
MSI	multi-frame structure identifier
MSOH	See multiplex section overhead
MSP	See multiplex section protection
MSPP	multi-service provisioning platform
MST	See multiplex section termination
MSTI	See multiple spanning tree instance
MSTP	See Multiple Spanning Tree Protocol
MTA	Mail Transfer Agent
MTBF	See mean time between failures
MTU	maximum transmission unit
multi-longitudinal mode laser	An injection laser diode that has a number of longitudinal modes.
multicast listener discovery	A component of the IPv6 suite. MLD is used by IPv6 routers to discover multicast listeners on their directly connected network segments and set up and maintain member relationships.
multiframe alignment signal	A distinctive signal inserted into every multiframe or once into every n multiframes, always occupying the same relative position within the multiframe, and used to establish and maintain multiframe alignment.
multiple spanning tree instance	A type of spanning trees calculated by MSTP within an MST Region, to provide a simply and fully connected active topology for frames classified as belonging to a VLAN that is mapped to the MSTI by the MST Configuration. A VLAN cannot be assigned to multiple MSTIs.
Multiple Spanning Tree Protocol	A spanning tree protocol used to prevent loops in bridge configurations. MSTP introduces mapping between VLANs and multiple spanning trees. This means that, unlike other types of STPs, MSTP can block ports selectively by VLAN.
multiplex section overhead	The overhead that comprises rows 5 to 9 of the section overhead (SOH) of the STM-N signal.
multiplex section protection	A function that switches a signal from a working to a protection channel when the multiplex section termination (MST) function detects a failure event.
multiplex section termination	A function that generates the multiplex section overhead (MSOH) during the formation of an SDH frame signal and that terminates the MSOH in the reverse direction.
multiplexer	Equipment that combines a number of tributary channels onto a fewer number of aggregate bearer channels, the relationship between the tributary and aggregate channels being fixed.

multiplexing	A procedure by which multiple lower order path layer signals are adapted into a higher order path or the multiple higher order path layer signals are adapted into a multiplex section.
Multiprotocol Label Switching	A technology that uses short tags of fixed length to encapsulate packets in different link layers, and provides connection-oriented switching for the network layer on the basis of IP routing and control protocols.
MUX	See multiplexer
MVOA	mechanical variable optical attenuator

N

NA	no acknowledgment
NCP	See Network Control Protocol
NE	See network element
NE database	A database that stores NE data. There are three types of NE databases: (1) DRDB: a dynamic database in a dynamic RAM, powered by battery (2) SDB: a static database in a power-down RAM (3) FDB0, FDB0: permanently saved databases in a Flash ROM
NE Explorer	The main operation interface of the NMS, which is used to manage the telecommunication equipment. In the NE Explorer, a user can query, manage, and maintain NEs, boards, and ports.
NE ID	An ID that uniquely indicates an NE in a network.
NE Panel	A graphical user interface, of the network management system, which displays subracks, boards, and ports on an NE. In the NE Panel, the user can complete most of the configuration, management, and maintenance functions for an NE.
NE-side data	The NE configuration data that is stored on the SCC board of an NE. The data can be uploaded to the NMS and is in this way stored on the NMS side.
NEBS	Network Equipment Building System
NEF	See network element function
Network Control Protocol	A protocol that switches the virtual circuit connections into place, implements path control, and operates the Synchronous Data Link Control (SDLC) link.
network element	A hardware device and the software running on it. An NE is equipped with at least one SCC board, which runs the NE software to manage and monitor the NE.
network element function	A function block that represents the telecommunication functions and communicates with the TMN OSF function block for the purpose of being monitored and/or controlled.
network management	The process of controlling a network so as to maximize its efficiency and productivity. The ISO model divides network management into five categories: fault management, accounting management, configuration management, security management, and performance management.
Network Management System	A system in charge of the operation, administration, and maintenance of a network.

network node interface	An interface at a network node that is used to interconnect with another network node.
network segment	Part of a network on which all message traffic is common to all nodes; that is, a message broadcast from one node on the segment is received by all other nodes on the segment.
network service access point	A network address defined by ISO, through which entities on the network layer can access OSI network services.
Network Time Protocol	A protocol that defines the mechanism for synchronizing time between a distributed time server and a client.
NM	See network management
NMS	See Network Management System
NNI	See network node interface
NOC	network operation center
noise figure	A measure of degradation of the signal-to-noise ratio (SNR), caused by components in a radio frequency (RF) signal chain. The noise figure is defined as the ratio of the output noise power of a device to the portion thereof attributable to thermal noise in the input termination at standard noise temperature T0 (usually 290 K). The noise figure is thus the ratio of actual output noise to that which would remain if the device itself did not introduce noise. It is a number by which the performance of a radio receiver can be specified.
NSAP	See network service access point
NTP	See Network Time Protocol

O

OA	See optical amplifier
OADM	See optical add/drop multiplexer
OADM frame	A frame that is used to hold OADM boards.
OAM	See operation, administration and maintenance
OAMS	Optical fiber line Automatic Monitoring System
OC	See optical coupler
OCI	open connection indication
OCP	See optical channel protection
OD	optical demultiplexing
ODB	optical duobinary
ODF	See optical distribution frame
ODUk	optical channel data unit-k
OEQ	optical equalizer
OFC	open fiber control
OLA	See optical line amplifier
OLP	See optical line protection

OM	optical multiplexing
OMS	optical multiplexing section
ONE	See optical network element
OOF	See out of frame
OPA	optical power adjust
open shortest path first	A link-state, hierarchical interior gateway protocol (IGP) for network routing that uses cost as its routing metric. A link state database is constructed of the network topology, which is identical on all routers in the area.
Open Systems Interconnection	A standard reference model for communication between different systems made by different vendors, in which the communications process is organized into seven different categories that are placed in a layered sequence based on their relationship to the user.
operation, administration and maintenance	A set of network management functions that cover fault detection, notification, location, and repair.
OPEX	operating expense
OPS	optical physical section
fiber connector	A component attached to the end of an optical fiber that allows the fiber to connect to another fiber or an optical source.
optical add/drop multiplexer	A device that can be used to add and drop the optical signals of various wavelengths on a channel.
optical amplifier	A device or subsystem in which optical signals are amplified.
optical attenuator	A passive device that increases the attenuation in a fiber link. An optical attenuator is used to ensure that the optical power of a signal at the receive end is not excessively high.
optical channel	A signal transmitted at a particular wavelength in a fiber-optic system.
optical channel protection	A mechanism that protects the services of a certain channel in an optical link. If the channel becomes faulty, its services are switched to the protection channel.
optical coupler	A device used for coupling light in an optical system.
optical distribution frame	A frame used to transfer and spool fibers.
optical line amplifier (OLA)	A device that amplifies optical input signals and compensates for the line loss. The erbium-doped fiber amplifier (EDFA) amplifier is a key component of the OLA.
optical line protection	A mechanism that protects line signals using the dual feeding and selective receiving principle, featuring single-ended switching.
optical network element (ONE)	A transport entity that implements the NE functions (terminal multiplexing, add/drop multiplexing, cross-connection and regeneration) in a DWDM layer network. The types of ONEs include OTM, OADM, OLA, REG and OXC.
optical signal-to-noise ratio	The ratio of signal power to noise power in a transmission link. OSNR is the most important index for measuring the performance of a DWDM system.
optical spectrum analyzer	A device that can analyze a region of the optical spectrum and is commonly used to diagnose DWDM systems.

optical supervisory channel	A channel used to transmit monitoring data among nodes in an optical transmission network.
optical switch	A passive component possessing two or more ports that selectively transmits, redirects, or blocks optical power in an optical fiber transmission line.
optical time domain reflectometer	A device that sends a series of short pulses of light down a fiber-optic cable and measures the strength of the return pulses. An OTDR is used to measure fiber length and light loss, and to locate fiber faults.
optical transmission section	A section in the logical structure of an optical transport network (OTN). The OTS allows the network operator to perform monitoring and maintenance tasks between NEs.
optical transponder unit	A device or subsystem that converts accessed client signals into a G.694.1/G.694.2-compliant WDM wavelength.
optical transport network	A network that transmits data using optical signals.
optical wavelength shared protection	A protection architecture that allows one wavelength to provide protection for multiple services between different stations, saving wavelength resources and lowering costs.
OPU	optical channel payload unit
OPUk	optical channel payload unit-k
orderwire	A channel that allows voice communication between engineers at different stations.
OSA	See optical spectrum analyzer
OSC	See optical supervisory channel
OSI	See Open Systems Interconnection
OSN	optical switch node
OSNR	See optical signal-to-noise ratio
OSPF	See open shortest path first
OTDR	See optical time domain reflectometer
OTM	optical terminal multiplexer
OTN	See optical transport network
OTS	See optical transmission section
OTU	See optical transponder unit
OTUk	optical channel transport unit-k
out of frame	A condition indicating that a specified number of consecutive frame alignment signals have been received in incorrect positions.
output optical power	The strength of an output optical signal.
overhead cabling	A method in which cables or fibers are routed from the top of a cabinet.
OWSP	See optical wavelength shared protection

P

PA	pre-amplifier

packet over SDH/ SONET	A technology that provides point-to-point data connections. The POS interface uses SDH/SONET as the physical layer protocol, and supports the transport of packet data (such as IP packets) in MANs and WANs.
packet switched network	A telecommunication network that works in packet switching mode.
packing case	A case used for packing a board or subrack.
paired slots	A pair of slots connected by a bus on the backplane. The bus enables the boards seated in paired slots to transmit overheads to each other.
pass-through	The action of transmitting the same information that is being received for any given direction of transmission.
PBS	See peak burst size
PCB	See printed circuit board
PCC	protection communication channel
PCC	See policy and charging control
PCS	See physical coding sublayer
PDF	power distribution frame
PDH	See plesiochronous digital hierarchy
PDL	See polarization dependent loss
PDU	protocol data unit
PE	provider edge
peak burst size	A parameter that defines the capacity of token bucket P, that is, the maximum burst IP packet size when the information is transferred at the peak information rate.
peak information rate	A traffic parameter, expressed in bit/s, whose value should be not less than the committed information rate.
performance register	A register that counts performance events taking place within a period of operation time, providing a statistical evaluation of the quality of the operation.
PGND	protection ground
PGND cable	A cable which connects the equipment and the protection ground bar. Usually, one half of the cable is yellow; while the other half is green.
phase-locked loop	A circuit that consists essentially of a phase detector that compares the frequency of a voltage-controlled oscillator with that of an incoming carrier signal or reference-frequency generator. The output of the phase detector, after passing through a loop filter, is fed back to the voltage-controlled oscillator to keep it exactly in phase with the incoming or reference frequency.
PHY	See physical sublayer & physical layer
physical coding sublayer	A sublayer of the Ethernet PHY layer. The PCS performs autonegotiation and coding 8b/10b encoding.
physical layer	Layer 1 in the OSI mode that defines the means of transmitting raw bits over a physical link connecting network nodes.
PID	photonics integrated device

PIM-DM	protocol independent multicast-dense mode
PIM-SM	See protocol independent multicast sparse mode
PIN	See Positive Intrinsic Negative
PIR	See peak information rate
plesiochronous digital hierarchy	A multiplexing scheme of bit stuffing and byte interleaving. It multiplexes the minimum rate 64 kit/s into rates of 2 Mbit/s, 34 Mbit/s, 140 Mbit/s, and 565 Mbit/s.
PLL	See phase-locked loop
PMD	polarization mode dispersion
PMI	payload missing indication
POH	path overhead
point to multipoint	A communications network that provides a path from one location to multiple locations (from one to many).
Point-to-Point Protocol	A protocol on the data link layer that provides point-to-point transmission and encapsulates data packets on the network layer. It is located in layer 2 of the IP protocol stack.
Point-to-Point Protocol over Ethernet (PPPoE)	A network protocol used mainly with DSL services for encapsulating PPP frames in Ethernet frames. PPPoE offers standard PPP features such as authentication, encryption, and compression.
Pointer	An indicator whose value defines the frame offset of a virtual container with respect to the frame reference of the transport entity on which it is supported.
polarization dependent loss	A measure of the peak-to-peak insertion loss or gain variation caused by a component when stimulated by all possible polarization states. PDL is specified in dB.
policy and charging control	A functional entity defined in 3GPP R7 to provide the QoS control and service-based charging functions in a wireless bearer network.
POS	See packet over SDH/SONET
Positive Intrinsic Negative	A photodiode with a neutrally-doped intrinsic region separating the p-doped and n-doped semiconducting regions. It has fast linear response and is used in fiber-optic receivers.
power box	A direct current power distribution box at the upper part of a cabinet, which supplies power for the subracks in the cabinet.
power distribution box	A power box through which the power enters the cabinet and is redistributed to various components. The power distribution box also protects the electrical devices from current overload.
PPP	See Point-to-Point Protocol
PPPoE	See Point-to-Point Protocol over Ethernet
PRBS	See pseudo random binary sequence
PRC	primary reference clock
PRI	See primary rate interface
primary rate interface	An interface consisting of 23 channel Bs and a 64 kbit/s channel D that uses a T1 line, or consisting of 30 channel Bs and a channel D that uses an E1 line.

printed circuit board	A board used to mechanically support and electrically connect electronic components using conductive pathways, tracks, or traces, etched from copper sheets laminated onto a non-conductive substrate.
protection path	A path in a protection group that transports services when a fault occurs on the working path.
protection policy	A policy that defines the preferred protection mode for a trail. Protection modes include protected (trail protection or SNCP), unprotected, and extra traffic.
protocol independent multicast sparse mode	A PIM operational mode. PIM sparse mode constrains data distribution; packets are sent only if they are explicitly requested at the rendezvous point (RP). In sparse mode, receivers are widely distributed, and the assumption is that downstream networks will not necessarily use the datagrams that are sent to them.
pseudo random binary sequence	A sequence that is random in the sense that the value of each element is independent of the values of any of the other elements, similar to a real random sequence.
PSI	payload structure identifier
PSN	See packet switched network
PSTN	See public switched telephone network
PT	payload type
PTMP	See point to multipoint
PTN	packet transport network
PTP	point to point
public switched telephone network	A telecommunications network that provides telephone services for the public. It is sometimes called the plain old telephone service (POTS).

Q

QA	Q adaptation
QoS	See quality of service
quality of service	A measure of the performance of a service. QoS measures the quality of the transmission system and the effectiveness of the services, as well as the capability of a service provider to meet user requirements.

R

radio network controller	A device in a radio network subsystem that is in charge of controlling the usage and integrity of radio resources.
RAI	remote alarm indication
RAM	See random access memory
random access memory	Semiconductor-based memory that can be read and written by the CPU or other hardware devices. The storage locations can be accessed in any order.
Rapid Spanning Tree Protocol	An evolution of the Spanning Tree Protocol (STP) that provides faster spanning tree convergence after a topology change. The RSTP protocol is backward compatible with the STP protocol.

receiver sensitivity	The minimum acceptable value of mean received power at point Rn (a reference point at an input to a receiver optical connector) to achieve a $1x10^{-12}$ BER when the FEC is enabled.
reconfigurable optical add/drop multiplexer	A device that flexibly and dynamically adjusts the add/drop wavelengths of sites on a network by adjusting the pass-through or block status of the wavelengths. The ROADM does not affect service transmission on the main optical path, and supports optical power equalization at the channel level.
Reed-Solomon Code	A type of forward error correction code invented in 1960 by Irving Reed and Gustave Solomon that has become commonplace in modern digital communications.
reference clock	A stable and high-precision autonomous clock that provides frequencies as a reference for other clocks.
reflectance	The ratio of the reflected optical power to the incident optical power.
regenerator (REG)	A piece of equipment or device that regenerates electrical signals.
regeneration	The process of receiving and reconstructing a digital signal so that the amplitudes, waveforms and timing of its signal elements are constrained within specified limits.
REI	remote error indication
Resource Reservation Protocol	A protocol that reserves resources on every node along a path. RSVP is designed for an integrated services Internet.
RF	radio frequency
RFC	Request For Comments
RFI	remote failure indication
ring network	A network topology in which each node connects to exactly two other nodes, forming a circular pathway for signals.
RIP	See Routing Information Protocol
RMON	remote network monitoring
RNC	See radio network controller
ROADM	See reconfiguration optical add/drop multiplexer
route	The path that network traffic takes from its source to its destination. Routes can change dynamically.
Routing Information Protocol	A simple routing protocol that is part of the TCP/IP protocol suite. It determines a route based on the smallest hop count between the source and destination. RIP is a distance vector protocol that routinely broadcasts routing information to its neighboring routers and is known to waste bandwidth.
RS Code	See Reed-Solomon Code
RS232	A standard that defines the electrical characteristics, timing, and meaning of signals, and the physical size and pinout of connectors.
RSTP	See Rapid Spanning Tree Protocol
RSVP	See Resource Reservation Protocol
RZ	return to zero code

S

S1 byte	A byte that provides NEs with information regarding the quality of the clock reference source. Bits 5 to 8 of the S1 byte represent 16 different quality levels.
SAN	See storage area network
SAP	service access point
SAPI	source access point identifiers
SBS	stimulated Brillouin scattering
SC	See square connector
SD	See signal degrade
SD trigger flag	A flag that determines whether to perform switching when signal degradation occurs. The SD trigger flag can be set using the network management system.
SDH	See synchronous digital hierarchy
SDI	See Serial Digital Interface
SDP	serious disturbance period
Secure File Transfer Protocol	A network protocol designed to provide secure file transfer over SSH.
self-healing	A mechanism that enables an NE to establish a replacement connection by itself. When a connection fails, the NE finds and establishes a replacement connection without the need of the NMC, depending on available network resources.
Serial Digital Interface	An interface for transmitting digital signals.
Serial Line Interface Protocol	A protocol that defines a sequence of characters that frame IP packets on a serial line.
service level agreement	An agreement made between a customer and a service provider that defines the level of service the customer receives. An SLA may include traffic conditioning rules that constitute a traffic conditioning agreement.
service protection	A technique used to ensure that the protected services can be received at the receive end.
SES	See severely errored second
SETS	See synchronous equipment timing source
settings	User-defined parameters of a system or operation.
severely errored second	A one-second period that has a bit error ratio >= 10^{-3} or at least one defect.
SF	See signal fail
SFP	See small form-factor pluggable
SFTP	See Secure File Transfer Protocol
shockproof reinforcement	The process of fastening a cabinet to a cable tray or to the ceiling of an equipment room so that the cabinet remains sturdy.
shortcut menu	A menu that is displayed when a user right-clicks an object's name or icon. It is also referred to as a context menu.
side panel	The door on the side of a cabinet. It is used to protect the equipment inside the cabinet against unexpected touch and environment impact.

side mode suppression ratio	The ratio of the largest peak of the total source spectrum to the second largest peak.
signal cable	A term that collectively refers to E1 cables, network cables, and other non-subscriber signal cables.
signal degrade	An indication that the data has degraded; that is, a degraded defect (dDEG) condition is active.
signal fail	An indication that the data has failed; that is, a near-end defect condition (non-degrade defect) is active.
signal-to-noise ratio	The ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time. SNR is expressed as 10 times the logarithm of the power ratio and is usually expressed in dB.
Simple Network Management Protocol	A network management protocol of TCP/IP that enables remote users to view and modify the management information of network devices. SNMP agents monitor the activities of network devices and report these activities to the network console workstation.
single-ended switching	A protection mechanism that takes switching action only at the affected end of the protected entity in the case of a unidirectional failure.
single-mode fiber	An optical fiber through which only one type of light signal with a fixed wavelength can travel at a time. This type of fiber is used to transmit data over long distances.
SLA	See service level agreement
SLIP	See Serial Line Interface Protocol
SLM	single longitudinal mode
SM	section monitoring
small form-factor pluggable	A specification for a new generation of optical modular transceivers.
SMF	See single-mode fiber
SMSR	See side mode suppression ratio
SNCP	See subnetwork connection protection
SNCTP	See subnetwork connection tunnel protection
SNMP	See Simple Network Management Protocol
SNR	See signal to noise ratio
soft permanent connection	An ASON connection that features flexible and dynamic adjustment of routes. SPC includes different classes of services (CoS).
SONET	See synchronous optical network
span	The physical reach between two pieces of WDM equipment.
Spanning Tree Protocol	A protocol that ensures a loop-free topology for a bridged LAN. STP implements the IEEE 802.1D algorithm to create a spanning tree and disable the links that are not part of the spanning tree, leaving a single active path between any two network nodes.
SPC	See soft permanent connection
SPM	self phase modulation
SQL	See structured query language

square connector	One of two types of cable connector. The other type is a D-style connector.
SRLG	Shared Risk Link Group
SRS	stimulated Raman scattering
SSM	See Synchronization Status Message
SSMB	synchronization status message byte
SSU	synchronization supply unit
STM	synchronous transfer mode
STM-1	See Synchronous Transport Module level 1
STM-4	Synchronous Transport Module level 4
storage area network	An architecture that handles large data transfers. A SAN is used to attach remote storage devices, such as disk arrays and tape libraries, to servers in such a way that they appear as locally attached devices to the operating system.
STP	See Spanning Tree Protocol
structured query language	A programming language widely used for accessing, updating, managing, and querying data in a relational database.
subnet	A logical subdivision of a network. A subnetwork, or subnet, typically consists of all the network devices at one geographical location; for example, in a building or on a LAN. Subnetting can improve network security and performance.
sub-network number	The ID of a subnet that is used to differentiate subnets for a sub-network conference.
subnet mask	A number of bits that separate network information and host information in a Class A, B, or C IP address. A subnet mask allows the creation of sub-networks.
subnetwork connection protection	A scheme that allows a working subnetwork connection to be replaced by a protection subnetwork connection if the working subnetwork connection fails or if its performance falls below a specified level.
subnetwork connection tunnel protection	A scheme that provides VC-4 level channel protection. When the working channel is faulty, the services of an entire VC-4 path can be switched over to the protection channel.
support	A frame used to support and fix a cabinet on the ESD floor. The support raises a cabinet above floor level, allowing cable access from underneath the cabinet.
suppression state	An attribute that determines whether an NE monitors a specified alarm. An NE will not monitor alarm conditions for an alarm in the suppression state, and the alarm will not occur even when alarm conditions are met.
switching priority	A priority assigned to boards that share protection. If multiple boards that are sharing protection fail, the services of the board with the highest priority are switched to the protection board. If two or more boards have the same priority, the services of whichever board fails first are switched.
Synchronization Status Message	A message that carries the quality levels of timing signals on a synchronous timing link. SSM messages provide upstream clock information to nodes on an SDH network or synchronization network.
synchronize NE time	To send the system time of the server of the network management system to NEs so as to synchronize all NEs with the server.

synchronous digital hierarchy	A transmission scheme that follows ITU-T G.707, G.708, and G.709. SDH defines the transmission features of digital signals, such as frame structure, multiplexing mode, transmission rate level, and interface code. SDH is an important part of ISDN and B-ISDN.
synchronous equipment timing source	A function that represents the SDH network element clock and provides timing reference to multiplexing equipment.
synchronous optical network	A high-speed synchronous network specification that supports transmission on optical media. SONET supports transmission at speeds of up to almost 2.5 Gbit/s.
Synchronous Transport Module level 1	Synchronous transfer mode at 155 Mbit/s.

T

TCM	tandem connection monitor
TCP	See Transmission Control Protocol
TDM	See time division multiplexing
TE	See traffic engineering
telecommunications management network	A protocol model defined by ITU-T for managing open systems in a communications network. TMN manages the planning, provisioning, installation, and OAM of equipment, networks, and services.
terminal multiplexer	A device used at a network terminal either to multiplex multiple channels of low rate signals into one channel of high rate signals, or to demultiplex one channel of high rate signals into multiple channels of low rate signals.
TFTP	See Trivial File Transfer Protocol
TIM	trace identifier mismatch
time division multiplexing	A technique that divides a transmission channel into successive time slots, thereby allowing multiple digital signals to be transmitted over a single channel.
timeslot	A repeating period of time on a transmission channel in which two devices are able to interconnect.
time synchronization	The process of synchronizing the time of a network device with UTC time. In order to achieve time synchronization, the start time of the network device must accord exactly with UTC time.
time to live	A specified period of time for best-effort delivery systems to prevent packets from looping endlessly.
TL1	Transaction Language 1
TLV	type-length-value
TM	See terminal multiplexer
TMN	See Telecommunication Management Network
TP	traffic policing

traffic engineering	A technology that is used to dynamically monitor network traffic and the load of NEs, to adjust in real time parameters such as traffic management, route, and resource restriction, and to optimize the utilization of network resources.
Transmission Control Protocol	A core protocol of the Internet protocol suite that manages the breakup of data messages into packets to be sent via IP (Internet Protocol) and the reassembly and verification of messages received by IP. TCP uses sequenced acknowledgement and retransmission of packets when necessary to provide a reliable delivery stream and virtual connection service to applications.
tray	A component that can be installed in a cabinet for holding chassis or other components.
tributary unit group	A group that contains one or more Tributary Units, which occupies fixed and defined positions in a higher-order VC-n payload.
Trivial File Transfer Protocol	A small and simple alternative to FTP for transferring files. TFTP is intended for applications that do not need complex interactions between the client and server. TFTP restricts operations to simple file transfers and does not provide authentication.
trTCM	two rate three color marker
TTI	trail trace identifier
TTL	See time to live
TU	tributary unit
TUG	See tributary unit group

U

UAS	unavailable second
UAT	See unavailable time event
UDP	See User Datagram Protocol
unavailable time event	An event that is reported when the monitored object generates 10 consecutive severely errored seconds.
UNI	See user network interface
unprotected	Pertaining to the transmission of services that are not protected. Unprotected services cannot be switched to the protection channel if the working channel is faulty or the service is interrupted, because protection is not configured.
User Datagram Protocol	A TCP/IP standard protocol that allows an application program on one device to send a datagram to an application program on another. UDP uses IP to deliver datagrams. UDP provides application programs with the unreliable connectionless packet delivery service. That is, UDP messages may be lost, duplicated, delayed, or delivered out of order. The destination device does not actively confirm whether the correct data packet is received.
user-to-network interface	The interface between user equipment and private or public network equipment (for example, ATM switches).

V

VB	virtual bridge

VC	See virtual container
VCG	See virtual concatenation group
VCI	See virtual channel identifier
virtual channel identifier	A 16-bit field in an ATM cell header that is used for channel identification. Each VCI works with a virtual path identifier (VPI) to ensure end-to-end data packet transfer.
virtual concatenation group	A group of co-located member trail termination functions that are connected to the same virtual concatenation link.
virtual container	An information structure used to support path layer connections in the SDH. A VC consists of a payload and path overhead (POH), which are organized in a block frame structure that repeats every 125 μs or 500 μs.
virtual local area network	A logical group of network devices that are not necessarily on the same physical network segment, but that are configured so they appear to be on the same LAN.
virtual path identifier	The field in the Asynchronous Transfer Mode (ATM) cell header that identifies to which virtual path the cell belongs.
virtual private network	A system configuration in which the subscriber can build a private network via connections to different network switches that may include private network capabilities.
VLAN	See virtual local area network
VOA	Variable Optical Attenuator
voice over IP	A set of facilities used to manage the delivery of voice information over the Internet. VoIP involves sending voice information in a digital form in discrete packets rather than using the traditional circuit-committed protocols of the public switched telephone network (PSTN).
VoIP	See voice over IP
VPI	See virtual path identifier
VPN	See virtual private network
VRRP	Virtual Router Redundancy Protocol

W

WAN	See wide area network
wavelength division multiplexing	A technology that enables multiple wavelengths with specific channel spacing to be transmitted over the same fiber.
WDM	See wavelength division multiplexing
WEEE	waste electrical and electronic equipment
wide area network	A network that covers a broad area such as a state, a country, or even the entire world. A WAN often connects multiple smaller networks such as LANs or MANs. The Internet is a good example of a WAN.
working path	A path in a protection group that transports services under normal conditions. If a fault occurs on the working path, services are switched to the protection path.
WRR	weighted round robin
WSS	wavelength selective switching

WTR	wait to restore
WXCP	wavelength cross-connection protection

X

XFP	10-GB small form-factor pluggable transceiver
XPM	cross-phase modulation