

OLT Optical Line Terminal

User Manual

Manual

Version

This guide is used for EPON OLT system R1.0.0.

Content Introduction

This manual mainly introduce OLT produced by our company: feature, network, hardware, hardware installation, port and cable distribution, troubleshooting and the technical parameters, etc.

Audience

- ◆ Installation engineers
- ◆ Maintenance engineers
- ◆ Training staff

The related manual

You can refer to the following information when read this manual:

- 《Optical Line Terminal CLI Operation Manual》




Conventions

This guide makes some conventions for formats, conventions and action. You can refer to the following table to facilitate your understanding for it

Format Convention:

Form at	Explanation
Courier New character	Courier New character indicates screen end show, include: configuration file, system output file, command,etc. Other also include input content by the user manually, and bold. For example: Password: *****.
< >	Text enclosed in angle brackets represents user interface buttons and keyboard function keys. Example: Click <OK>.
<Key1+key2>	Indicate the user need press these keys at the same time. For example<Ctrl + Shift+ D> indicates to press Ctrl, Shift and D keys.
[]	Text enclosed in square brackets represents menu items, data table and field name such as [File] and [File/New].
" "	Indicate Single box, check box, tab, list box, window

Notice Icon Description:

Icon	Notice Type	Description
	Note	Explanation of the current content, providing more information related with the current subject
	Caution	Alert information that the potential damage to a program, data, system, or device. It may result in minor or moderate damage if not avoided. It may also alert against unsafe practices and the potential program, data, system or device damage.
	Warn	Operation alert information that may cause an accident, personal injury, fatality or the potential electrical hazard. If not avoided, would result in the serious injury or even death

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1 Overview

1.1 GEPON System Introduction

GEPON (Gigabit Ethernet Passive Optical Network) is consist of OLT (Optical Line Terminal), ONU (Optical Network Unit) and the optical splitter. OLT provides the uplink Ethernet port which is connected to IP core network, and meanwhile offers the downlink PON ports. Every PON port is connected to the optical splitter by the single optical fiber, and then connected to ONU according to the certain ratio

GEPON OLT – OPM production series provide the higher access bandwidth, more terminal users, and effectively decrease the project operation and investment cost. So it's the ideal FTTx solution for operators.

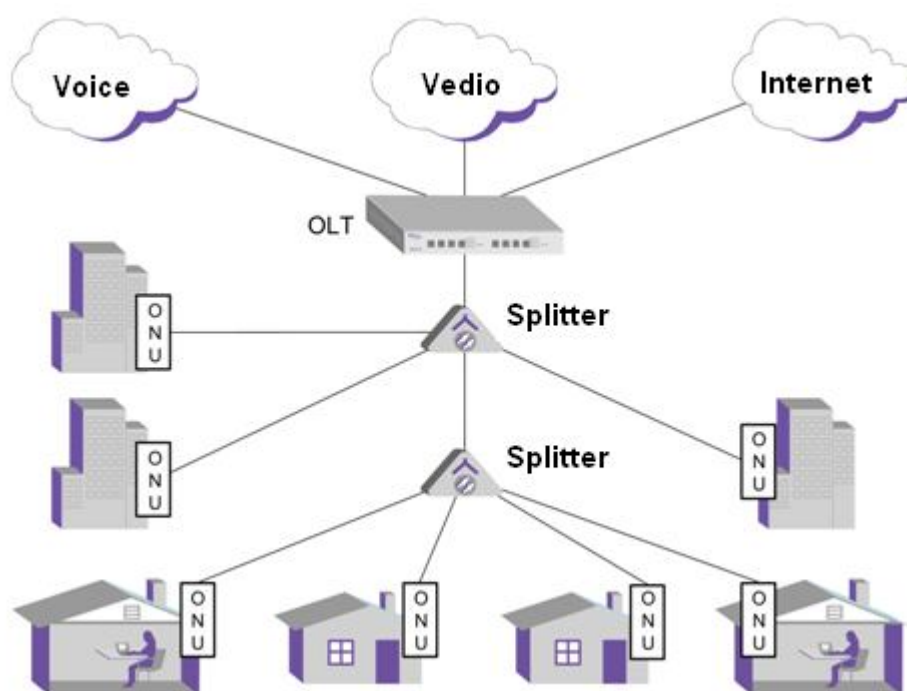


Figure1-1 GEPON System Network

1.2 OLT Introduction

OLT is a equipment integrating L2/L3 switch function in GEPON system.

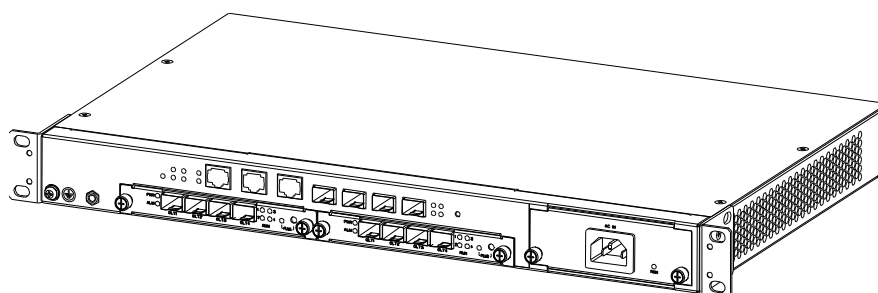


Figure1-2 OLT External View with AC Power Supply

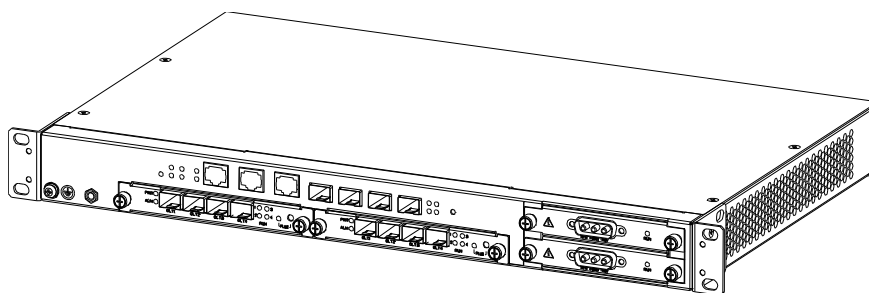


Figure1-3 OLT External View with DC Power Supply

OLT Features:

- 1U height, the installation is simple and flexible
- Follow IEEE802.3ah standard
- Support 1:64 splitting ratio, High utilization rate of optical fiber
- Support the transmission distance 20 kilometers
- Offer L2/L3 switch function
- Support ACL
- Support DBA(Dynamic Bandwidth Allocation)
- QoS supports IEEE802.1p, IP Precedence, DSCP IP
- ONU automatic identification
- MAC address limitation
- Have AES-128 encryption technology
- Support IGMP Snooping
- Support OAM
- Support IEEE802.1x
- Provide NMS based on SNMP, GUI interface, and support in-band and out-band management

1.3 OLT Application

Figure 1-4 is the typical GEAPON system application, OLT is used in the center end for operators, ONU is used in the customers' place. As the FTTx solution, there are the following features:

- Each OLT uplink can offer up to 1Gbps bandwidth, support high-speed internet, IPTV multicast/VoD, etc high bandwidth IP data service.
- OLT downlink can support up to 512 ONU customers by the optical splitter
- It's the passive optical network between OLT and ONU, greatly reduce the optical cable line investment for operators

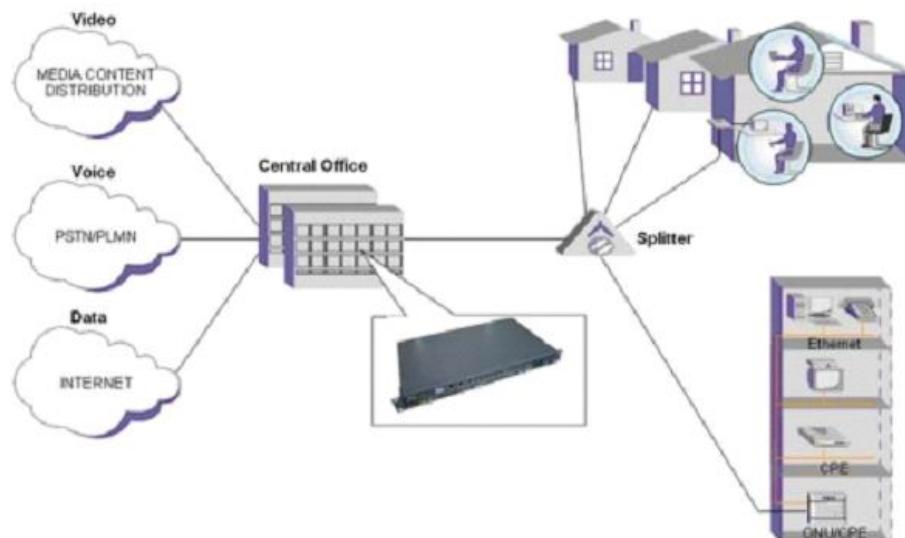


Figure 1-4 OLT Application Network

1.4 Hardware Composition

OLT equipment contains the following parts:

- One rack
- One CSM (Control and Switch Module)
- Two ELM (EPON Link Module, PON card)
- Two redundancy protection -48V DC power supply modules or one 110/220V AC power supply module
- Three Fans

In the above parts, PON card and power supply support hot Swap. Other module is built inside.

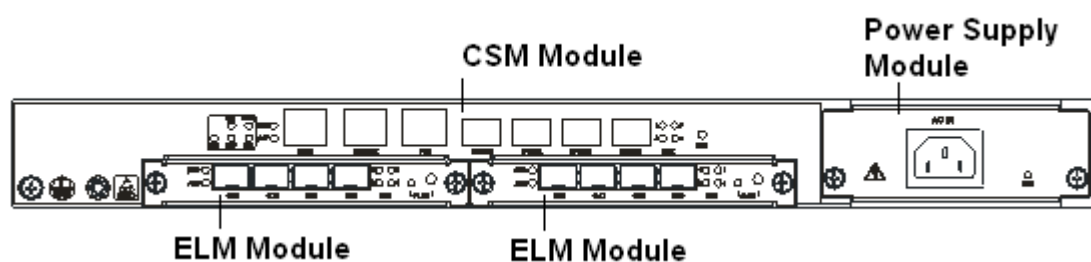


Figure 1-5 OLT hardware Composition (AC)

1.4.1 Machine Frame

The rack is 1U, can be mounted into the standard 19" rack

Dimension of machine frame: 440 mm (Length) x 275 mm (Width) x 43.6 mm (Height).

As shown below:

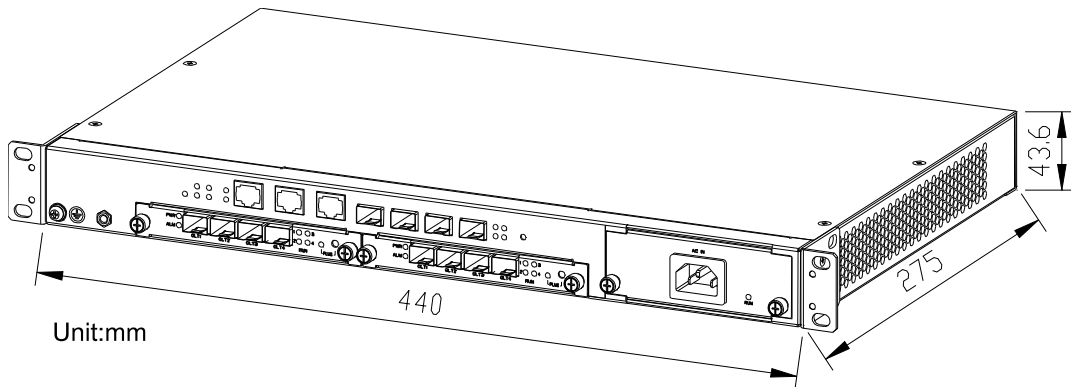


Figure 1-6 Front View of OLT Machine Frame (AC)

1.4.2 CSM

CSM (Control and Switch Module) is the main module of OLT, offer the in-band and out-band system management, switch and aggregation function. As shown in the following Figure:

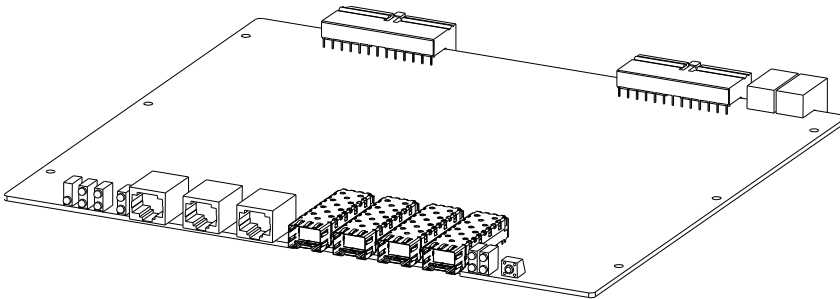


Figure 1-7 CSM Front View (Without SFP Module)

CSM offer the following ports:

- One Console port with RJ45
- One Management port with RJ45
- One COM port with RJ45
- Four GE uplink ports support SFP (Small Form-factor Pluggable) to transmit and receive signal, and support both the optical module and the electrical module.

1.4.3 ELM

ELM (EPON Link Module) is the business card of OLT system. As shown below:

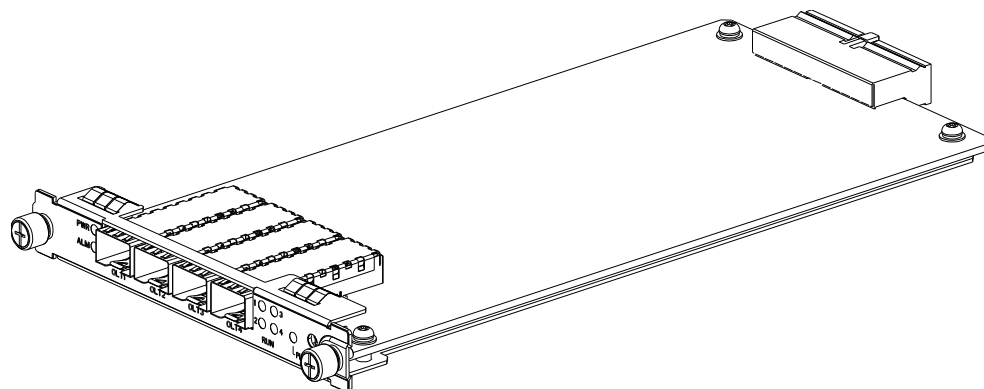


Figure 1-8 ELM Front View (Without SFP module)

Each ELM offer four PON ports, SFP module is the optical module.

1.4.4 Power supply Module

Power supply offers the stable work power for the system.

- Receive the input voltage from outside
 - DC power supply is -48V (Allow: $-36 \sim -72\text{V}$)
 - AC power supply is $110\text{V}/220\text{V}$ (Allow: $85 \sim 264\text{V}$)
- Offer power supply for all components in the system
- Offer protection against input voltage, already passed ITU-T K.20 test.



Note: *ITU-T K.20 is the capacity test about protection again overcurrent, and input voltage for the telecom equipment by the international Telecom Union*

- **AC power supply confirms to CCC authentication.**

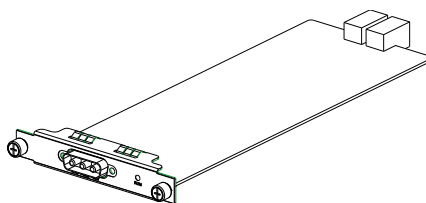


Figure 1-9 DC Power Supply Module

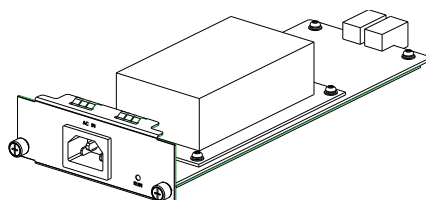


Figure 1-10 AC Power Supply Module

1.4.5 Fan

Fan is used to cool forcibly for the system. The Figure 1-11 below is the front view of fan.

Three 12V fans are equipped in the machine frame. There will be fan alarm when any fan breaks down. The fan has the characteristics of long life and low noise.

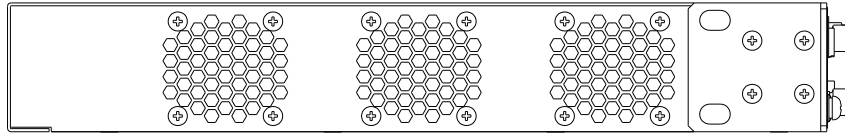


Figure 1-11 Fan Front View

1.5 Port and Indicator

The port on the front panel of OLT:

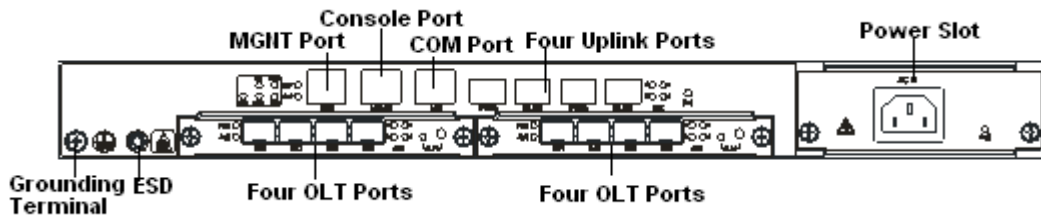


Figure 1-12 OLT Port Diagram (AC)

The simple explanation for the port on the front panel of OLT is shown below. Please refer to the forth chapter about the detailed description for ports.

Table 1-1 OLT Port Explanation

Port	Explanation
Grounding Terminal	One, it's in the left of the front panel and is used to grounding for machine frame
ESD	One, used for the anti-static protection
Power supply slot	There are two module when use DC power supply; or there is one when use AC power supply.
MGNT Port	RJ45, offer the out-band management port
CONSOLE Port	RJ45, offer the system diagnosis
COM Port	RJ45, offer alarm communication
Uplink Port	Four GE ports which is connected with the uplink equipment after the business is aggregated.
PON Port	Maximum 8 PON ports, and is connected with ONU by the optical splitter

Please refer to Table 1-2 about LED and button on the front panel of OLT .

Table 1-2 LED and Button on the Front Panel of OLT

Type	Identification	Status	Indication
CSM Indicator	FAN	Green	Fan work normally
		Red	Fan breaks down
	PWR	Green , Always ON	Normal
		OFF	Power supply breaks down
	MIN	Yellow, always ON	Minor alarm
		OFF	No Minor alarm
	MAJ	Red, always ON	Major alarm
		OFF	No major alarm
	CRI	Red, always ON	Major alarm
		OFF	No major alarm
	LINK	Flash	There is the communication data at MGNT
		Green , Always ON	MGNT port is connected
		OFF	MGNT port isn't connected
	SPD	Yellow, always ON	Work rate of MGNT port is 100Mbps/s
		OFF	Work rate of MGNT port is 10Mbps/s
	LINK n (n = 1/2/3/4)	Flash	There i s the communication data at the uplink port(n)(n = 1/2/3/4)
		Green , Always ON	The uplink port(n)(n = 1/2/3/4) is connected
		OFF	The uplink port(n)(n = 1/2/3/4) isn't connected
Reset CSM	RST	No Display	Start OLT system after press Reset button
ELM	PWR	Green , Always ON	ELM is power on
		OFF	There is no power supply for ELM
	ALM	Red, always ON	ELM card is abnormal
		OFF	PON link is normal
	PLUG&LED	Yellow, always ON	PON link isn't normal
		OFF	There i s no power supply for PON card or PON card can't be inserted
		Flash	PON card is waiting that OLT system confirm the hot-swap requirement
	RUN n (n = 1/2/3/4)	Flash	There is communication data at OLT port
Green , Always ON		Management status of OLT port is ON, and the optical fiber link is normal.	

Type	Identification	Status	Indication
		OFF	Management status of OLT port is OFF
		Red, always ON	Management status of OLT port is OFF, and the optical fiber link is unconnected
Hot swap button on ELM	PLUG & BUTTON	No display	It indicate to sent the hot-swap request if press the button.
Power supply indicator	RUN	Green , Always ON	Normal Power supply
		OFF	Power supply is unconnected

2 Pre-installation Preparation

2.1 Power Requirement

The input voltage must be stable, no EMI noise and distortion.

When use DC power supply, the input voltage is -48VDC, the allowed range is -36 ~ -72 VDC.

When use AC power supply, the input voltage is 110/220VAC, the allowed range is 85 ~ 264VAC.



Note: Follow all security specification and the rule about the electricity in the locality or the building. All power supply must be legal.

2.2 Equipment Ground

The grounding body must be configured in the machine room, the grounding resistance value is less than 1Ω.. It can be realize by layout the anti-static copper nose.

2.3 Room Design Requirements

The environment of the equipment operation has very big effect on its long-term reliable operation .Room design requests to up to the following standards:

- The device allows room temperature is 0 ° C ~ 40 ° C. To ensure that equipment works in the normal temperature environment (25 ° C or so), should try to make the equipment away from the main heat source (such as power supply, etc.), if the environment temperature is higher than 40 ° C, should try to improve the ventilated condition of the room, such as install fan in the frame or air-conditioning in the room. The ventilation pipe in the room should be swept clean and ventilated, etc.;
- There must be the good cable wiring and go line space in the room. Cable and optical cable wiring (including fiber splicing work) are already in place.
- The related humidity 10%~95%, No condensation, no frost;

- The dust particles density with more than $5\mu\text{m}$ in diameter $\leq 3.0 \times 10^4/\text{m}^3$; Dust particles is a non-conductive, the non-magnetic and the non-corrosive;
- Absolute altitude: 0 ~ 2540 meters
- The security range of field intensity is: field intensity $< 140\text{dB}$ ($\mu\text{V/m}$) , Frequency range $10\text{KHz} \sim 10\text{GHz}$

3 Hardware Installation

OLT Installation Process:

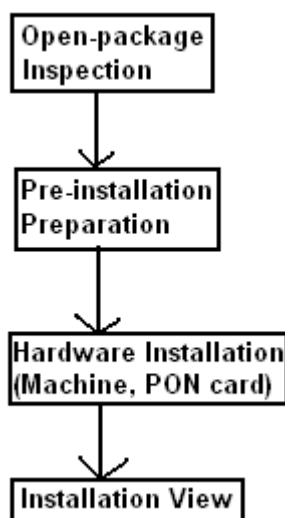


Figure 3-1 OLT Hardware Installation Process

3.1 Open-package Inspection

Check and verify the goods, if any component is loss or damaged, please contact with the customer service center.

The list includes the following content:

- 1 OLT Machine Frame(1 Pcs)

ELM and SFP modules are ordered according to user requirement, The package for ELM and SFP module is a separate box with OLT machine frame

- 2 DC power line (Two) or AC power line (One)
- 3 Install accessory case

All accessories are packaged in the built-in package, include:

- RS232 Console line with 1.5 meter (one)
- Grounding line with 1.5 meter (one)
- M6 frame nuts (Four)
- M6x16bolt (Four)

3.2 Pre-installation Preparation

Verify the following working environment and installation requirements

- 1 Power Supply Requirement:
 - AC power supply: -48V DC, the allowed range:-36VDC~ -72 VDC
 - DC power supply: 110/220V AC, the allowed range: 85 ~ 264VAC
- 2 The equipment should be equipped in the dry, cool place, at least have 10 centimeters at both sides for the ventilation space.
- 3 Avoid the direct light, far away from the heat source or the place with the stronger electromagnetic interference
- 4 If want to install OLT inside the rack, ensure that have the necessary mounting screws and nuts and necessary tools.
- 5 Check the required cable and connectors for installation
- 6 In the system management, need connect the following equipment with OLT:
 - A management platform, such as PC
 - RJ45/DB9 RS232 Console line



Note: Contain Console line in OLT package.

3.3 OLT Machine Frame Installation

OLT can be put in the bigger horizontal surface or within the standard EIA 19 " rack. In addition to the basic unit installation, the optional module can be installed according to the system requirements.

3.3.1 Plane stack installation

OLT can stack in the any enough large horizontal surfaces, as shown below:

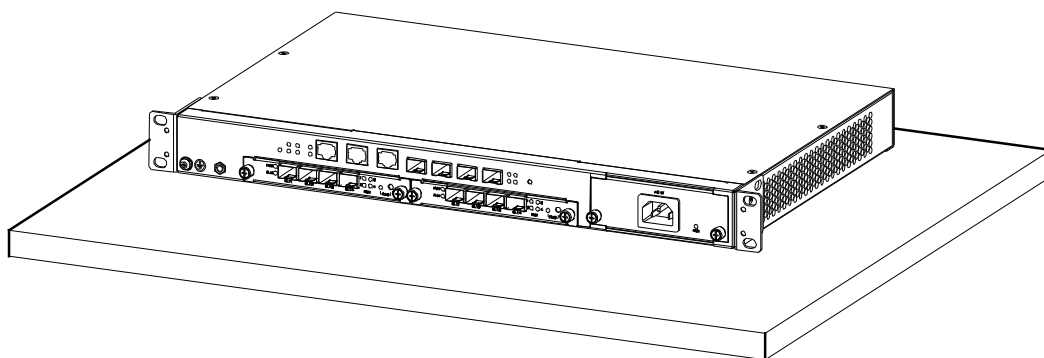


Figure 3-2 OLT Plane Installation Diagram

3.3.2 Rack Installation

OLT equipment can be installed inside 19" rack which is compliance with ETSI

standard. The company can provide the standard 19" frame, including indoor and outdoor type rack. OLT rack diagram as shown in Figure 3-3 installation shown:

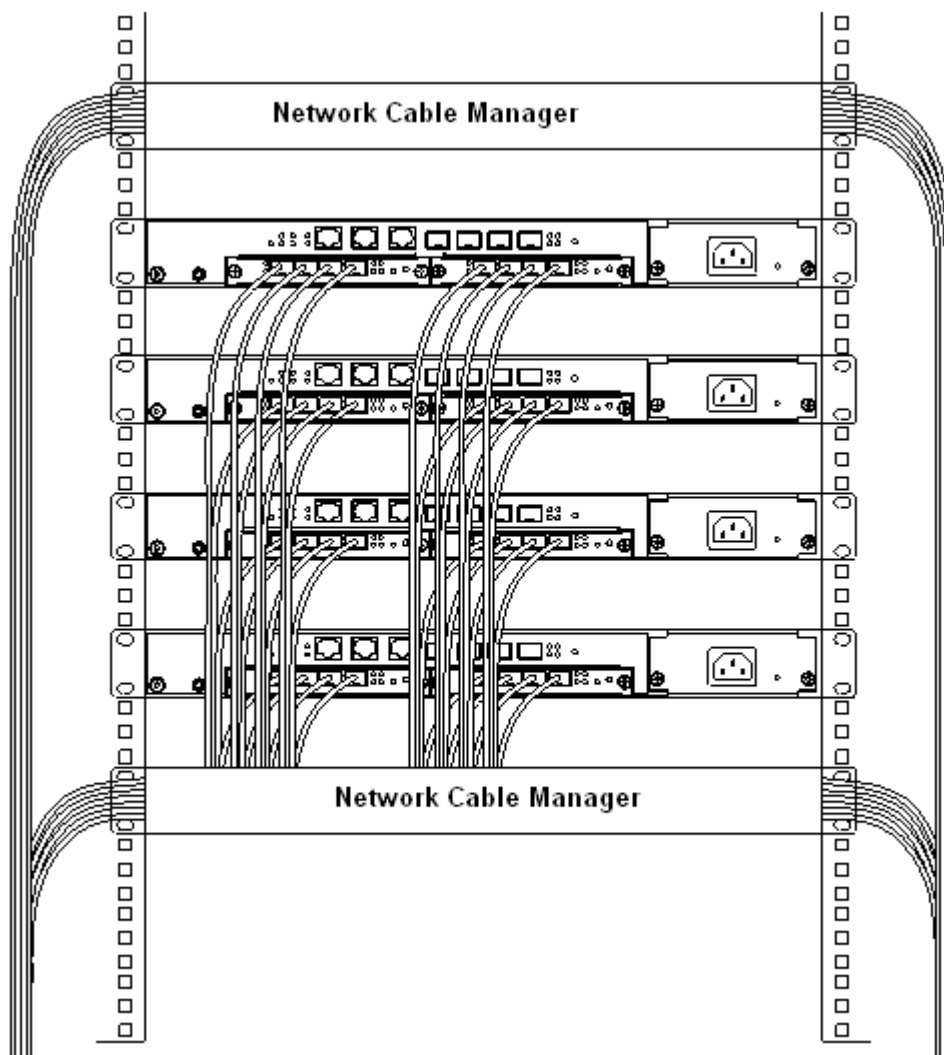


Figure 3-3 OLT Rack Installation Diagram

3.3.3 Installation Process

Below with OLT installation as an example, and explain how to install OLT.

- 1 Adopt the supported plate and screws provided in the installation package
- 2 Fix the supported plate at both sides of OLT by the cross screwdriver
- 3 Aim holes in the supported plate to the holes in the rack, and then fix OLT in the rack with the provided screws.

If need install ELM, to complete the following two steps:

- a Unscrew the empty panel screw, and remove the empty panel
 - b Insert ELM into OLT machine frame, refer to ELM installation about the specific ELM installation instructions.
- 4 Install SFP module on CSM and ELM

- 5 Connect each port of OLT, please refer to **the forth chapter** about the port and connection introduction.
 - a Connect ports at both uplink and downlink
 - b Connect power supply line
 - c According to the customer's requirement, connect MGNT and Console port.
- 6 System will start automatically after power supply is connected.

3.4 ELM Installation

The operators must wear the anti-static wrist strap, pay attention to ESD protection (ESD), when insert or take down PON card, see figure 3-4



Note: *Except in the environment without the electrostatic interference, otherwise don't take each board from anti-static pocket. Many electronic plate are susceptible to be damaged by electrostatic release (ESD). ESD damage will not immediately be obvious, it can lead to the partial collapse of semiconductor equipment, and won't cause the instant failure.*

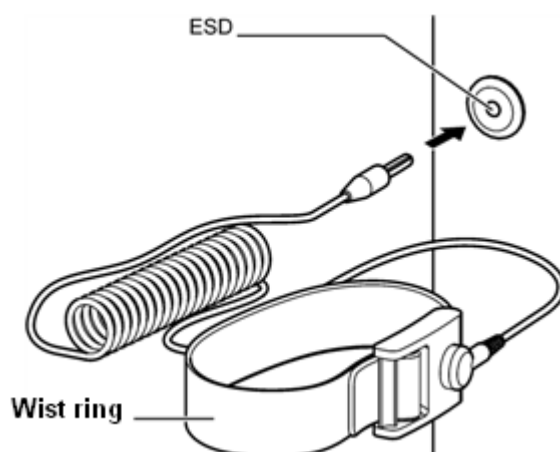
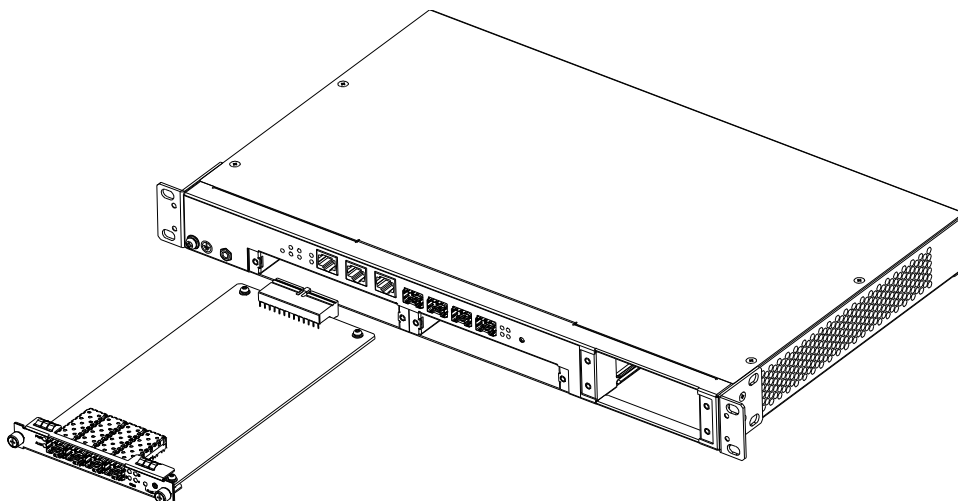


Figure 3-4 Wear anti-static wrist ring and grounding

ELM Installation Step:

- 1 Take out PON card from the anti-static protection bag, check whether PON card is intact, and whether it's PON card.
- 2 Check and ensure there is no foreign object in the machine frame and slot.
- 3 According to PON card configuration plan to ensure the specific installing position of PON card.
- 4 Pinch the left and right sides of the front panel of PON card with two hands, and insert it into the slot, as shown below:



Picture 3-5 ELM Installation Diagram



Alarm: When plug PON card, it's forbidden to touch the devices and line on the circuit board.

- 5 Along the guide rail, carefully plug PON card into the slot
- 6 Tighten the left and right nuts on the front panel of PON card



Note: When pull out PON card, loosen nuts on both sides firstly.

3.5 Installation Review

After complete hardware installation, please to review according to the following request:

- All screws and nuts on the machine frame, PON card are tightened;
- Verify whether there is a lack of needle on power supply socket, or short circuit phenomenon
- The right position for power outlet, make the power line to tighten lest the electricity was suddenly cut off;
- All labels on the equipment are neat and clean with the clear writing, and be stucked on the correct position.

4 Port and Connection

The chapter describes the port and power supply connection situation in OLT system, mainly include the following parts:

- [MGNT Port](#)
- [Console Port](#)
- [Power Supply Connection](#)
- [Grounding Terminal](#)

- Uplink Ports
- PON Ports



Note: COM port is reserved for alarm communication port in the system. Here not introduce.

Please carefully read the following introduction before connecting each port of OLT:

4.1 MGNT Port

Connection Occasion: Perform the out-band management from PC to OLT

The provided cables in the packaged case: One category 5 cable with 2.1 meter

4.1.1 Port Explanation

OLT MGNT (Management port) is RJ45 connector, the cable is UTP (Unshielded Twisted-Pair)

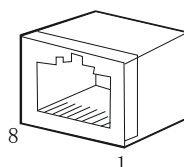


Figure 4-1 RJ45 Port

The follow features decide the cable type used for OLT MGNT port:

- 10/100Base-T auto-adaptation

When the equipment on the opposite end also support 10/100Base-T auto-adaptation, category 5 cable is recommended, and the cable length is less than 100 meters.



Note: Category 3, 4, 5 cables are suitable for 10M connection; category 5 cable is suitable for 100M connection. Category 3, 4, 5 cables also is called Ethernet cables.

- Can automatically identify the type of Ethernet cables

When the equipment on the opposite end also can automatically identify the cable type, either the straight-through cable or the cross cable is ok.

4.1.2 Port Connection

UTP cable with RJ45 connectors at both sides, one end is connected with OLT MGNT port, another end is connected to network port of PC.

Connection Process:

- 1 Prepare the network equipment need to be connected, ensure these devices are equipped with 10 base-t 100 or BASE-TX network interface board (NIC). These NIC will be connected to OLT MGNT port.
- 2 Prepare a the straight-through or the cross UTP cable with RJ45 connectors at both side, adopt category 3, 4, or 5 cable to be connected to 10Mbps, and category 5 cable is connected to 100Mbps.



Note: It's advised that all network connection adopt category 5 cable, which is convenient to upgrade to the high-speed Ethernet device.

- 3 One end of the cable is connected to RJ45 port on the network equipment, another end is connected to OLT MGNT port. Ensure the plug is inserted into the correct position, thus guarantee the good contract.

4.1.3 Method of making cable

The below figure introduces pin marks of RJ45 connector:

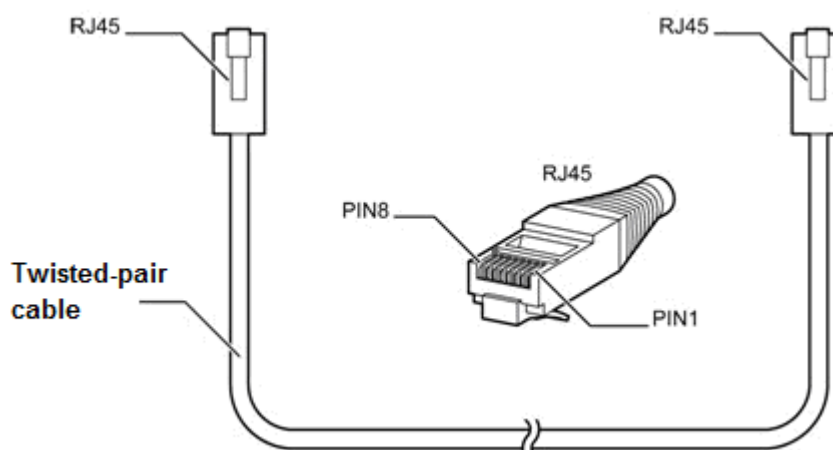


Figure 4-2 RJ45 PIN Mark

About twisted-pair cable and wiring sequence of RJ45 each pin, there are two specifications EIA/TIA 568 A and EIA/TIA 568 B. Under these two conventions, the connection relationship between each end of twisted pair and RJ45 pin is shown in the table 4-1below:

Table 4-1 Connection relationship between each end of twisted pair and RJ45 pin

EIA/TIA 568A Connection Specification		EIA/TIA 568B Connection Specification	
RJ45 Pin	Twisted-pair cable end	RJ45 Pin	Twisted-pair cable end
1	White and Green	1	White and Orange
2	Green	2	Orange
3	White and Orange	3	White and Green
4	Blue	4	Blue
5	White and Blue	5	White and Blue
6	Orange	6	Green
7	White and Brown	7	White and Brown
8	Brown	8	Brown

There are two kinds of cable in the actual application: the straight-through cable and the cross cable. All physical matters are the same for both cables, the difference is the connection sequence between twisted-pair cable end and RJ45 pin. The connection relationship between two cables is shown below:

Table 4-2 connection sequence between twisted-pair cable end and RJ45 pin and application occasion

	Standard Network Cable	Cross Cable
Line sequence of cable A end	Follow 568A(or 568B)	Follow 568A
Line sequence of cable B end	Follow 568A(or 568B)	Follow 568B
Line Sequence Contrast	Line sequence at both sides must be the same, both follow 568A, or both follow 568B.	One end follows 568A, another end follow 568B.
The characteristics of line sequence	Line sequence is one-to-one correspondence.	1 and 3 is cross-connected, 2 and 6 is cross-connected, know as "1326" relationship
Application Occasion	OLT's MGNT port is connected with HUB	OLT MGNT port is connected with the port of network management PC
	OLT's MGNT port is connected with the opposite equipment(equipments both sides can automatically identify the network cable type)	

4.1.4 Port Management (Out-band)

The remote management can be performed at the specified Management Port on OLT

Before login OLT by Management Port, the user need configure its IP address and subnet mask according to network requirement. Refer to 《Optical Line Terminal CLI Operation Guide》.

4.2 Console Port

Connection Occasion: Direct access from PC to OLT

Cable packaged in the case: One RS232 Console line with 1.8 meters

4.2.1 Port Explanation

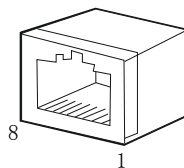


Figure 4-3 RJ45 Port

4.2.2 Port Line

OLT has offered one Console cable which is used to connect OLT Console port. RJ45 end of this cable is connected with OLT, another end DB9 connector is connected with PC.

4.2.3 Method of making cable

We offer the straight-through cable when ship goods. Please refer to figure 4-4 if you need make cable on the site.

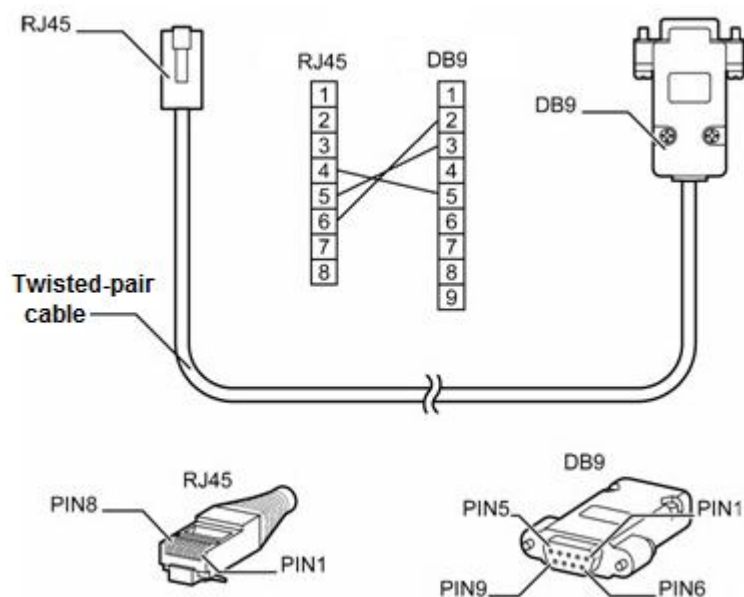


Figure 4-4 Straight-through cable explanation

Note: if the user makes the above specification console cable, request the cable length is less than 3 meters.

4.2.4 Port Management

Start OLT by console port with the straight-through cable, access and manage OLT by CLI command.

4.3 Power Supply Connection

4.3.1 AC Power Supply

About AC power supply connection, connect AC power supply line to OLT power slot and power socket of power supply, as shown in the below figure 4-5:

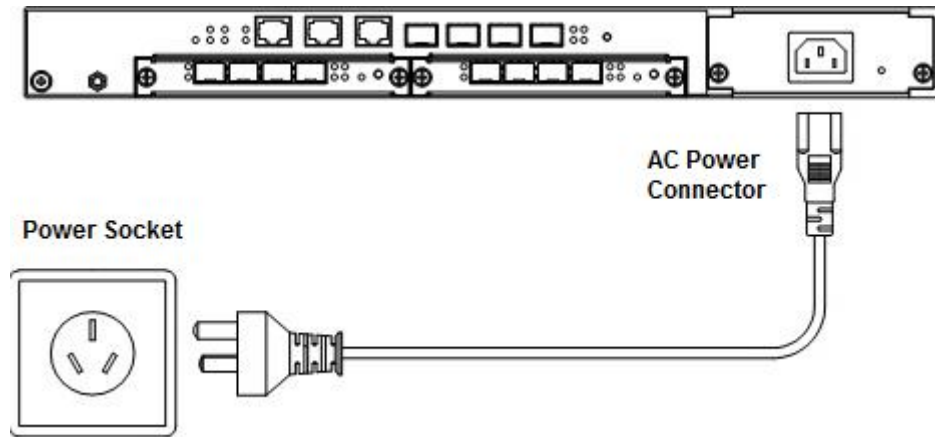


Figure 4-5 Power Supply Connection Diagram

⚡ Alarm: Must pull out power supply before pulling out AC power supply module

4.3.2 DC Power Supply

4.3.2.1 Port Explanation

OLT can be configured two DC power modules as redundancy backup.

The below is the diagram of power supply slot.

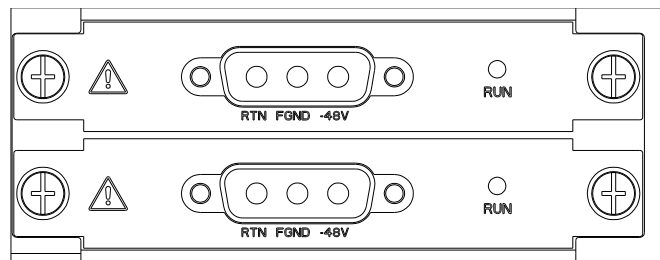


Figure 4-6 Power Supply Slot

The below is the diagram of the power line connector and cable

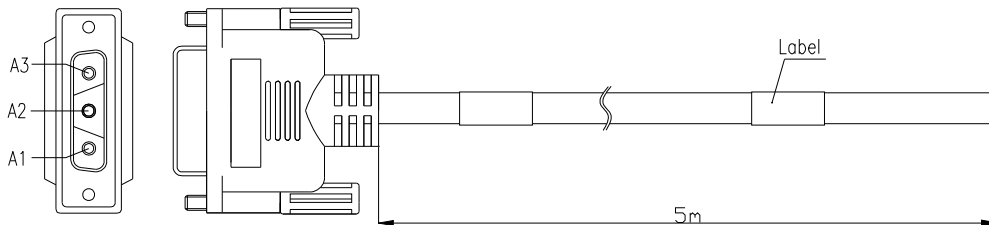


Figure 4-7 Power Line

Table 4-3 The mark for the connector of power line and the cable

Power supply slot mark		Mark for power supply connector and the cable	
Slot identifier	Signal Name	PIN Number	Power line color
RTN	Power supply reflow GND	A1	Black
FGND	Machine Frame PGND	A2	Yellow and Green
-48V	Positive power supply	A3	Blue



Note: If make power supply line, please ensure the length is between 1.5m-4.5m.

4.3.2.2 Power Supply Connection

When two power supplies are redundancy work, it need two power supply lines.

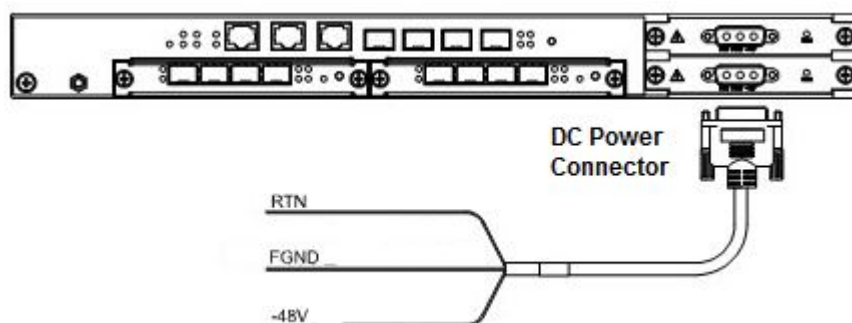


Figure 4-8 Power Connection Diagram

Table 4-2 Line Sequence Connection in power connection diagram

Slot Mark	Power Supply Line	Power adapter
-48V	Blue	-48V
RTN	Black	Power supply reflow GND
FGND	Yellow and Green	Machine Frame PGND

4.4 Grounding Terminal

There is grounding terminal on the left side of the machine frame, the user can install the ground cable according to the site situation.

4.4.1 Grounding Terminal Connection

Take out the grounding wire with 1.5 meters from the packing case, the end of copper nose is connected to Grounding terminal of OLT, another end is connected to any PGND listed below:

- PDP PGND
- Machine frame PGND
- Distribution frame PGND in the room

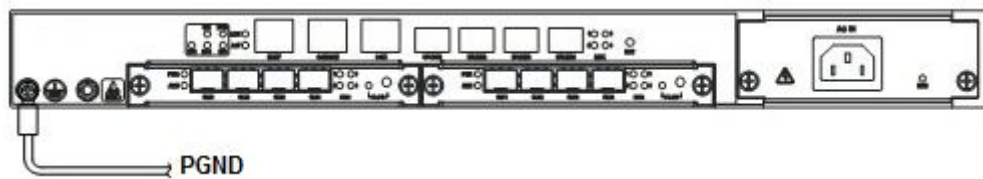


Figure 4-9 Grounding Terminal Connection Diagram

4.4.2 Method of making Cable

Choose a suitable PGND to connect with OLT grounding terminal according to the room devices condition. Make the corresponding length ground cable, and then connect the copper nose with the naked line end of ground cable. As shown in the figure 4-10:

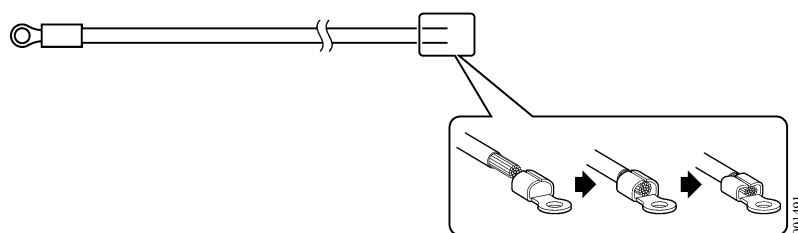


Figure 4-10 Method of making the ground wire

4.5 Uplink Port

4.5.1 Port Explanation

OLT CSM offers four Eth uplink ports, each port supports SFP transceiver, SFP module can be the optical module or the electrical module, and follow standards below:

- 1000Base-LX (Longwave length)
- 1000Base-SX (Shortwave length)
- 10/100/1000Base-T (Electrical port)

When use the single mode optical fiber, the maximum transmission distance can be up to 10-40km; when use the multimode fiber, the maximum transmission distance is less than 500 meters.

Gigabit Ethernet uplink port supports the duplex mode and flow control auto-negotiation. But need note that the maximum length of the optical fiber is related with work mode of the optical fiber:

- Maximum length of 1000Base-LX fiber is depend on duplex mode
- Maximum length of 1000Base-SX fiber is the same in both full duplex and half duplex mode

4.5.2 Port Connection

As shown in Figure 4-11, two kinds of uplink network connection:

- Cable with RJ45 connectors at both sides
- Cable with LC connector at both sides

Decide the port type of OLT according to the port type of the uplink device (Route)

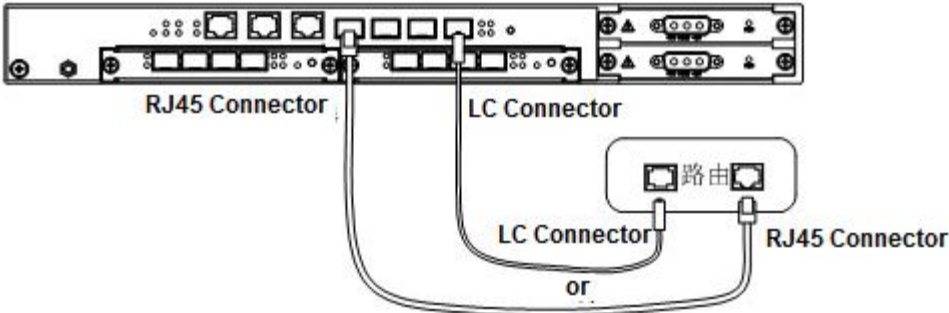


Figure 4-11 Uplink Port Connection Diagram

⚠ Caution: When insert into optical cable, please confirm the connector is inserted into the correct position, thus guarantee the good contract.

4.5.3 Method of making cable

- SFP is the optical module, cable specification: the optical cable with LC connector at both sides
- SFP is the electrical module, cable specification: Category 5 cable or Category 5 super cable with RJ45 connector at both sides

The below the reference for making STP (Shielded Twisted-Pair) cable with RJ45 connector at both sides

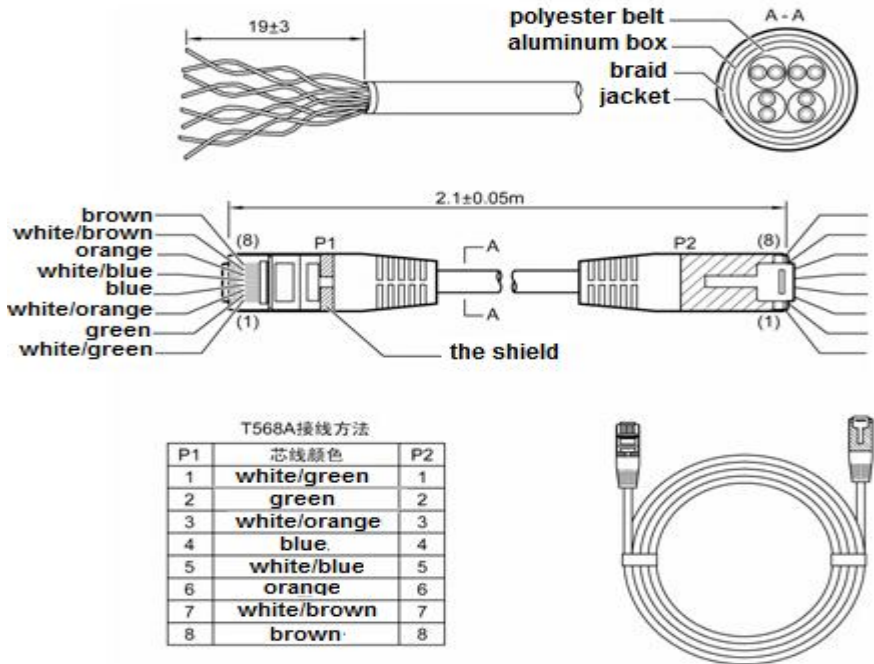


Figure 4-12 RJ45 的 STP cable Explanation with RJ45 Connector

4.5.4 Port Management (In-band)

Can perform the remote in-band management by OLT uplink ports. About the detailed information, refer to 《Optical Line Terminal CLI Operation Guide》.

4.6 PON Port

4.6.1 Port Explanation

OLT's ELM can be equipped with four SFP modules; every SFP module provides one PON port.

SFP module can be: Pigtail SFP and SC receptacle SFP. It depends on the specific application occasion.

4.6.2 Port Connection

It's one of downlink network connection diagrams as shown in the figure 4-13:

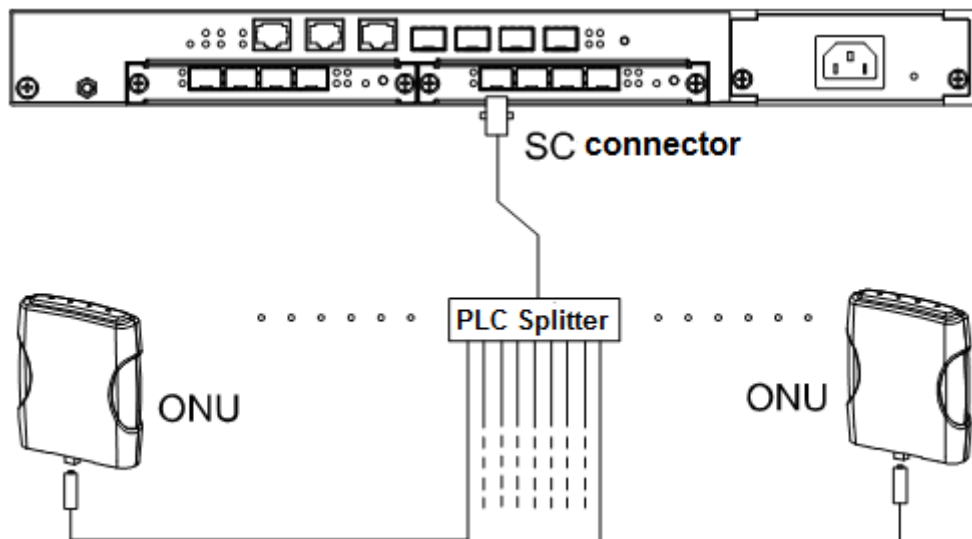


Figure 4-13 PON Port Connection Diagram



Caution: When insert into optical cable, please confirm the connector is inserted into the correct position, thus guarantee the good contract.


Connection Explanation:

- OLT PON port is connected with the optical splitter
 - The single mode optical fiber with SC connector at both sides
- ONU is connected with the optical splitter
 - Choose the corresponding connector of the optical fiber according to ONU's PON port type
 - Must has 14db attenuation from OLT to ONU, otherwise it may damage ONU's transceiver.

 **Note:** *About the connection requirement for ONU, refer to the related ONU user manual.*

4.6.3 Port Management (In-band)

Login OLT remotely to perform the in-band management by PC connected to OLT by ONU. For the detailed operations, please refer to 《Optical Line Terminal CLI Operation Guide》.

 **Note:** *If the in-band management function is Disable at the downlink PON port, the user need change it into Enable by CLI command. And then it can work normally.*

5 Software Debug Preparation

After complete hardware installation and power on normally, the user need perform software debug preparation for OLT to realize the local or remote management. OLT provide two kinds of access methods:

- CLI (Command Line Interface): System configuration program with command form, which is used for the advanced performance management.
 - Access OLT with the super terminal program by Console port on CSM. For detailed information, please refer to [Configure the Super Terminal](#)
 - Out-band access OLT with telnet way by Management Port on CSM
- The unified NETMAN management platform: CSM installed internally SNMP/RMON management agent, support SNMP protocol, NETMAN is just a management platform based on SNMP protocol.
 - Access OLT by Management Port on CSM

When the field engineer make the first debug for the system, it must enter CLI interface by Console port on CSM, configure network login preparation. After complete network login preparation and debug normally, the user can login Telnet or SNMP management system

 **Note:** *For the detailed steps of network management login and configuration, please refer to 《Optical Line Terminal CLI Operation Guide》.*

5.1 Configure Super Terminal

Here with Windows2000 Professional as an example to explain how to configure Super Terminal.

Preparation before configuration:

- Connect CSM's Console port to the serial port of PC by the serial line offered

Configuration Step:

- 1 Click "Start/Program/Attachment/Communication/Super Terminal", Type a name and choose a icon as shown in the picture 5-1:



Figure 5-1 New Connection Settings

- 2 Click < OK >, to enter figure 5-2 interface, choose PC serial port connected with the configured serial port in "Connect using", such as "COM1"



Figure 5-2 Terminal Type Settings

- 3 Click <OK> to enter Terminal Communication Parameter Settings, as show figure 5-3:
 - Data Bits: 8
 - Stop Bits: 1
 - Parity: None
 - Bits per second: 115200 bps (Apply to the initial configuration)

- Flow control: None

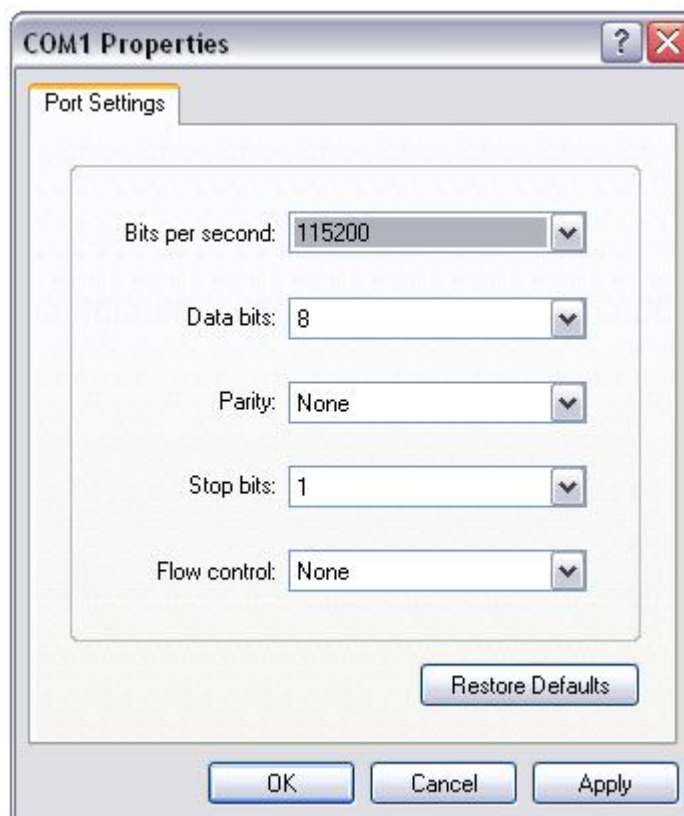


Figure 5-3 Terminal Communication Parameter Settings

- 4 Click <OK> to enter the operation interface of the super terminal

Username:

Password:

6 Troubleshooting

The chapter contains troubleshooting for hardware Failure in OLT system and the basic Failure of connection between OLT and ONU. For software configuration and installation, refer to 《Optical Line Terminal CLI Operation Guide》.



Note: Before beginning troubleshooting, please confirm ONU has been installed correctly, and the fiber connection between OLT and ONU is good. Please refer to ONU user manual about its troubleshooting.

Main faculties:

- OLT Hardware Failures
 - [AC Power Supply Module](#)
 - [DC Power Supply Module](#)
 - [CSM Hardware](#)

- [ELM Hardware](#)
- [Fan Failure](#)
- [SFP Hardware](#)
- [Connection Failure between Connection Failure between OLT and ONU](#)

6.1 AC Power Supply Module Failure

OLT system would can't work when a failure happens on AC power supply.

Failure Indication:

When use AC power supply, the indicator "RUN" of power supply module is always OFF, it indicates power supply Failure.

Troubleshooting:

- 1 Unplug power line of the Failure module
- 2 Loosen two fixed screws on the front panel with a screwdriver
- 3 Pull out the Failure power supply module
- 4 Insert the normal AC power module



Alarm: Please remember to unplug power line firstly if you want to pull out power supply module.

6.2 DC Power Supply Module Failure

When the single DC power supply module is configured, OLT system would can't work when a failure happens on DC power supply; when the redundancy power supply modules are configured, the system would automatically switch to the normal power supply module, so there is no effect on the system when a failure happens on one of DC power supplies.

Power supply module contained in this section:

- Identify and deal with the power supply module Failure
- Power supply module hot swap process

6.2.1 Failure Indication and processing

Failure Indication 1: according to RUN LED status on power supply module:

- 1 Check RUN LED status on power supply module
- 2 If be OFF, indicating there is a failure on power supply module

Failure Indication 2: Judge according to network management

- 1 Confirm by network management, if it's power supply Failure
 - Indicate there is the Failure if use the single power supply module

- Locate Failure module according to RUN LED when use two power supply modules

Troubleshooting:

- 1 To confirm that the power supply module is a failure module
- 2 Unplug the power cord of the failure module
- 3 Pull out the Failure power modules
- 4 Insert a new power supply module
- 5 Connect the power cord

Processing results:

- If use a single power supply module, this time the system will reboot.
- If use two power supply modules, this time the system's power modules work in redundancy backup state.



Note: If use two power supply module, make sure both power lines of the power modules are correct connection.

1.1.2 DC Power Supply Module Hot Swap

Preparation before the operation:

- To confirm that the power supply module is the failure module
- Ready for new power supply module
- Antistatic wrist ring (recommended)

The hot swaps process of power modules Failure processing is as follows:

- 1 Insert the earth terminal of anti-static wrist to ESD port of OLT
- 2 Loosen two fixed screws on the front panel with a screwdriver
- 3 Take out the new power supply module from anti-static pocket
- 4 Knead the front panel of a new power module at both left and right sides, insert PON card into its slot. As shown in figure 6-1 below

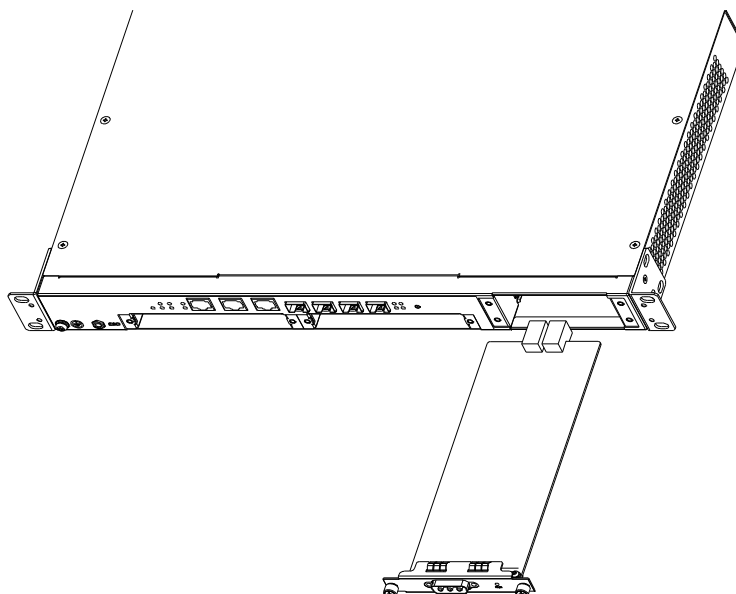


Figure 6-1 DC Power Supply Module Installation Diagram



Alarm: When plug PON card, it's forbidden to touch the devices and line on the circuit board.

- 5 Along the guide rail, carefully plug PON card into the slot
- 6 Tighten the left and right nuts on the front panel

1.2 CSM Hardware Failure

CSM hardware Failure will lead that OLT system can't work

CSM hardware Failures include:

- Identify and Process CSM Failure

1.2.1 Failure Indication and Processing

Failure Indication 1:

When all indicators on CSM board is OFF, it indicates there is the trouble on CSM hardware.

Failure Indication 2:

- 1 Access directly OLT by Console or MGNT port, the system will start after power on.
- 2 System self-check failed, to stay in a process of self-inspection.
- 3 Press the RESET button on the front OLT, the system restarts.
- 4 OLT system fails to the normal starting.
- 5 After many (suggest 3) RESET to restart, OLT system still can't start normally
- 6 Indicate CSM hardware has the trouble

Troubleshooting:

- 1 To confirm that the CSM boards fail
- 2 Record the port connection and its SFP modules information at CSM board
- 3 Pulled out all connection lines and SFP modules at CSM board
- 4 Power outage
- 5 Open the cabinet and pull out the Failure CSM board
- 6 Plug in new CSM
- 7 According to records, in the right uplink port to install the corresponding SFP modules
- 8 According to records, connect CSM port.

Processing results:

System will restart automatically



Alarm: If need replace CSM board, please contact with the service staff of our company. It's strictly forbidden opening the cabinet without authentication.

1.3 ELM Hardware Failure

ELM hardware Failure would lead to ONU can't be connected with OLT.

ELM Hardware Failures include:

- Identify and Process ELM Failure
- ELM hot plug process

1.3.1 Failure Indication and Processing

Failure Indication:

When ELM PWR LED is always OFF, it indicates ELM fails.

Processing Failure:

- 1 To confirm that the ELM boards fail
- 2 Record the port connection and its SFP modules information at CSM board
- 3 Pulled out all connection lines and SFP modules at ELM board
- 4 Pulled out the failed ELM
- 5 Plug in new ELM
- 6 According to records, in the right PON port to install the corresponding SFP modules
- 7 According to records, connect the port on ELM

Processing results:

The ELM PWR LED is always green, ELM ONU connected to PON port will register and login to OLT again.

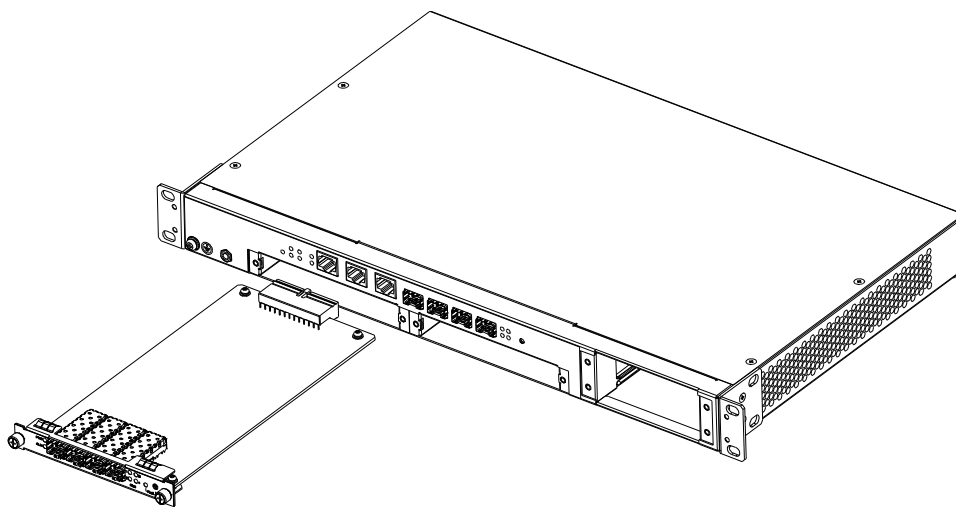
1.3.2 ELM Hot Swap

Preparation before the operation:

- To confirm that the ELM board failed
- Ready for new ELM boards
- Antistatic wrist ring (recommended)

Hot swaps process in ELM Failure processing is as follows:

- 1 Insert the earth terminal of anti-static wrist to ESD port of OLT
- 2 Insert the earth terminal of anti-static wrist to ESD port of OLT
- 3 Loosen two fixed screws on the ELM front panel with a screwdriver
- 4 Press PLUG button on ELM front panel, LED will flash 5 s or so, finally always be yellow
- 5 Pull out the failed card along the guide rail horizontally
- 6 Take out the new ELM card from anti-static pocket
- 7 Knead the front panel of ELM card at both left and right sides, insert PON card into its slot. As shown in the figure below



Picture 6-2 ELM Installation Diagram



Alarm: When plug PON card, it's forbidden to touch the devices and line on the circuit board.

- 8 Along the guide rail, carefully plug PON card into the slot
- 9 Tighten the left and right nuts on the front panel

1.4 Fan Failure

Fan Failure will influence the plug-in boards operation temperature in OLT system . If the system temperature is too high, will produce system temperature alarm. Fan failure, It need to change fan in time when there is the failure on the fan.

Fan Failures include:

- Identify and processing fan Failure

1.4.1 Failure Indication and Processing

Failure indication1:

When FAN LED on the CSM front panel is red, it indicated there is the failure on the fan

Failure indication 2:

- 1 If the fan failure, confirm it by network management
- 2 Indicate fan failure

Failure Processing:

- 1 To confirm that the fan fails
- 2 Without electricity, and open the cabinet
- 3 Dismantling the Failure fan
- 4 With the new fan

Processing Results:

FAN LED is green on CSM front panel



Alarm: If need change fan, please contact with the service staff of our company. It's strictly forbidden opening the cabinet without authentication

1.5 SFP Hardware Failure

Both OLT CSM and ELM can be installed SFP modules. When SFP hardware is at Failure, it will lead to a port connection to the disconnect, happened OLT uplink or downlink connection failure.

SFP hardware failures include:

Identify and deal with the SFP Failure

1.5.1 Failure Indication and Processing

Failure Indication:

- 1 When RUN LED of ELM PON port is red, indicating port link failure; After power on , the LINK LED of OLT CSM uplink port is always ON,indicating port link failure.
- 2 Confirm PON port work normally, and the connection between OLT and ONU is normal
- 3 This time judgment:ELM or CSM SFP cause the port link failures.

Failure Processing:

Here with OLT1 SFP module in ELM-1 board as an example to describe.

- 1 To confirm that the SFP modules failure
- 2 Pull out the SFP modules connection cable.
- 3 Pull out the fault SFP modules.
- 4 Insert the new SFP module
- 5 Connect the SFP module cable on OLT port

SFP modules connected to a port on the attachment

Processing Result:

The failure port link restore to normal, RUN(OLT1) LED on ELM board shows green.

1.6 Connection Failure between OLT and ONU

According to the following steps, processing OLT and ONU connection failure. As shown in figure 6-3 below.

- 1 Check the system level LED on OLT machine frame to ensure that each module functions normally.



Note: For the related explanation, please see 1.4 Hardware Composition /table 1-2 LED's description.

- 2 In OLT **Privileged EXEC** command, input the following CLI command, show the PON port attributes and the number of ONU connected with PON ports:

```
telnet@OLT# show interface epon-olt brief
```

OLT Firmware	state	admin state	phy addr	mac num	ONU type	transceiver state	self-diag version	Hardware version
1/1 0x20004	Running	Enabled	present	00:e0:8e:88:07:00	3	ELM-SFP	passed	0x20
1/2 0x20004	Running	Enabled	present	00:e0:8e:88:07:00	0	ELM-SFP	passed	0x20
1/3 N/A	Disabled	Enabled	present	00:e0:8e:88:07:00	0	ELM-SFP	passed	0x20
1/4 0x20004	Running	Enabled	present	00:e0:8e:88:07:00	0	ELM-SFP	passed	0x20
2/1 N/A	Disabled	Enabled	present	00:e0:8e:88:08:00	0	ELM-SFP	passed	0x20
2/2 N/A	Disabled	Enabled	present	00:e0:8e:88:08:00	0	ELM-SFP	passed	0x20
2/3 N/A	Disabled	Enabled	present	00:e0:8e:88:08:00	0	ELM-SFP	passed	0x20
2/4 N/A	Disabled	Enabled	present	00:e0:8e:88:08:00	0	ELM-SFP	passed	0x20

In the example above, Both OLT port 1 and 2 on ELM-1 board are already enabled and available. Both two ports adopt ELM-SFP transceiver. Three ONUs have been registered on OLT port 1 of ELM-1.

3 Start management status of OLT port

Type the following command to enable OLT port :

```
telnet@OLT(config-t-if-olt-module/port)# no shutdown
```

4 Check LED on ELM board

If **ALM** LED of OLT port is red. Check the fiber connection at this port. To ensure **RUN** LED is green when continue the next operation.

5 Check the transceiver Type

Pull out ELM board, Visually inspect the transceiver on ELM board, ensure transceiver type is the same as the listed type in step 2 . If don't confirm to it, correct transceiver machine type through the following command:

```
telnet@OLT(config-t-if-olt-module/port)# transceiver-type ?
```

```
fiberson          - Select transceiver type FIBERXON
infineon          - Select transceiver type INFINEON
sfp              - Select transceiver type SFP
zenko            - Select transceiver type ZENKO
zonu             - Select transceiver type ZONU
```

Then through the following command to load OLT port properties, and activate the new optical fiber parameters:

```
interface epon-olt<module/port> shutdown
```

```
interface epon-olt <module/port> no shutdown
```

6 Check ONU authentication in the system

There are two authentication methods: Radius server authentication or local authentication.

Show ONU authentication by the following command:

```
telnet@OLT(config-t)# show pon-sys
```

PON system global parameters:

```
local sla authentication = enabled
local sla sync with radius server = disabled
local logical port strict binding = enabled
MAC Address Aging Timer = 300 seconds
olp-mode = disabled
remote-mgmt onu-authentication time out = 10
```

In the example above, we can know it use the local authentication from "local sla authentication = enabled"

- If you use Radius server, ensure that the Radius server enter the correct ONU information in the database, including ONU username (ONU-ID) and password.

The detailed steps configuration, see 《Optical Line Terminal CLI Operation Guide》

- If choose local authentication, according to lport binding Settings, divide the following two kind of situations:
 - Lport-strict-binding is set to **disable**, and have nothing to do with ONU MAC address.
 - Lport-strict-binding is set to **enable**, need to ensure to input the correct ONU MAC address.in he local SLA list.

⚠ Note: Firstly to ensure the correct OLT port number in the local SLA list, Input ONU MAC address.

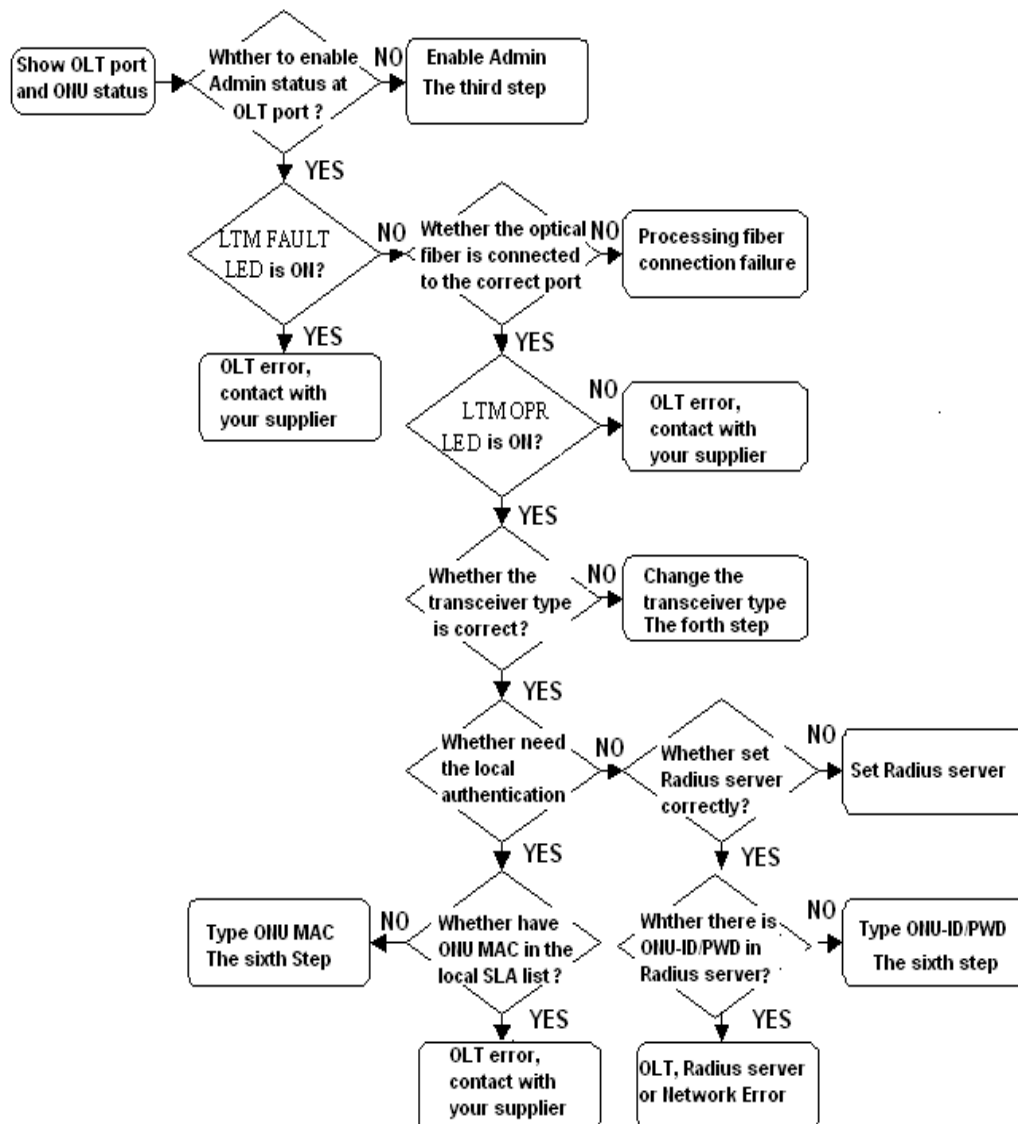


Figure 6-4 Failure processing in the connection between OLT and ONU

2 Technical Specification

Table 7-1 OLT Technical Specification

Host	
Demession	440 mm (Length) x 275 mm (Width) x 43.6 mm (Height)
Weight	12 pound
Power of Single ELM	Maximum: 30 W
Power of two ELM	Maximum: 100W
Power	Two DC power slota: Input voltage -48V (Allowed range: -36V~-72V DC) Or one AC power slot, input voltage: 110/220V (allowed range: 85 ~ 264VAC)
Power Consumption of power supply	140W
Uplink Port	Four GE ports which support SFP transceiver, can equipped with the optical module or the electrical module.
OLT Port	Maximum offer 8 PON ports which support SFP transceiver, only can be equipped with the optical module. And it's connected with ONU by the optical splitter
MGNT Port	RJ45, offer 10/100Base-T out-band management port.
CONSOLE Port	RJ45, offer Console port for the system diagnosis.
COM Port	RJ45, offer connection alarm communication
ELM Board	
The number fo OLT ports	4
Standard	IEEE802.3ah
Optical fiber	SMF, Single Mode Fiber
Connector	SC
The number of the supported ONU	Each OLT port supports up to 64 ONUs
Rate	1 Gbps uplink and downlink
Light loss budget	29 dB
Wavelength	Transmission wavelength: 1490 nm; Received wavelength: 1310 nm
ONU Authentication Customer	IEEE802.1x
QoS	IEEE802.1p
DBA	Assign the maximum bandwidth or the assured bandwidth to each ONU customer
L2 Switch Function	
Non-blocking switch	link-speed forwarding
Flexible address learning	Independent VLAN Learning (IVL) Address learning based on hardware L2 forwarding list based on the software configuration 16K L2 unicast list

L2 Multicast	512 L2 multicast lists Support IGMP-Snooping、IGMP-Proxy
VLAN	4094 tagged (802.1Q) VLANs Ingress filter mechanism based on 802.1Q VLAN
Link Aggregation	At most aggregate four uplink IEEE 802.3ad link
Packet mirror	Mirror based on the port: Ingress, egress, ingress and egress
Packet buffer and senior flow control	HOL jam prevention based on Cos Support back pressure Support suspended frame

QoS

CoS	Each egress supports four CoS queue Support 802.1 Q priority Support queuing mechanisms: strict method, time-delay method and weighting method Support priority remapping of IPv4 TOS mechanism Support IP Precedence, DSCP
Rate shaping for Output port	From 1 Mbps ~ 1 Gbps token bucket limiting flow function Radio, multicast and DLF rate control based on the port

Security

ACL	the strategy based on all kinds of agreement, source and destination IP, source and destination TCP/UDP port and ToS combination Support five actions, such as permit, deny, DSCP remarking, rate limit or priority remarking
-----	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

L3 Route Protocol

TCP/IP	RFC 0768	User Datagram Protocol
	RFC 0791	Internet Protocol.
	RFC 0793	Transmission Control Protocol
ICMP	RFC 0792	Internet Control Message Protocol.
ARP	RFC 0826	Ethernet Address Resolution Protocol.
Proxy ARP	RFC 1027	Using ARP to implement transparent subnet gateways.
OSPF	RFC 1587	OSPF NSSA Option
	RFC 1745	BGP-4/IDRP for IP-OSPF Interaction
	RFC 1850	OSPF Version 2 MIB
	RFC 2328	OSPF Version 2
	RFC 1771	A Border Gateway Protocol 4 (BGP-4)
	RFC 1965	Autonomous System Confederations for BGP
	RFC 1966	BGP Route Reflection
	RFC 1997	BGP Communities Attribute
PIM-SM	RFC 2362	Protocol Independent Multicast-Sparse Mode (PIM-SM)
IGMP	RFC 2236	Internet Group Management Protocol, Version 2

L3 Switch /Route Performance		
L3 Host Table		8K
L3 LPM Table		64K
L3 Interface Table		4K
DeFailure route		DeFailure route based on VLAN
L3 enable		Based on the port
ECMP routing		Support
IP Multicast replication		Support
IPMC Group Table		1K
IPMC enable		Based on the port
Jumbo Frame		Up to 9216 bytes packet
Network Management		
FTP	RFC 959	File Transfer Protocol
Telnet	RFC 0854	Telnet Protocol Specification
SNMP	V2.0	Simple Network Management Protocol
DHCP	RFC 2131	Dynamic Host Configuration Protocol
AAA		
RADIUS	RFC 2138	Remote Authentication Dial In User Service (RADIUS).

A Acronym

Acronym	Description
ACL	Access Control List
ARP	Address Resolution Protocol
CLI	Command Line Interface
CO	Central Office
CoS	Class of Service
CPE	Customer Premise End
CSM	Control and Switch Module
DBA	Dynamic Bandwidth Allocation
DHCP	Dynamic Host Configuration Protocol
ELM	EPON Link Module
E/O	Electronical to Optical
GEPON	Gigabit Ethernet Passive Optical Network
GUI	Graphical User Interface

Acronym	Description
HDLC	High-level Data Link Control
HOL	Head-Of-Line
HTTP	Hypertext Transfer Protocol
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineering
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IVL	Independent VLAN Learning
LAG	Link Aggregation
LAN	Local Area Network
LGID	Link Aggregation Identifier
MAC	Medium Access Control
MIB	Management Information Base
MTU	Maximum Transmission Unit
NTP	Network Time Protocol
OAM	Operations, Administration and Maintenance
OLT	Optical Line Terminal
ONU	Optical Network Unit
OSPF	Open Shortest Path first
PDU	Protocol Data Unit
PIM-SM	Protocol Independent Multicast-Sparse Mode
PON	Passive Optical Network
POS	Packet over SONET
PPP	Point-to-Point Protocol
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service

Acronym	Description
RFC	Request For Comments
RIP	Routing Information Protocol
RMII	Reduced Medium Independent Interface
RMON	Remote Monitoring
RSTP	Rapid Spanning Tree Protocol
RSVP	Resource Reservation Protocol
SLA	Server Level Agreement
SMF	Single Mode Fiber
SNMP	Simple Network Management Protocol
SOHO	Small Office /Home Offices
STP	Spanning Tree Protocol
STP	Shielded Twisted Pair
TCP	Transmission Control Protocol
TOS	Type of Service
UTP	Unshielded Twisted Pair
VID	VLAN Identifier
VLAN	Virtual LAN
VoIP	Voice over IP
VPN	Virtual Private Network