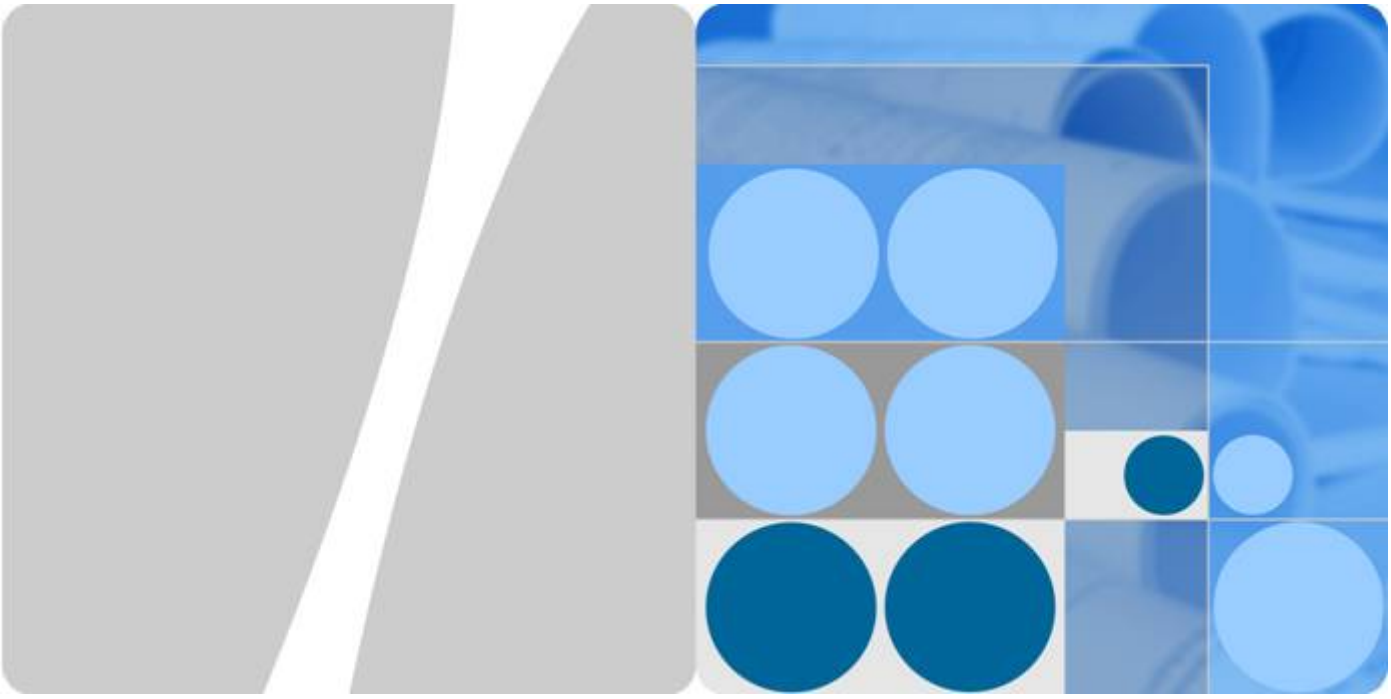


HUAWEI NE40E-X1 & NE40E-X2 Universal Service Router

V600R003C00

Hardware Description

Issue 02

Date 2011-09-10

HUAWEI TECHNOLOGIES CO., LTD.

Trademarks and Permissions


and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute the warranty of any kind, express or implied.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: http://www.huawei.com

Email: support@huawei.com

About This Document

Purpose

This document describes the hardware structure of the NE40E-X1 and NE40E-X2, including power modules, a heat dissipation system, and cables. This document also provides a list of acronyms and abbreviations.

Intended Audience

This document is intended for:

- Network planning and design engineers
- Hardware installation engineers
- Commissioning engineers
- Maintenance engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Alerts you to a high risk hazard that could, if not avoided, result in serious injury or death.
 WARNING	Alerts you to a medium or low risk hazard that could, if not avoided, result in moderate or minor injury.
 CAUTION	Alerts you to a potentially hazardous situation that could, if not avoided, 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.

Symbol	Description
NOTE	Provides additional information to emphasize or supplement important points in the main text.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Changes in Issue 02 (2011-09-10)

Second commercial release.

Changes in Issue 01 (2011-06-30)

Initial commercial release.

Contents

1 NE40E-X1 Hardware Description

About This Chapter

1.1 Overview

The NE40E-X1 is a high-end network device developed by Huawei. This device is based on the VRP and applies to the access, convergence, and transmission of Metro services.

The NE40E-X1 has great capabilities for network access, Layer 2 switching, and EoMPLS transmission, and supports a wide range of high-speed and low-speed interfaces. In addition, the NE40E-X1 supports triple-play of voice, video, and data services and can bear 2G, 3G, and LTE services simultaneously. The NE40E-X1 can be deployed together with Huawei NE, CX, and ME series products to build a hierarchical Metro Ethernet network that offers extensive services.

1.1.1 System Hardware Description

By adopting a centralized routing engine and NP forwarding structure, the NE40E-X1 has a great capacity and can provide diverse services.

The NE40E-X1 has an integrated chassis that can be installed independently. The main parts of the NE40E-X1 such as MPUs, NPUs, PICs, fan modules, and PSUs are hot-swappable.

Figure 1-1 shows the outline of the NE40E-X1. The NE40E-X1 provides one slot for the NPU and four slots for PICs. The network process unit on the NE40E-X1 is NPUI-20. All the PICs switch data with each other through the NPUI-20. The NPUI-20 has a bidirectional data processing capability of up to 20 Gbit/s.

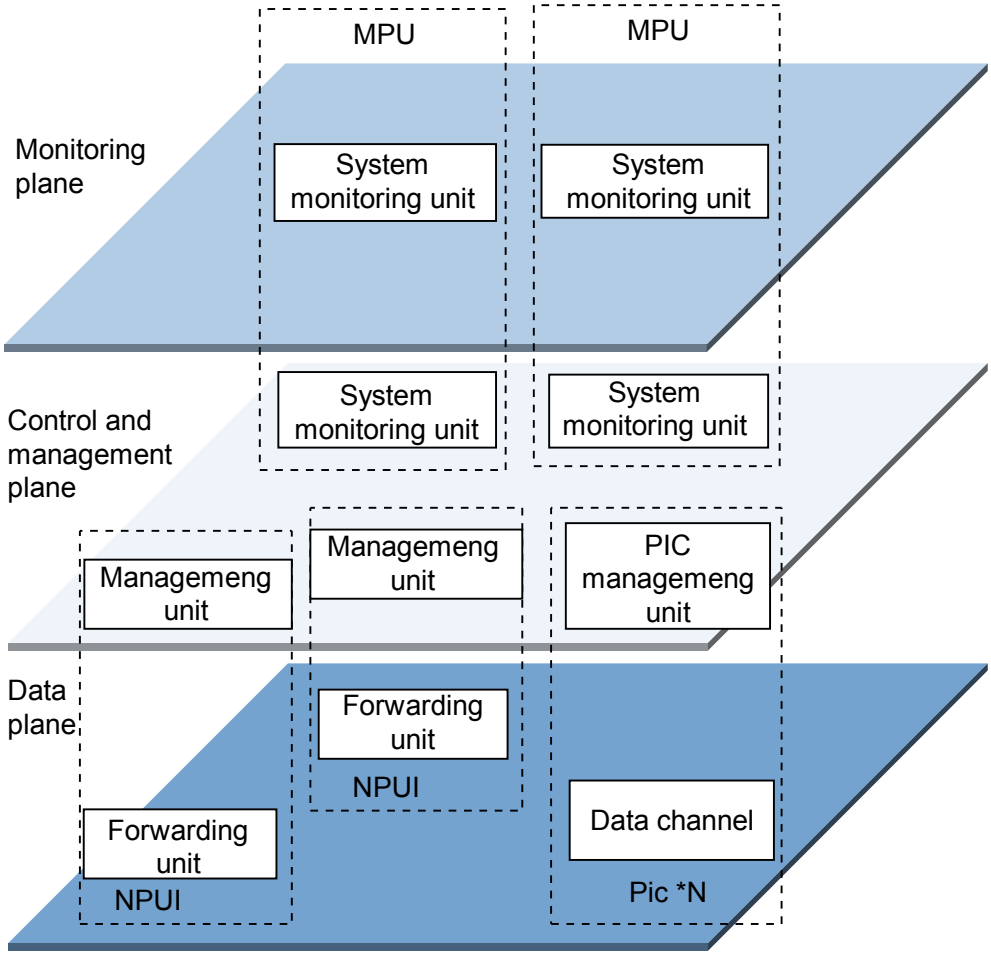
The maximum interface capacity of the NE40E-X1 is 52 Gbit/s.

Figure 1-1 Outline of the NE40E-X1

1.1.2 System Architecture

The logical architecture of the NE40E consists of the following planes: data plane, control and management plane, and monitoring plane, as shown in **Figure 1-2**. The data plane processes and switches data packets quickly and smoothly; the control and management plane, as the core of the system, controls and manages the system; the monitoring plane monitors the ambient operating conditions.

Figure 1-2 Diagram of the system architecture



NOTE

NE40E-X2 has two NPUI boards, and NE40E-X1 has only one NPUI board.

1.1.3 Main System Features

The main features of the system include:

- NP-based forwarding which enables fast service deployment
- Compact structure which increases the port density
- Separation of the control channels, service channels, and monitoring channels, which ensures the connectivity of control channels and monitoring channels
- High-level carrier-class reliability and manageability
- Module-level shielding which meets Electro Magnetic Compatibility (EMC) requirements
- Hot-swappable boards, PSUs, and fan modules
- 1:1 backup of MPUs
- Backup for key parts such as PSUs, fan modules, clocks, and management buses
- Protection against incorrect insertion of boards

- Queries about alarm prompts, alarm indications, running status, and alarm status of PSUs
- Queries about alarm prompts, alarm indications, running status, and alarm status of the voltage and ambient temperature

1.1.4 System configuration

Table 1-1 System configuration list of the NE40E-X1

Item	Description
Processing unit	Main frequency: 1.3GHz
SDRAM	2 GB
Flash	32 MB
CF card	1 GB
Switching capacity	20 Gbit/s (bidirectional)
Interface capacity	52 Gbit/s
Number of NPU slots	1
Number of PIC slots	4
Number of MPU slots	2
Maximum port rate supported by PICs or NPU	10 Gbit/s

1.1.5 Main Parts of the NE40E-X1

The NE40E-X1 has an integrated chassis with main parts that all support hot swapping.

Figure 1-3 shows the outline and parts of the NE40E-X1.

Figure 1-3 Outline and parts of the NE40E-X1

1. NPU	2. PIC	3. MPU	4. Cabling rack
5. PSU	6. ESD jack	7. Grounding Terminal	8. Air intake vent
9. Rack-mounting ear	10. Grounding Terminal	11. Fan module	

1.1.6 Number of Main Parts and Slot Layout of the NE40E-X1

Figure 1-4 shows the slot layout of the NE40E-X1.

Figure 1-4 Slot layout of the NE40E-X1

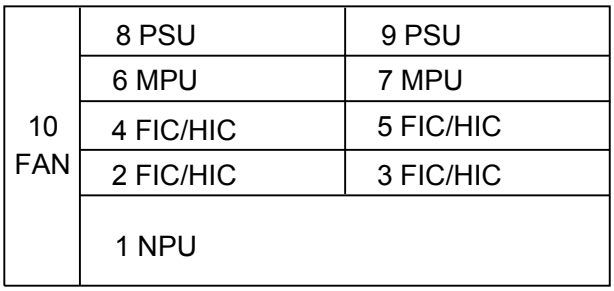


Table 1-2 Number and layout of slots on the NE40E-X1

Slot No.	Quantity	Remarks
1	1	For NPUs.
2, 3, 4, and 5	4	For sub-cards, which include HICs and FICs.
6 and 7	2	For MPUs, which work in 1:1 backup mode.

Slot No.	Quantity	Remarks
8 and 9	2	For DC PSUs, which work in 1+1 backup mode.
10	1	For a fan module.

NOTE

A FIC refers to a sub-card on which every port has a rate lower than 1 Gbit/s. A HIC refers to a sub-card on which every port has a rate of at least 1 Gbit/s.

1.2 Power Supply System

1.2.1 Architecture of the Power Supply System

The device supports DC power input of -48 V DC or -60 V DC.

The device is powered by two PSUs, which work in 1+1 backup mode. When one PSU fails or is removed, the other one can still supply adequate power for the device. The PSUs are installed in the two top slots of the chassis and supply power for the MPUs, NPU, PICs, and fan module.

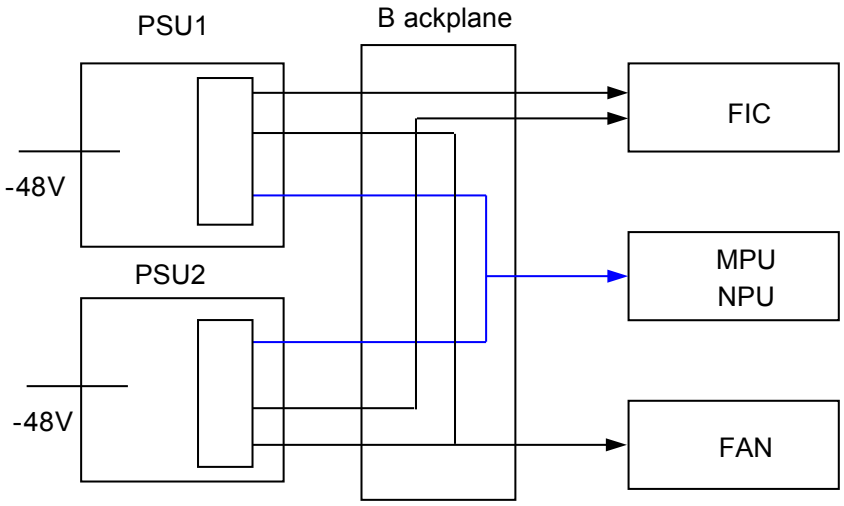
The following measures are taken to ensure that the PSUs can supply stable and safe power for the system:

- Protection against output overcurrent
- Protection against output overvoltage
- Protection against input undervoltage
- Protection against overtemperature
- Protection against short circuit
- Alarm generation

1.2.2 Diagram of the Power Supply Architecture

The two PSUs work in 1+1 backup mode. **Figure 1-5** shows the power supply architecture. Two -12 V power supplies are combined on the backplane, and then are directed to the MPU and NPU. Two -48 V power supplies are input to the PICs, and then are combined on the PICs. Two -48 V power supplies are combined on the backplane, and then are directed to the fan module.

Figure 1-5 Diagram of the power supply architecture



1.2.3 DC Power Supply System

The device adopts two PSUs, which work in 1+1 backup mode, for power supply. **Figure 1-6** shows the outline of a PSU.

Figure 1-6 Outline of a PSU

Figure 1-7 shows the panel of a PSU.

Figure 1-7 Panel of a PSU

Table 1-3 Parameters of the PSUs

Item	Parameter
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Weight	1 kg (2.21 lb)
Rated voltage	-48 V DC or -60 V DC
Input voltage range	-38 V DC to -72 V DC
Maximum input current	24 A
Maximum output power	905 W

Table 1-4 Description of the indicators on the PSUs

Indicator Name	Description
OUT	When the indicator is steady green, it indicates that the PSUs work normally and supply stable power. When the indicator is steady red, it indicates that the hardware of the PSUs fails or the device is not supplied with power ranging from -48 V or -60 V. When the indicator is off, it indicates that the PSUs are switched off or the hardware of the PSUs is faulty.
IN	When the indicator is steady green, it indicates that the power input is normal. When the indicator is off, it indicates that the device is not supplied with power ranging from -48 V or -60 V.

- Notes on DC power monitoring:

  The DC power monitoring channel can implement real-time monitoring on power supply. In addition, the DC power monitoring channel allows you to query the manufacturing ID, input voltage, and temperature of the PSUs in real time, and supports real-time reporting of power supply alarms.
- Notes on the configuration of DC power cables:

  You do not need to connect protection ground cables to the PSUs, but the protection ground cable for the chassis must be properly grounded. DC power cables include a -48 V power cable and a return (RTN) ground cable. The required cable length depends on the distance between the cabinet and the power distribution cabinet for the device. The DC power cables need to be prepared according to the required lengths on site. For details of DC power cables see **4.1 DC Power Cables**.

1.3 Heat Dissipation System

The heat dissipation system is responsible for the heat dissipation of the entire device. Heat generated by the boards is dissipated through the heat dissipation system. In this manner, the temperatures of the components on the boards are controlled within a normal range, enabling the boards to work stably. The heat dissipation system is composed of a fan frame, an air intake vent, an air exhaust vent, and an air channel. All the fans in the fan frame work simultaneously, and their rotation speeds can be adjusted by area. When one fan fails, the heat dissipation system can still allow the device to work at the ambient temperature of 40°C (104°F) for a short period. The temperature sensors, which are located on the air exhaust vent and boards, monitor the temperatures of the components on the boards and adjust the fan rotation speeds according to the commands delivered by the MPU to control the board temperatures.

1.3.1 System Air Channel

The NE40E-X1 dissipates heat by blowing air in a left-to-right direction. **Figure 1-8** shows the air flow in the NE40E-X1.

Figure 1-8 Air flow in the NE40E-X1

1.3.2 Fan Module

The air intake vent of the NE40E-X1 is 3 U (133.35 mm or 5.25 in.) high and 220 mm (8.67 in.) deep.

There are six fans in the fan frame of the NE40E-X1. When one fan fails, the device can still work at the ambient temperature of 40°C (104°F) for a short period.

The rotation speeds of the fans can be adjusted based on the device temperature automatically .

Figure 1-9 Outline of the fan module for the NE40E-X1

Figure 1-10 shows the panel of the fan module for the NE40E-X1.

Figure 1-10 Panel of the fan module for the NE40E-X1

Table 1-5 Technical specifications of the fan module for the NE40E-X1

Parameter	Value
Outline dimensions (W x D x H)	50 mm x 226 mm x 130 mm (1.97 in. x 8.90 in. x 5.12 in.)
Weight	1.1 kg (2.43 lb)
Maximum power consumption	100 W
Maximum wind pressure	477.2 Pa
Maximum wind rate	64.4 cubic feet per minute (CFM)
Noise	64.3 dB

Table 1-6 Description of the indicators on the fan module

Indicator/Button	Description
FAN indicator	When the indicator is steady green, it indicates that the fan module works normally. When the indicator is off, it indicates that the fan module is unregistered, powered off, or has a hardware fault. When the indicator is steady red, it indicates that the fan module fails.

1.4 Data Plane

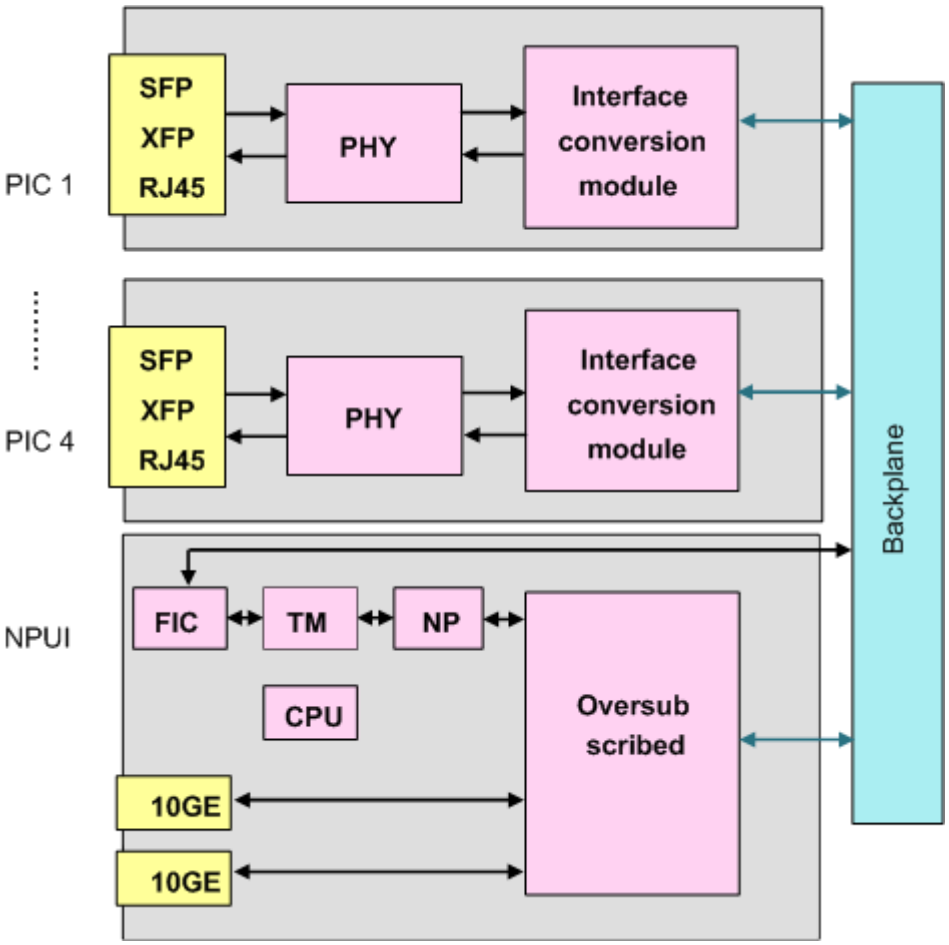
1.4.1 Introduction to the Data Plane

As key parts of the NE40E-X1, Network Processing Units (NPUs) are responsible for data processing and data switching between Physical Interface Cards (PICs) and NPUIs.

The procedure for data processing is as follows:

1. The IP packets sent from PICs and 2x10G interfaces on an NPU converge at a convergence module.
2. The Network Processor (NP) processes the IP packets.
3. The Traffic Management (TM) module performs traffic management on the IP packets.
4. The Fabric Interface Chip (FIC) performs IP packet switching.

Figure 1-11 Data plane architecture of the NE40E-X1



1.4.2 Introduction to the NPUI-20

The NPUI-20 on the NE40E-X1 processes service data of the entire system.

The NPUI-20 has the bidirectional 20-Gbit/s forwarding capability, and all subcards switch data through the NPUI-20.

You can install only one NPUI-20 into the chassis of the NE40E-X1.

The NPUI-20 consists of the following planes:

- Control and management plane

  Through the management channels between MPUs and the NPUI-20, the MPUs can manage NPU and associated subcards, and transmit routing protocol data.

- Data forwarding plane

  The NPUI-20 is responsible for service processing in the entire system, and is connected to all subcards through data channels.

  The NPUI-20 provides two 10G Ethernet optical interfaces that can work in WAN or LAN mode and can be installed with XFP optical modules.

Table 1-7 NPUI-20 parameters

Item	Description	Remarks
Forwarding capability	20 Gbit/s (bidirectional)	-
Interface	Two 10GE XFP optical interfaces that can work in LAN or WAN mode	-

Figure 1-12 Appearance of the NPU on the NE40E-X1

1. Ejector lever
2. OFL indicator
3. OFL button
4. L/A1 indicator
5. Optical interface
6. L/A0 indicator
7. ACT indicator
8. STAT indicator

Table 1-8 describes the buttons and indicators on the NPU panel.

Table 1-8 Description of the buttons and indicators on the NPU panel

Indicator/ Button	Description
STAT indicator	If the indicator is steady green, it indicates that the NPU works normally. If the indicator is steady red, it indicates that the hardware of the NPU is faulty. If the indicator blinks green, it indicates that NPU is being registered. If the indicator is off, it indicates that the NPU is not powered on or fails to be registered.
ACT indicator	If the indicator is steady green, it indicates that the NPU is in the master state. If the indicator is off, it indicates that the NPU is in the slave state or fails to be registered.
OFL indicator	If the indicator is steady red, it indicates that the NPU is powered off. In this case, the NPU can be safely removed. If the indicator is off, it indicates that the NPU works normally.
OFL button	This button indicates the removal of the NPU. Before removing the NPU, you need to press and hold the OFL button for six seconds until the OFL indicator is turned on. Then, the NPU can be safely removed.

Indicator/ Button	Description
L/A0 indicator	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
L/A1 indicator	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.

1.5 Control Plane

1.5.1 Introduction to the Control Plane

The function of control plane is implemented by the MPU.

The device can be equipped with a single MPU or double MPUs (in backup mode).

In the case of double MPUs, the master MPU works and the slave MPU is in the standby state. You cannot access the management network interface on the slave MPU or run commands on the console or AUX interface. The slave MPU exchanges information (heartbeat messages and backup data) with only the master MPU. Data consistency between the master and slave MPUs is ensured through high reliability mechanisms such as batch backup and real-time backup. After the master-slave switchover, the slave MPU immediately takes over as the master MPU. The default master MPU is configurable. During the start process, the MPU that you set wins the competition and becomes the master MPU.

MPUs support two switchover modes: failover and manual switchover. The failover is triggered by serious faults or resetting of the master MPU. The manual switchover is triggered by commands run on the console interface or management interface.

The MPU integrates multiple functional units. By integrating the system control and management unit, clock unit, and system maintenance unit, the MPU provides the functions of the control plane and maintenance plane. The functions of the MPU are detailed as follows:

- System control and management unit

  The MPU is mainly responsible for processing routing protocols. In addition, the MPU broadcasts and filters routing packets, downloads routing policies from the policy server.

  The MPU manages the NPUs and communicates with the NPUs. The MPU implements outband communication between boards. The MPU manages and carries out communication between the NPUs and slave MPU through the outband management bus.

  The MPU is also responsible for data management. The system configuration data, booting file, upgrade software, and system logs are stored on the MPU. The Compact Flash (CF) card on the MPU functions as a mass storage device for saving data files including system files, configuration files, and logs, and is not hot-swappable.

  The MPU manages and maintains the device. Through management interfaces such as serial interfaces and network interfaces on the MPU, you can manage and maintain the device.
- System clock unit

The system clock unit of the MPU provides NPUs and PICs with reliable and synchronous SDH clock signals.

The MPUs supports the clock that complies with IEEE 1588v2.

- System maintenance unit

  The system maintenance unit of the MPU collects monitoring information, remotely or locally tests system units, or performs in-service upgrade of system units.

  Through the Monitorbus, the MPU collects the operation data periodically. The MPU produces controlling information, such as detecting the board presence and adjusting the fan speed.

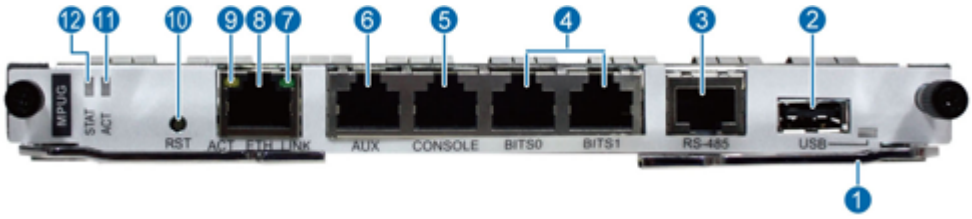
  NOTE

  The MPUs work in 1:1 hot backup mode, improving system reliability.

1.5.2 MPUG

Figure 1-13 shows the MPUG panel.

Figure 1-13 Appearance of the MPUG panel



1. USB indicator	2. USB interface	3. RS-485 interface	4. BITS clock interface
5. Console interface	6. AUX interface	7. ETH LINK indicator	8. ETH interface
9. ETH ACT indicator	10. RST button	11. ACT indicator	12. STAT indicator

Table 1-9 Description of the buttons and indicators on the MPUG panel

Indicator/ Button	Description
STAT indicator	If the indicator is steady green, it indicates that the MPUG works normally. If the indicator blinks green, it indicates that the MPUG is being registered. If the indicator is steady red, it indicates that the hardware of the MPUG is faulty. If the indicator is off, it indicates that the MPUG is not powered on or fails to be registered.
ACT indicator	If the indicator is steady green, it indicates that the MPUG functions as the master MPU. If the indicator is off, it indicates that the MPUG functions as the slave MPU or is not registered.

Indicator/ Button	Description
USB indicator	If the indicator is steady green, it indicates that a mobile storage device is identified. If the indicator blinks green, it indicates that a mobile storage device is being accessed or written. If the indicator is steady red, it indicates that a mobile storage device cannot be identified or fails to be accessed or written. If the indicator is off, it indicates that no mobile storage device is connected to the USB interface.
ETH LINK indicator	If the indicator is steady green, it indicates that the ETH link is Up. If the indicator is off, it indicates that the ETH link is Down.
ETH ACT indicator	If the indicator blinks yellow, it indicates that data is being transmitted. If the indicator is off, it indicates that no data is being transmitted.
RST button	The button is used for resetting the MPUG. Pressing the RST button resets the MPUG.

Table 1-10 Interfaces on the MPUG

Interface Name	Interface Type	Description
ETH interface (10M/100M/ 1000M Base-TX auto-sensing)	RJ45	One ETH interface, for system maintenance
Console interface	RJ45	One console interface, used to connect to the console for on-site configuration
AUX interface	RJ45	One AUX interface, used to connect to the modem for remote maintenance through a dial-up connection
USB interface	USB 2.0	One USB interface (USB 2.0 host interface), for software upgrade
BITS clock interface	RJ45	Two RJ45 interfaces, used to input 1588v2 time signals
RS485 interface	RJ45	Used to connect to the monitoring interface on the external AC power supply module

- Attributes of the interfaces on the MPUG

Table 1-11 lists the USB interface attributes.

Table 1-11 Attributes of the USB interface

Attribute	Description
Connector type	USB
Working mode	High-speed or full-speed
Standard compliance	USB 2.0

Table 1-12 lists the 10Base-T/100Base-TX/1000Base-T-RJ45 interface attributes.

Table 1-12 Attributes of the 10Base-T/100Base-TX/1000Base-T-RJ45 interface

Attribute	Description
Connector type	RJ45
Working mode	10M/100M/1000M auto-sensing, half-duplex or full-duplex
Standard compliance	IEEE 802.3-2002
Cable specification	Category 5 unshielded twisted pair (UTP) cables recommended in the case of 10 Mbit/s or 100 Mbit/s; super category 5 Shielded Twisted Pair (STP) cables recommended in the case of 1000 Mbit/s

Table 1-13 lists the console interface attributes.

Table 1-13 Attributes of the console interface

Attribute	Description
Connector type	RJ45
Working mode	Duplex Universal Asynchronous Receiver/Transmitter (UART)
Electrical characteristics	RS-232
Baud rate	9600 bit/s (default value), which is configurable
Data equipment type	Data Circuit-terminating Equipment (DCE)
Cable specification	8-core shielded cable

Table 1-14 lists the AUX interface attributes.

Table 1-14 Attributes of the AUX interface

Attribute	Description
Connector type	RJ45
Working mode	Duplex UART
Electrical characteristics	RS-232
Baud rate	9600 bit/s (default value), which is configurable
Data equipment type	DTE (Data Terminal Equipment)
Cable specification	8-core shielded cable

Table 1-15 lists the external clock interface attributes.

Table 1-15 Attributes of the external clock interface

Attribute	Description
Connector type	RJ45
Cable specification	120-ohm clock cable
Standard compliance	G.703

1.6 Physical Specifications

1.6.1 Chassis Specifications

Table 1-16 Physical specifications of the NE40E-X1

Item	Description
Dimensions (W x D x H)	442 mm x 220 mm x 132 mm (17.40 in. x 8.66 in. x 5.20 in.)
Installation	Can be installed in an N63B cabinet, a 19-inch standard cabinet, or a 23-inch rack that complies with the North American standard
Weight	Full configuration: 14 kg (30.87 lb)
Typical power consumption	350 W

Item		Description
Heat dissipation		1136 BTU/hour
DC input voltage	Rated voltage	-48 V
	Maximum voltage range	-38 V to -72 V
Ambient temperature	Long-term	-5°C to +50°C (23°F to 122°F)
	Short-term	-20°C to +60°C (-4°F to 140°F)
	Remarks	Temperature change rate limit: 30°C/hour (86°F/hour)
Storage temperature		-40°C to +70°C (-40°F to 158°F)
Ambient relative humidity	Long-term	5% RH to 85% RH, noncondensing
	Short-term	5% RH to 95% RH, noncondensing
Storage relative humidity		0% RH to 95% RH, noncondensing
Long-term working altitude		Lower than 3000 m (9842.4 ft)
Storage altitude		Lower than 5000 m (16404 ft)

DANGER

The width in the dimensions does not count the size of rack-mounting ears.

The measurement point of the temperature and humidity is 1.5 m (4.92 ft) over the cement floor or ESD-preventive floor and 0.4 m (1.31 ft) in front of the cabinet with no front door or back door.

Short-term operation means that the continuous working time does not exceed 96 hours and that the accumulated working time per year does not exceed 15 days. Otherwise, it is referred to as long-term operation.

The device can not be start at low temperature.

1.6.2 Board Specifications

Type	Board Name	Silkscreen Print
MPU	CR5D00MPUG70	MPUG
2-port 10GE LAN/WAN-XFP NPU	CR5DNPUI2070	NPUI-20
8-port 100/1000Base-X-SFP HIC	CR5D00E8GF70	8xFE/GE

Type	Board Name	Silkscreen Print
8-port 100/1000Base-X-SFP 1588v2 HICA	CR5D0E8GFA70	8xFE/GE-A
8-port 100Base-X-SFP 1588v2 flexible card	CR5D00E8FF10	8xFE-SFP-A
8-port 100Base-RJ45 1588v2 flexible card	CR5D00E8FE10	8xFE-RJ45A
16-port E1 flexible card (75 ohms)	CR5D000DE110	16xE1-75
16-port E1 flexible card (120 ohms)	CR5D000DE111	16xE1-120
4-port 100Base-RJ45 1588v2 flexible card (supporting AUXQ)	CR5D00AUXQ10	AUX/4xFE-A
1-port channelized OC3c/STM1c POS-SFP flexible card	CR5D00C1CF10	1xOC3/cPOS

2 NE40E-X2 Hardware Description

About This Chapter

2.1 Overview

The NE40E-X2 is a high-end network device developed by Huawei. This device is based on the VRP and applies to the access, convergence, and transmission of Metro Ethernet services.

The NE40E-X2 has great capabilities in network access, Layer 2 switching, and EoMPLS transmission, and supports a wide range of high-speed and low-speed interfaces. Hence, the NE40E-X2 supports triple-play of voice, video, and data services and can bear 2G/3G/LTE services simultaneously. The NE40E-X2 can be deployed together with Huawei NE, CX, and ME series products to build a Metro Ethernet network with a clear hierarchy and offer extensive services. This chapter provides an overview of the hardware of the NE40E-X2.

2.1.1 Hardware Description

By adopting a centralized routing engine and NP forwarding structure, the NE40E-X2 has a great capacity and can provide extensive services.

The NE40E-X2 adopts an integrated chassis that can be installed independently. The main parts of the NE40E-X2 such as MPUs, NPUs, PICs, fan modules, and PSUs are hot-swappable.

Figure 2-1 shows the outline of the NE40E-X2. The NE40E-X2 provides two slots for NPUs and eight slots for PICs. The network process unit on the NE40E-X2 is NPUI-20. All the PICs perform data switching through the NPUI-20. The NPUI-20 has a bidirectional processing capability of up to 20 Gbit/s.

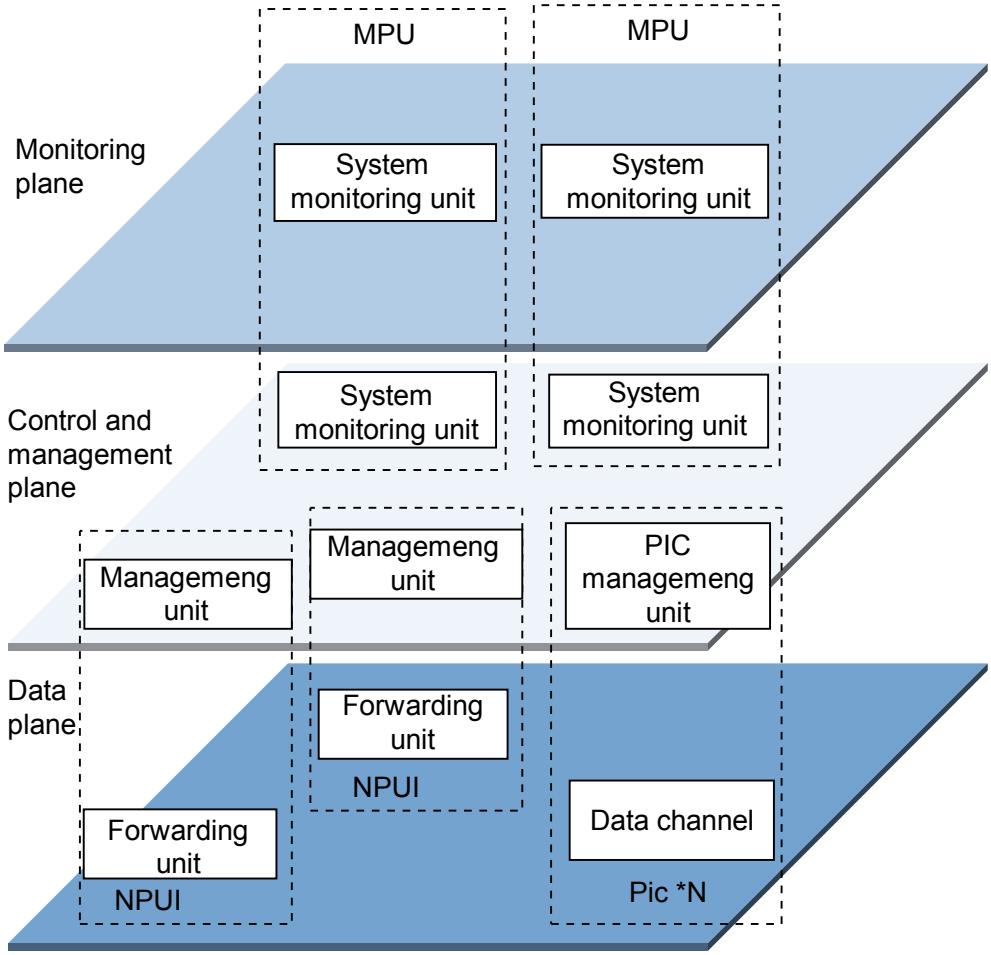
The maximum interface capacity of the NE40E-X2 is 75.2 Gbit/s.

Figure 2-1 Outline of the NE40E-X2

2.1.2 System Architecture

The logical architecture of the NE40E consists of the following planes: data plane, control and management plane, and monitoring plane, as shown in **Figure 2-2**. The data plane processes and switches data packets quickly and smoothly; the control and management plane, as the core of the system, controls and manages the system; the monitoring plane monitors the ambient operating conditions.

Figure 2-2 Diagram of the system architecture



NOTE

NE40E-X2 has two NPUI boards, and NE40E-X1 has only one NPUI board.

2.1.3 Main System Features

The main features of the system include:

- NP-based forwarding which enables fast service deployment
- Compact structure which increases the port density
- Separation of the control channels, service channels, and monitoring channels, which ensures the connectivity of control channels and monitoring channels
- High-level carrier-class reliability and manageability
- Module-level shielding which meets Electro Magnetic Compatibility (EMC) requirements
- Hot-swappable boards, PSUs, and fan modules
- 1:1 backup of MPUs
- Backup for key parts such as PSUs, fan modules, clocks, and management buses
- Protection against incorrect insertion of boards

- Queries about alarm prompts, alarm indications, running status, and alarm status of PSUs
- Queries about alarm prompts, alarm indications, running status, and alarm status of the voltage and ambient temperature

2.1.4 System configuration

Table 2-1 System configuration list of the NE40E-X2

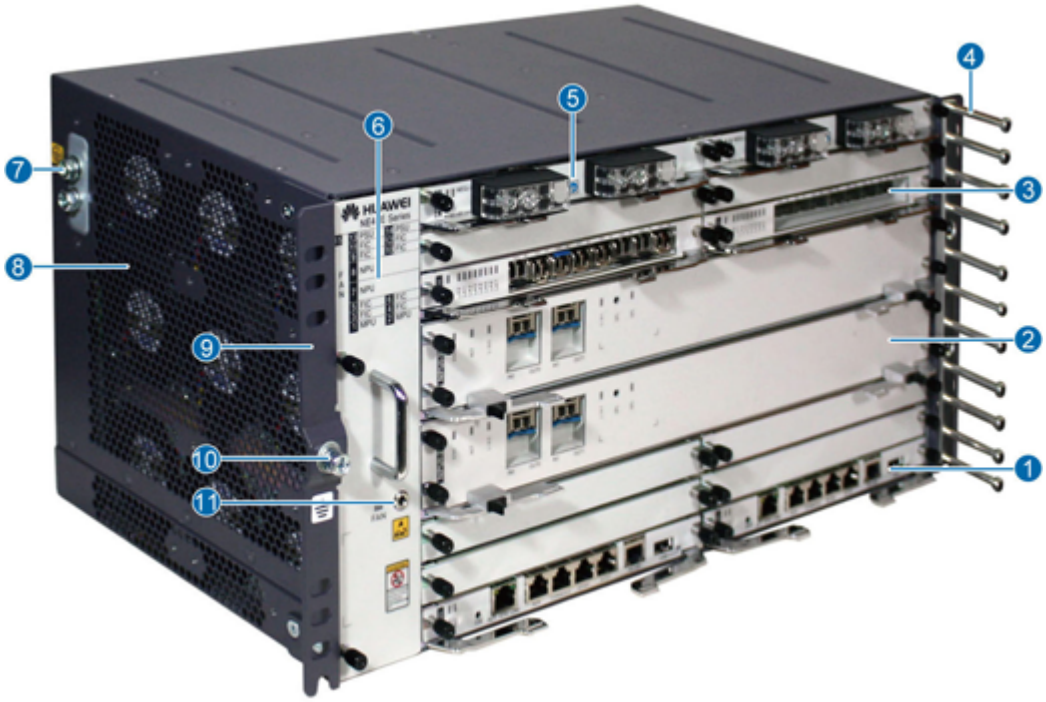
Item	Description
Processing unit	Main frequency: 1.3GHz
SDRAM	2 GB
Flash	32 MB
CF card	1 GB
Switching capacity	40 Gbit/s (bidirectional)
Interface capacity	75.2 Gbit/s
Number of NPU slots	2
Number of PIC slots	8
Number of MPU slots	2
Maximum port rate supported by PICs or NPUs	10 Gbit/s

2.1.5 Main Parts of the NE40E-X2

The NE40E-X2 adopts an integrated chassis, and the main parts of the NE40E-X2 are hot-swappable.

Figure 2-3 shows the outline and parts of the NE40E-X2.

Figure 2-3 Outline and parts of the NE40E-X2



1. MPU	2. NPU	3. PIC	4. Cabling rack
5. PSU	6. Fan Module	7. Grounding Terminal	8. Air intake vent
9. Rack mounting ear	10. Grounding Terminal	11. ESD jack	

2.1.6 Number of Main Parts and Slot Layout of the NE40E-X2

Figure 2-4 shows the slot layout of the NE40E-X2.

Figure 2-4 Slot layout of the NE40E-X2

<table>
<tr><td rowspan="8">15
FAN</td><td>13 PSU</td><td>14 PSU</td></tr>
<tr><td>11 FIC</td><td>12 FIC</td></tr>
<tr><td>9 FIC/HIC</td><td>10 FIC/HIC</td></tr>
<tr><td colspan="2">8 NPU</td></tr>
<tr><td colspan="2">7 NPU</td></tr>
<tr><td>5 FIC/HIC</td><td>6 FIC/HIC</td></tr>
<tr><td>3 FIC</td><td>4 FIC</td></tr>
<tr><td>1 MPU</td><td>2 MPU</td></tr>
</table>

Table 2-2 Slot layout of the NE40E-X2

Slot	Number	Remarks
3 to 6 and 9 to 12	8	For PICs. Slots 5, 6, 9, and 10 apply to both FICs and HICs. Slots 3, 4, 11, and 12 apply to only FICs.
7 and 8	2	For NPUs.
1 and 2	2	For MPUs, which are in 1:1 backup.
13 and 14	2	For PSUs, which are in 1+1 backup.
15	1	For the fan frame.

NOTE

A FIC refers to a sub-card on which every port has a rate of lower than 1 Gbit/s. A HIC refers to a sub-card on which every port has a rate of at least 1 Gbit/s.

2.2 Power Supply System

2.2.1 Architecture of the Power Supply System

The device supports DC power input of -48 V DC or -60 V DC.

The device is powered by two PSUs, which work in 1+1 backup mode. When one PSU fails or is removed, the other one can still supply adequate power for the device. The PSUs are installed in the two top slots of the chassis and supply power for the MPUs, NPU, PICs, and fan module.

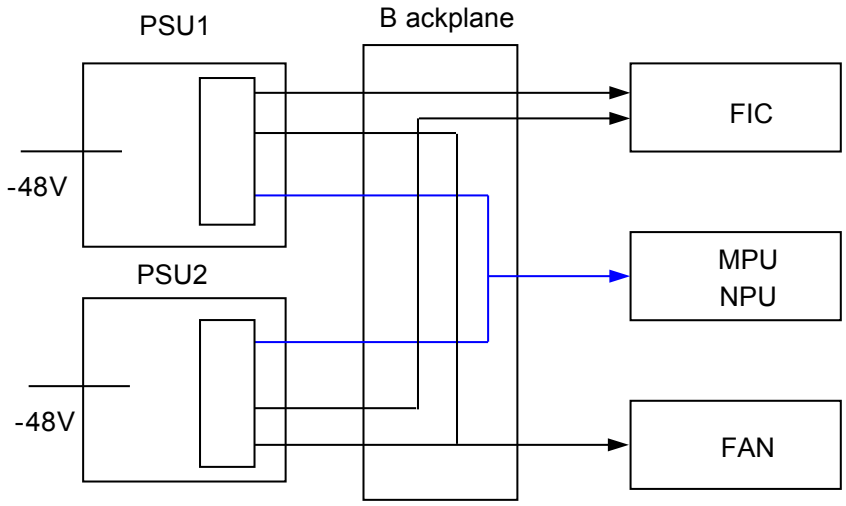
The following measures are taken to ensure that the PSUs can supply stable and safe power for the system:

- Protection against output overcurrent
- Protection against output overvoltage
- Protection against input undervoltage
- Protection against overtemperature
- Protection against short circuit
- Alarm generation

2.2.2 Diagram of the Power Supply Architecture

The two PSUs work in 1+1 backup mode. **Figure 2-5** shows the power supply architecture. Two -12 V power supplies are combined on the backplane, and then are directed to the MPU and NPU. Two -48 V power supplies are input to the PICs, and then are combined on the PICs. Two -48 V power supplies are combined on the backplane, and then are directed to the fan module.

Figure 2-5 Diagram of the power supply architecture



2.2.3 DC Power Supply System

The device adopts two PSUs, which work in 1+1 backup mode, for power supply. **Figure 2-6** shows the outline of a PSU.

Figure 2-6 Outline of a PSU

Figure 2-7 shows the panel of a PSU.

Figure 2-7 Panel of a PSU

Table 2-3 Parameters of the PSUs

Item	Parameter
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Weight	1 kg (2.21 lb)
Rated voltage	-48 V DC or -60 V DC
Input voltage range	-38 V DC to -72 V DC
Maximum input current	24 A
Maximum output power	905 W

Table 2-4 Description of the indicators on the PSUs

Indicator Name	Description
OUT	When the indicator is steady green, it indicates that the PSUs work normally and supply stable power. When the indicator is steady red, it indicates that the hardware of the PSUs fails or the device is not supplied with power ranging from -48 V or -60 V. When the indicator is off, it indicates that the PSUs are switched off or the hardware of the PSUs is faulty.
IN	When the indicator is steady green, it indicates that the power input is normal. When the indicator is off, it indicates that the device is not supplied with power ranging from -48 V or -60 V.

- Notes on DC power monitoring:

  The DC power monitoring channel can implement real-time monitoring on power supply. In addition, the DC power monitoring channel allows you to query the manufacturing ID, input voltage, and temperature of the PSUs in real time, and supports real-time reporting of power supply alarms.
- Notes on the configuration of DC power cables:

  You do not need to connect protection ground cables to the PSUs, but the protection ground cable for the chassis must be properly grounded. DC power cables include a -48 V power cable and a return (RTN) ground cable. The required cable length depends on the distance between the cabinet and the power distribution cabinet for the device. The DC power cables need to be prepared according to the required lengths on site. For details of DC power cables see **4.1 DC Power Cables**.

2.3 Heat Dissipation System

The heat dissipation system is responsible for the heat dissipation of the entire device. Heat generated by the boards is dissipated through the heat dissipation system. In this manner, the temperatures of the components on the boards are controlled within a normal range, enabling the boards to work stably. The heat dissipation system is composed of a fan frame, an air intake vent, an air exhaust vent, and an air channel. All the fans in the fan frame work simultaneously, and their rotation speeds can be adjusted by area. When one fan fails, the heat dissipation system can still allow the device to work at the ambient temperature of 40°C (104°F) for a short period. The temperature sensors, which are located on the air exhaust vent and boards, monitor the temperatures of the components on the boards and adjust the fan rotation speeds according to the commands delivered by the MPU to control the board temperatures.

2.3.1 Air Channel

The NE40E-X2 dissipates heat by blowing air from left to right. **Figure 2-8** shows the air flow in the NE40E-X2.

Figure 2-8 Air flow in the NE40E-X2

2.3.2 Fan Module

The air intake vent of the NE40E-X1 is 5 U (222.25 mm or 8.75 in.)high and 220 mm (8.66 in.) deep.

There are nine fans in the fan frame of the NE40E-X1. When one fan fails, the device can still work at the ambient temperature of 40°C (104°F) for a short period.

The rotation speeds of the fans can be adjusted based on the device temperature.

Figure 2-9 Appearance of the fan module for the NE40E-X1

Figure 2-10 shows the panel of the fan module for the NE40E-X1.

Figure 2-10 Panel of the fan module for the NE40E-X1

Table 2-5 Technical specifications of the fan frame for the NE40E-X1

Parameter	Value
Outline dimension (W * D * H)	50 mm x 226 mm x 219 mm (1.97 in. x 8.90 in. x 8.62 in.)
Weight	1.7 kg (3.75 lb)
Maximum power consumption	150W
Maximum air pressure	477.2 Pa
Maximum air volume	64.4 cubic feet per minute
Noise	64.3 dB

Table 2-6 Indicators on the fan module

Indicator	Description
FAN indicator	If the indicator is steady green, it indicates that the fan module works normally. The indicator is off when the fan module is unregistered, powered off, or has a hardware fault. If the indicator is steady red, it indicates that the fan module fails.

2.4 Data Plane

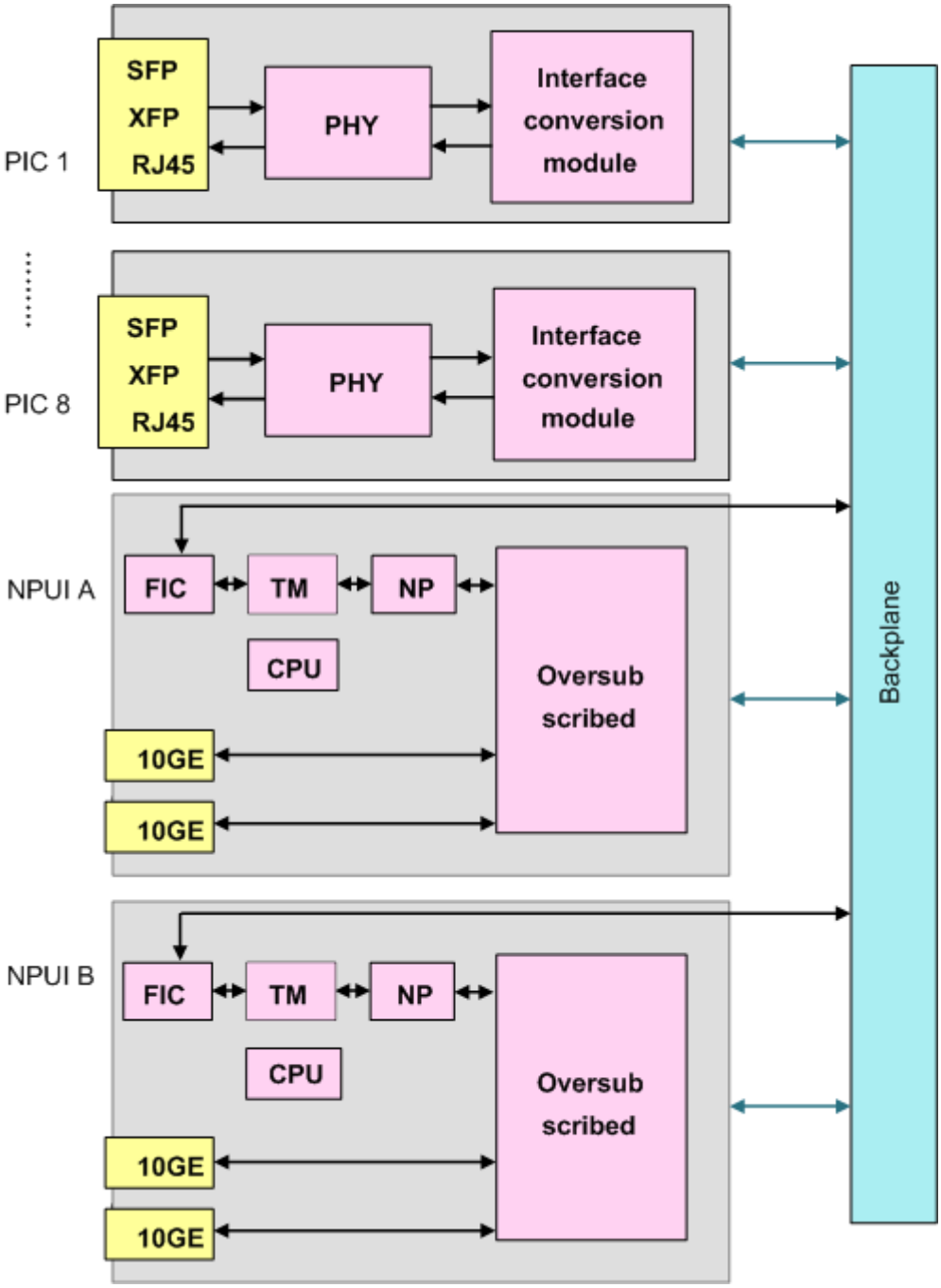
2.4.1 Introduction to the Data Plane

NPUs are key parts on the NE40E-X2 and are responsible for data processing and data switching between PICs and NPUIs.

The procedure for data processing is as follows:

1. The IP packets sent from PICs and 2x10G interfaces on an NPU converge at a convergence module.
2. The NP processes the IP packets.
3. The TM module performs traffic management on the IP packets.
4. The Fabric Interface Chip (FIC) performs IP packet switching.

Figure 2-11 Data plane architecture of the NE40E-X2



2.4.2 Introduction to the NPUI-20

The NPUI-20 has the bidirectional 20-Gbit/s forwarding capability, and all subcards switch data through the NPUI-20.

You can install two NPUs into the chassis of the NE40E-X2. The NPUI-20 in slot 7 is connected to the PICs in slots 3, 4, 5, and 6. The NPUI-20 in slot 8 is connected to the PICs in slots 9, 10, 11, and 12.

The NPUI-20 consists of the following planes:

- Control and management plane

  Through the management channels between MPUs and NPUI-20s, the MPUs can manage NPUs and associated subcards, and transmit routing protocol data.

- Data forwarding plane

  The NPUI-20s are responsible for service processing in the entire system, and are connected to all subcards through data channels.

  An NPUI-20 provides two 10G Ethernet optical interfaces that can work in the WAN or LAN mode and can be installed with XFP optical modules.

Table 2-7 NPUI-20 parameters

Item	Description	Remarks
Forwarding capability	20 Gbit/s (bidirectional)	-
Interface	Two 10GE XFP optical interfaces that can work in the LAN or WAN mode	-

Figure 2-12 Appearance of the NPUI-20 panel

1. Ejector lever
2. OFL indicator
3. OFL button
4. L/A1 indicator
5. Optical interface
6. L/A0 indicator
7. ACT indicator
8. STAT indicator

Table 2-8 describes the buttons and indicators on the NPU panel.

Table 2-8 Description of the buttons and indicators on the NPU panel

Indicator/ Button	Description
STAT indicator	If the indicator is steady green, it indicates that the NPUIworks normally. If the indicator is steady red, it indicates that the hardware of the NPU is faulty. If the indicator blinks green, it indicates that NPU is being registered. If the indicator is off, it indicates that the NPU is not powered on or fails to be registered.

Indicator/ Button	Description
ACT indicator	If the indicator is steady green, it indicates that the NPU is in the master state. If the indicator is off, it indicates that the NPU is in the slave state or fails to be registered.
OFL indicator	If the indicator is steady red, it indicates that the NPU is powered off and can be safely removed. If the indicator is off, it indicates that the NPU works normally.
OFL button	This button indicates the removal of the NPU. Before removing the NPU, you need to press and hold the OFL button for six seconds until the OFL indicator is turned on. Then, the NPU can be safely removed.
L/A0 indicator	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
L/A1 indicator	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.

2.5 Control Plane

2.5.1 Introduction to the Control Plane

The function of control plane is implemented by the MPU.

The device can be equipped with a single MPU or double MPUs (in backup mode).

In the case of double MPUs, the master MPU works and the slave MPU is in the standby state. You cannot access the management network interface on the slave MPU or run commands on the console or AUX interface. The slave MPU exchanges information (heartbeat messages and backup data) with only the master MPU. Data consistency between the master and slave MPUs is ensured through high reliability mechanisms such as batch backup and real-time backup. After the master-slave switchover, the slave MPU immediately takes over as the master MPU. The default master MPU is configurable. During the start process, the MPU that you set wins the competition and becomes the master MPU.

MPUs support two switchover modes: failover and manual switchover. The failover is triggered by serious faults or resetting of the master MPU. The manual switchover is triggered by commands run on the console interface or management interface.

The MPU integrates multiple functional units. By integrating the system control and management unit, clock unit, and system maintenance unit, the MPU provides the functions of the control plane and maintenance plane. The functions of the MPU are detailed as follows:

- System control and management unit

  The MPU is mainly responsible for processing routing protocols. In addition, the MPU broadcasts and filters routing packets, downloads routing policies from the policy server.

The MPU manages the NPUs and communicates with the NPUs. The MPU implements outband communication between boards. The MPU manages and carries out communication between the NPUs and slave MPU through the outband management bus.

The MPU is also responsible for data management. The system configuration data, booting file, upgrade software, and system logs are stored on the MPU. The Compact Flash (CF) card on the MPU functions as a mass storage device for saving data files including system files, configuration files, and logs, and is not hot-swappable.

The MPU manages and maintains the device. Through management interfaces such as serial interfaces and network interfaces on the MPU, you can manage and maintain the device.

- System clock unit

  The system clock unit of the MPU provides NPUs and PICs with reliable and synchronous SDH clock signals.

  The MPUs supports the clock that complies with IEEE 1588v2.

- System maintenance unit

  The system maintenance unit of the MPU collects monitoring information, remotely or locally tests system units, or performs in-service upgrade of system units.

  Through the Monitorbus, the MPU collects the operation data periodically. The MPU produces controlling information, such as detecting the board presence and adjusting the fan speed.

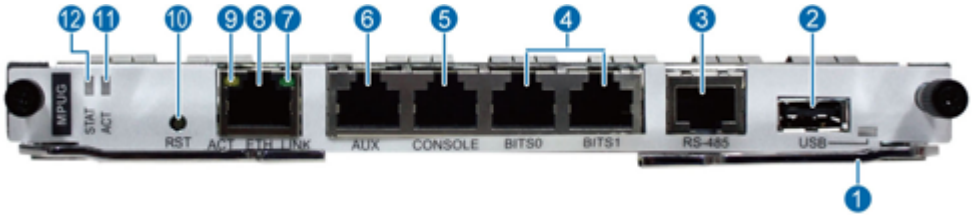
  NOTE

  The MPUs work in 1:1 hot backup mode, improving system reliability.

2.5.2 MPUG

Figure 2-13 shows the MPUG panel.

Figure 2-13 Appearance of the MPUG panel



1. USB indicator	2. USB interface	3. RS-485 interface	4. BITS clock interface
5. Console interface	6. AUX interface	7. ETH LINK indicator	8. ETH interface
9. ETH ACT indicator	10. RST button	11. ACT indicator	12. STAT indicator

Table 2-9 Description of the buttons and indicators on the MPUG panel

Indicator/ Button	Description
STAT indicator	If the indicator is steady green, it indicates that the MPUG works normally. If the indicator blinks green, it indicates that the MPUG is being registered. If the indicator is steady red, it indicates that the hardware of the MPUG is faulty. If the indicator is off, it indicates that the MPUG is not powered on or fails to be registered.
ACT indicator	If the indicator is steady green, it indicates that the MPUG functions as the master MPU. If the indicator is off, it indicates that the MPUG functions as the slave MPU or is not registered.
USB indicator	If the indicator is steady green, it indicates that a mobile storage device is identified. If the indicator blinks green, it indicates that a mobile storage device is being accessed or written. If the indicator is steady red, it indicates that a mobile storage device cannot be identified or fails to be accessed or written. If the indicator is off, it indicates that no mobile storage device is connected to the USB interface.
ETH LINK indicator	If the indicator is steady green, it indicates that the ETH link is Up. If the indicator is off, it indicates that the ETH link is Down.
ETH ACT indicator	If the indicator blinks yellow, it indicates that data is being transmitted. If the indicator is off, it indicates that no data is being transmitted.
RST button	The button is used for resetting the MPUG. Pressing the RST button resets the MPUG.

Table 2-10 Interfaces on the MPUG

Interface Name	Interface Type	Description
ETH interface (10M/100M/ 1000M Base-TX auto-sensing)	RJ45	One ETH interface, for system maintenance
Console interface	RJ45	One console interface, used to connect to the console for on-site configuration

Interface Name	Interface Type	Description
AUX interface	RJ45	One AUX interface, used to connect to the modem for remote maintenance through a dial-up connection
USB interface	USB 2.0	One USB interface (USB 2.0 host interface), for software upgrade
BITS clock interface	RJ45	Two RJ45 interfaces, used to input 1588v2 time signals
RS485 interface	RJ45	Used to connect to the monitoring interface on the external AC power supply module

- Attributes of the interfaces on the MPUG

Table 2-11 lists the USB interface attributes.

Table 2-11 Attributes of the USB interface

Attribute	Description
Connector type	USB
Working mode	High-speed or full-speed
Standard compliance	USB 2.0

Table 2-12 lists the 10Base-T/100Base-TX/1000Base-T-RJ45 interface attributes.

Table 2-12 Attributes of the 10Base-T/100Base-TX/1000Base-T-RJ45 interface

Attribute	Description
Connector type	RJ45
Working mode	10M/100M/1000M auto-sensing, half-duplex or full-duplex
Standard compliance	IEEE 802.3-2002
Cable specification	Category 5 unshielded twisted pair (UTP) cables recommended in the case of 10 Mbit/s or 100 Mbit/s; super category 5 Shielded Twisted Pair (STP) cables recommended in the case of 1000 Mbit/s

Table 2-13 lists the console interface attributes.

Table 2-13 Attributes of the console interface

Attribute	Description
Connector type	RJ45
Working mode	Duplex Universal Asynchronous Receiver/Transmitter (UART)
Electrical characteristics	RS-232
Baud rate	9600 bit/s (default value), which is configurable
Data equipment type	Data Circuit-terminating Equipment (DCE)
Cable specification	8-core shielded cable

Table 2-14 lists the AUX interface attributes.

Table 2-14 Attributes of the AUX interface

Attribute	Description
Connector type	RJ45
Working mode	Duplex UART
Electrical characteristics	RS-232
Baud rate	9600 bit/s (default value), which is configurable
Data equipment type	DTE (Data Terminal Equipment)
Cable specification	8-core shielded cable

Table 2-15 lists the external clock interface attributes.

Table 2-15 Attributes of the external clock interface

Attribute	Description
Connector type	RJ45
Cable specification	120-ohm clock cable
Standard compliance	G.703

2.6 Physical Specifications

2.6.1 Chassis Specifications

Table 2-16 Physical specifications of the NE40E-X2

Item		Description
Dimensions (W x D x H)		442 mm x 220 mm x 222 mm (17.40 in. x 8.66 in. x 8.74 in.)
Installation		Can be installed in an N63B cabinet, a 19-inch standard cabinet, or a 23-inch rack that complies with the North American standard
Weight		Full configuration: 22 kg (48.51 lb)
Typical power consumption		650 W
Heat dissipation		2109 BTU/hour
DC input voltage	Rated voltage	-48 V
	Maximum voltage range	-38 V to -72 V
Ambient operating temperature	Long-term	-5°C to +50°C (23°F to 122°F)
	Short-term	-20°C to +60°C (-4°F to 140°F)
	Remarks	Temperature change rate limit: 30°C/hour (86°F/hour)
Storage temperature		-40°C to +70°C (-40°F to 158°F)
Ambient operating relative humidity	Long-term	5% RH to 85% RH, noncondensing
	Short-term	5% RH to 95% RH, noncondensing
Storage relative humidity		0% RH to 95% RH, noncondensing
Long-term working altitude		Lower than 3000 m (9842.4 ft)
Storage altitude		Lower than 5000 m (16404 ft)

DANGER

The width in the dimensions does not count the size of rack-mounting ears.

The measurement point of the temperature and humidity is 1.5 m (4.92 ft) over the cement floor or ESD-preventive floor and 0.4 m (1.31 ft) in front of the cabinet with no front door or back door.

Short-term operation means that the continuous working time does not exceed 96 hours and the accumulated time per year does not exceed 15 days. Otherwise, it is referred to as long-term operation.

The device can not be start at low temperature.

2.6.2 Board Specifications

Type	Board Name	Silkscreen Print
MPU	CR5D00MPUG70	MPUG
2-port 10GE LAN/WAN-XFP NPU	CR5DNPUI2070	NPUI-20
8-port 100/1000Base-X-SFP HIC	CR5D00E8GF70	8xFE/GE
8-port 100/1000Base-X-SFP 1588v2 HICA	CR5D0E8GFA70	8xFE/GE-A
8-port 100Base-X-SFP 1588v2 flexible card	CR5D00E8FF10	8xFE-SFP-A
8-port 100Base-RJ45 1588v2 flexible card	CR5D00E8FE10	8xFE-RJ45A
16-port E1 flexible card (75 ohms)	CR5D000DE110	16xE1-75
16-port E1 flexible card (120 ohms)	CR5D000DE111	16xE1-120
4-port 100Base-RJ45 1588v2 flexible card (supporting AUXQ)	CR5D00AUXQ10	AUX/4xFE-A
1-port channelized OC3c/STM1c POS-SFP flexible card	CR5D00C1CF10	1xOC3/cPOS

3 Boards

About This Chapter

This chapter describes the boards of the device.

3.1 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)

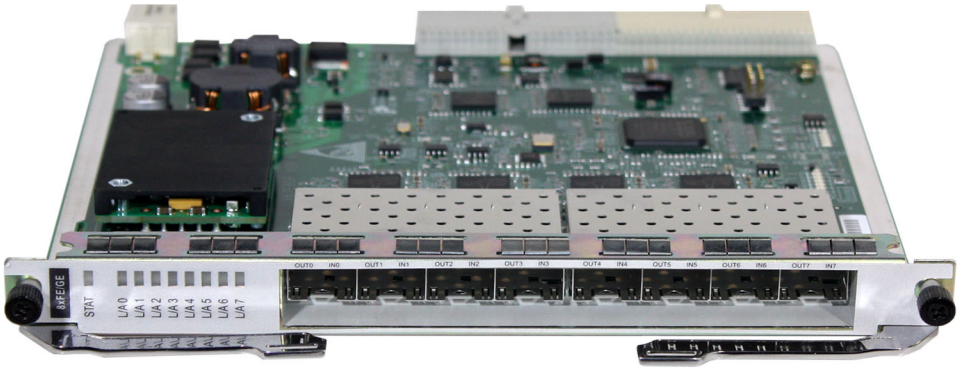
Overview

The 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)supports synchronization Ethernet and the following types of optical modules:

- GE optical module, providing features of GE optical interfaces
- FE optical module, providing features of FE optical interfaces
- Electrical-interface SFP module, providing features of 100M/1000M auto-sensing electrical interfaces When the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC) is installed with an electrical-interface SFP module, synchronization Ethernet is not supported.
- The 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)supports the mixed use of various types of modules.

Figure 3-1 shows the outline of the 8-port 100/1000Base-X-SFP flexible card.

Figure 3-1 Outline of the8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)



Panel Description

Table 3-1 lists the functions of the indicators on the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC).

Table 3-1 Functions of the indicators on the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)

Indicator	Description
STAT	If the indicator is steady green, it indicates that the FPIC works normally. If the indicator is off, it indicates that the FPIC is powered off or is not registered. If the indicator is steady red, it indicates that the hardware on the FPIC is faulty. If the indicator is steady yellow, it indicates that the FPIC is installed in a slot for a HIC and an alarm is reported or the FPIC is not loaded with the logic.
LINK/ACT (green)	If the indicator is steady on, it indicates that the link is normal. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the link is Down.

Interface Attributes

Table 3-2 lists the attributes of the interfaces on the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC).

Table 3-2 Attributes of the interfaces on the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)

Attribute	Value
Connector	LC/PC
Interface attributes	Determined by the selected SFP optical module
Working mode	Full-duplex
Standard compliance	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table 3-3 Attributes of the 100 M SFP optical module

Attribute	Value			
Maximum transmission distance	2 km (1.24 mi.)	15 km (9.32 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)
Center wavelength	1310 nm	1310 nm	1310 nm	1550 nm

Attribute	Value			
Minimum output power	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
Maximum output power	-14.0 dBm	-8.0 dBm	0 dBm	0 dBm
Receiver sensitivity	-30.0 dBm	-31.0 dBm	-37.0 dBm	-37.0 dBm
Overload optical power	-14.0 dBm	-8.0 dBm	-10.0 dBm	-10.0 dBm
Fiber type	Multimode	Single-mode	Single-mode	Single-mode

Table 3-4 Attributes of 1000M SFP optical modules

Attribute	Value					
Transmission Distance	0.5 km (0.31 mi.)	10 km (6.21 mi.)	40 km (24.86 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)	100 km (62.14 mi.)
Center wavelength	850 nm	1310 nm	1310 nm	1550 nm	1550 nm	1550 nm
Minimum output power	-9.5 dBm	-9.5 dBm	-4.5 dBm	-4.0 dBm	-2.0 dBm	0 dBm
Maximum output power	-2.5 dBm	-3.0 dBm	3.0 dBm	1.0 dBm	5.0 dBm	5.0 dBm
Receiving sensitivity	-17.0 dBm	-20.0 dBm	-22.5 dBm	-21.0 dBm	-23.0 dBm	-30.0 dBm
Overload optical power	0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-9.0 dBm
Optical fiber type	Multimode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

Table 3-5 Attributes of 1000M Colored Optical Modules

Attribute	Value							
Transmission Distance	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)
Center wavelength	1470 nm	1490 nm	1510 nm	1530 nm	1550 nm	1570 nm	1590 nm	1610 nm
Minimum output power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm

Attribute	Value							
Maximum output power	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm
Receiving sensitivity	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm
Overload optical power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
Optical fiber type	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

Specifications

Table 3-6 lists the specifications of the8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC) .

Table 3-6 Specifications of the8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)

Parameters	Value
Silkscreen print	8xFE/GE
Typical power consumption	17 W
Heat dissipation	55 BTU/hour
Weight (kg)	0.62 kg/(1.37 lb)
Dimensions (width x depth x height)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector	LC/PC
Earliest Software Version	V600R002C03

Product Specifications

Table 3-7 lists the specifications of the 8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC).

Table 3-7 Specifications of the8-Port 100/1000Base-X-SFP High-speed Interface Card (HIC)

Feature	Description
Supported protocol and service	IEEE 802.3x traffic control IEEE 802.1q, jumbo frames supported by VLAN IEEE 802.3ad link aggregation IEEE 802.1p label
Interface type	SFP LC optical interface
Reliability and availability	Hardware features ● Hot-swappable
NMS	Enhanced command line management interfaces SNMP and MIB
Operating environment	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Storage environment	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

3.2 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)

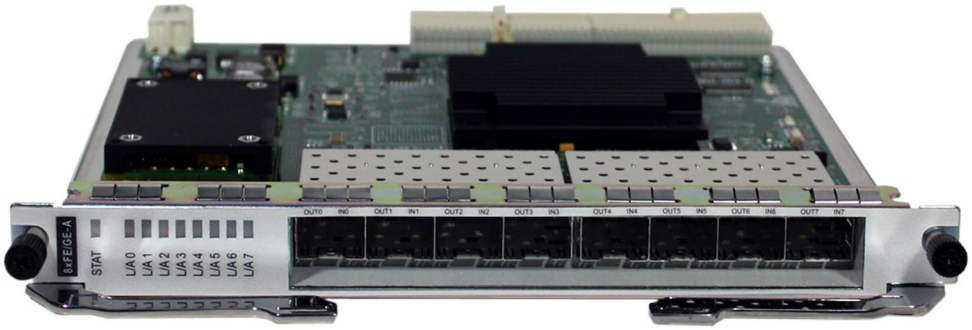
Overview

The 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2) provides eight GE interfaces and supports the 1588v2 function and synchronization Ethernet. The E8GFA supports the following types of optical modules:

- GE optical module, providing features of GE optical interfaces
- FE optical module, providing features of FE optical interfaces
- Electrical-interface SFP module, providing features of 100M/1000M auto-sensing electrical interfaces When the The 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2) is installed with an electrical-interface SFP module or O/E converter, the 1588v2 function and synchronization Ethernet are not supported.
- The 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2) supports the mixed use of the three types of modules.

Figure 3-2 shows the outline of the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2).

Figure 3-2 Outline of the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)



Panel Description

Table 3-8 lists the functions of the indicators on the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2).

Table 3-8 Functions of the indicators on the8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)

Indicator	Meaning
STAT	If the indicator is steady green, it indicates that the FPIC works normally. If the indicator is off, it indicates that the FPIC is powered off or is not registered. If the indicator is steady red, it indicates that the hardware on the FPIC is faulty. If the indicator is steady yellow, it indicates that the FPIC is installed in a slot for a HIC and an alarm is reported or the FPIC is not loaded with the logic.
LINK/ACT (green)	If the indicator is steady green, it indicates that links are Up. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the link is Down.

Interface Attributes

Table 3-9 lists the attributes of the interfaces on the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2).

Table 3-9 Attributes of the interfaces on the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)

Attribute	Value
Connector	LC/PC
Interface attributes	Determined by the selected SFP optical module
Working mode	Full-duplex
Standard compliance	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table 3-10 Attributes of the 100 M SFP optical module

Attribute	Value			
Maximum transmission distance	2 km (1.24 mi.)	15 km (9.32 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)
Center wavelength	1310 nm	1310 nm	1310 nm	1550 nm
Minimum output power	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
Maximum output power	-14.0 dBm	-8.0 dBm	0 dBm	0 dBm
Receiver sensitivity	-30.0 dBm	-31.0 dBm	-37.0 dBm	-37.0 dBm
Overload optical power	-14.0 dBm	-8.0 dBm	-10.0 dBm	-10.0 dBm
Fiber type	Multimode	Single-mode	Single-mode	Single-mode

Table 3-11 Attributes of the 1000M SFP optical module

Attribute	Value					
Transmission Distance	0.5 km (0.31 mi.)	10 km (6.21 mi.)	40 km (24.86 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)	100 km (62.14 mi.)
Center wavelength	850 nm	1310 nm	1310 nm	1550 nm	1550 nm	1550 nm
Minimum output power	-9.5 dBm	-9.5 dBm	-4.5 dBm	-4.0 dBm	-2.0 dBm	0 dBm

Attribute	Value					
Maximum output power	-2.5 dBm	-3.0 dBm	3.0 dBm	1.0 dBm	5.0 dBm	5.0 dBm
Receiving sensitivity	-17.0 dBm	-20.0 dBm	-22.5 dBm	-21.0 dBm	-23.0 dBm	-30.0 dBm
Overload optical power	0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-9.0 dBm
Optical fiber type	Multimode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

Table 3-12 Attributes of the 1000M colored optical module

Attribute	Value							
Transmission distance	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)	70 km (43.50 mi.)
Center wavelength	1470 nm	1490 nm	1510 nm	1530 nm	1550 nm	1570 nm	1590 nm	1610 nm
Minimum output power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
Maximum output power	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm
Receiving sensitivity	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm
Overload optical power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
Optical fiber type	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

Specifications

Table 3-13 lists the specifications of the specifications of the8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2) .

Table 3-13 Specifications of the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)

Parameter	Value
Silkscreen print	8xFE/GE-A
Typical power consumption	22 W
Heat dissipation	71 BTU/hour
Weight (kg)	0.69 kg (1.52 lb)
Dimensions (width x depth x height)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector type	LC
Earliest Software Version	V600R002C03

Product Specifications

Table 3-14 lists the specifications of the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2).

Table 3-14 Product specifications of the 8-Port 100/1000Base-X-SFP High-speed Interface Card A (HIC, Supporting 1588v2)

Model	Value
Supported protocol and service	IEEE 802.3x traffic control IEEE 802.1q jumbo frames supported by VLAN IEEE 802.3ad link aggregation IEEE 802.1p label 1588 V2
Interface type	SFP LC optical interface
Reliability and availability	Hardware features ● Hot-swap
NMS	Enhanced command line management interfaces SNMP and MIB

Model	Value
Operating environment	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Storage environment	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

3.3 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)

Overview

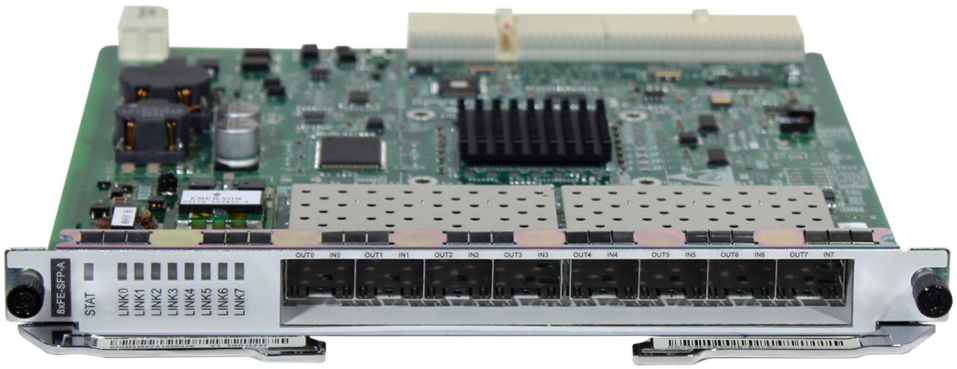
The 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)has eight FE optical interfaces.

The8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)consists of an access convergence module, a control drive module, a clock module, and a power supply module.

- Access convergence module
  - Providing eight FE optical interfaces
  - Supporting the cache function to avoid the loss of signals on the FE optical interface
  - Supporting the flow control function for controlling the volume of packets
  - Supporting the 1588v2 packet processing function
- Control drive module
  - Detecting the system status through the management and control bus
  - Implementing the hot-swap function
- Clock module
  - Providing a working clock for each module
  - Supporting synchronization Ethernet
  - Supporting the IEEE 1588V2 protocol
- Power supply module
  - Supporting two -48V/-60V DC inputs
  - Supplying 3.3 V and 1.2 V power

Figure 3-3 shows the appearance of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2).

Figure 3-3 Appearance of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)



Panel Description

Table 3-15 lists the indicators on the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-15 Description of the indicators on the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)

Indicator/ Button	Meaning
STAT	If the indicator is steady green, it indicates that the FPIC works normally. If the indicator is off, it indicates that the FPIC is powered off or is not registered. If the indicator is steady red, it indicates that the hardware on the FPIC is faulty. If the indicator is steady yellow, it indicates that the FPIC is not loaded with the logic.
LINK/ACT (green)	If the indicator is steady green, it indicates that the FPIC works normally. If the indicator is off, it indicates that the link is Down.

Interface Attributes

Table 3-16 lists the interface attributes of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-16 Interface attributes of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)

Attribute	Value
Connector type	SFP LC optical interface
Interface attributes	Determined by the selected SFP optical module
Working mode	Full-duplex
Compliant standard	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table 3-17 Attributes of the 100 M SFP optical module

Attribute	Value			
Maximum transmission distance	2 km (1.24 mi.)	15 km (9.32 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)
Center wavelength	1310 nm	1310 nm	1310 nm	1550 nm
Minimum output power	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
Maximum output power	-14.0 dBm	-8.0 dBm	0 dBm	0 dBm
Receiver sensitivity	-30.0 dBm	-31.0 dBm	-37.0 dBm	-37.0 dBm
Overload optical power	-14.0 dBm	-8.0 dBm	-10.0 dBm	-10.0 dBm
Optical fiber type	Multimode	Single-mode	Single-mode	Single-mode

Specifications

Table 3-18 lists the technical specifications of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-18 Specifications of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)

Parameters	Value
Silkscreen print	8xFE-SFP-A

Parameters	Value
Typical power consumption	13 W
Heat dissipation	42 BTU/hour
Weight	0.45 kg (0.99 lb)
Dimensions (width x depth x height)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector type	LC
Earliest Software Version	V600R002C03

Product Specifications

Table 3-19 lists the specifications of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-19 Specifications of the 8-Port 100Base-X-SFP Flexible Interface Card (FIC, Supporting 1588v2)

Feature	Description
Supported protocol and service	IEEE 802.3
Interface type	SFP LC optical interface
Reliability and availability	Hardware features ● Hot-swappable
NMS	Enhanced command line management interfaces SNMP and MIB
Operating environment	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Storage environment	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

3.4 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)

Overview

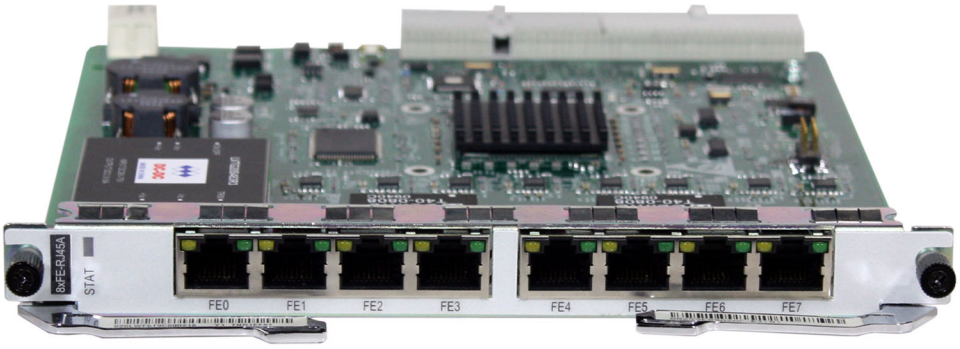
The 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2) has eight FE interfaces for electrical signal access.

The 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)consists of an access convergence module, control drive module, clock module, and power supply module.

- Access convergence module
  - Providing eight FE interfaces for electrical signal access
  - Supporting the cache function to avoid the loss of signals on the FE interface
  - Supporting the flow control function for controlling the volume of packets
  - Supporting 1588v2 packet processing function
- Control drive module
  - Implementing the system status detection function through the management and control bus
  - Implementing the hot swap function
- Clock module
  - Providing a working clock for each module
  - Supporting synchronization Ethernet
  - Supporting IEEE 1588v2
- Power supply module
  - Supporting two -48V/-60V DC inputs
  - Supplying 3.3 V and 1.2 V power for the card

Figure 3-4 shows the appearance of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2).

Figure 3-4 Appearance of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)



Panel Description

Table 3-20 describes the indicators on the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-20 Indicators on the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)

Indicator	Meaning
STAT	If the indicator is steady on, it indicates that the TND1EF8T works normally. If the indicator is off, it indicates that the TND1EF8T is not powered on or fails to be registered. If the indicator is steady red, it indicates that the hardware of the TND1EF8T is faulty. If the indicator is steady yellow, it indicates that the FPIC is not loaded with the logic.

Interface Attributes

Table 3-21 lists the interface attributes of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-21 Interface attributes of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)

Attribute	Value
Connector	RJ45
Working mode	Full-duplex
Standard compliance	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Specifications

Table 3-22 lists the technical specifications of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-22 Specifications of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)

Parameters	Value
Silkscreen print	8xFE-RJ45A
Typical power consumption	9 W
Heat dissipation	29 BTU/hour
Weight	0.43 kg (0.95 lb)
Dimensions (width x depth x height)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector	RJ-45
Earliest software version	V600R002C03

Product Specifications

Table 3-23 lists the specifications of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2).

Table 3-23 Specifications of the 8-Port 100Base-RJ45 Flexible Interface Card (FIC, Supporting 1588v2)

Feature	Description
Supported protocol and service	IEEE 802.3
Interface type	RJ-45
Reliability and availability	Hardware features ● Hot-swappable
NMS	Enhanced command line management interfaces SNMP and MIB
Operating environment	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%

Feature	Description
Storage environment	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

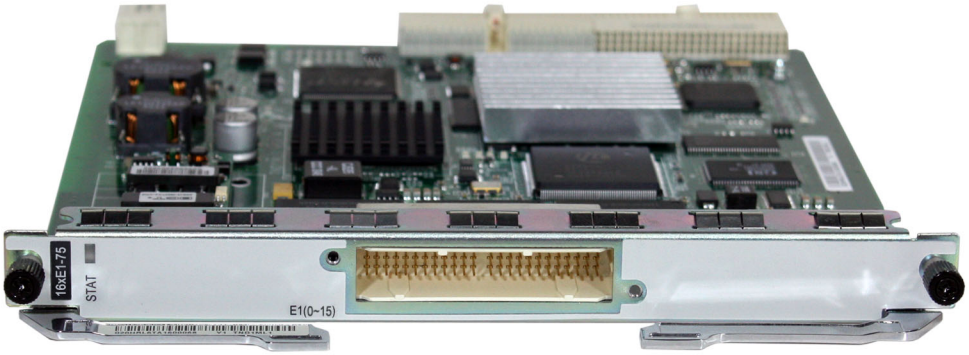
3.5 16-Port E1(75ohm) Flexible Interface Card (FIC)

Overview

The 16-Port E1(75ohm) Flexible Interface Card (FIC)is hot-swappable and provides up to 16 E1 interfaces. The service type of every interface can be configured flexibly.

Figure 3-5 shows the appearance of the 16-Port E1(75ohm) Flexible Interface Card (FIC).

Figure 3-5 Appearance of 16-Port E1(75ohm) Flexible Interface Card (FIC)



Panel Description

Table 3-24 describes the buttons and indicators on the 16-Port E1(75ohm) Flexible Interface Card (FIC).

Table 3-24 Buttons and indicators on the16-Port E1(75ohm) Flexible Interface Card (FIC)

Indicator	Meaning
STAT	If the indicator is steady green, it indicates that the card works normally. If the indicator is off, it indicates that the card is powered off or is not registered. If the indicator is steady red, it indicates that the hardware on the card is faulty. If the indicator is steady yellow, it indicates that logic is not loaded to the card.

Interface Attributes

Table 3-25 shows the interface attributes of the 16-Port E1(75ohm) Flexible Interface Card (FIC).

Table 3-25 Interface attributes of the 16-Port E1(75ohm) Flexible Interface Card (FIC)

Attribute	Description
Connector type	Anea 96, 75 ohm
Nominal bit rate	2048 kbit/s
Interface impedance	75 ohm
Interface code	HDB3
Pulse waveform of the output interface	Compliant with ITU-T G0.703
Attenuation (dB) of the input interface at 1024 kHz	0 to 6
Immunity of the input interface	Compliant with ITU-T G0.703
Input jitter tolerance	Compliant with ITU-T G.823
Output jitter	Compliant with ITU-T G.823

Technical Parameters

Table 3-26 shows the technical parameters of the16-Port E1(75ohm) Flexible Interface Card (FIC) .

Table 3-26 Technical parameters of the 16-Port E1(75ohm) Flexible Interface Card (FIC)

Description	Description
Silkscreen print	16xE1-75
Typical power consumption	15 W
Heat dissipation	49 BTU/hour
Weight	0.45 kg (0.99 lb)

Description	Description
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector type	Anea 96, 75 ohm
Earliest software version	V600R002C03

Product Specifications

Table 3-27 lists the specifications of the 16-Port E1(75ohm) Flexible Interface Card (FIC).

Table 3-27 Specifications of the 16-Port E1(75ohm) Flexible Interface Card (FIC)

Feature	Description
Protocol and services	● ATM/IMA: supporting up to eight IMA groups; 16 E1 links per IMA group ● CES: supporting Circuit Emulation Service (CES) of up to 16 E1 links ● ML-PPP: supports up to 7 ML-PPP groups.
Interface type	Anea 96, 75 ohm
Reliability and availability	Hardware feature ● Hot-swappable
NMS	Supporting command line management interfaces Supporting SNMP and MIBs
Operating ambients	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Storage ambients	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

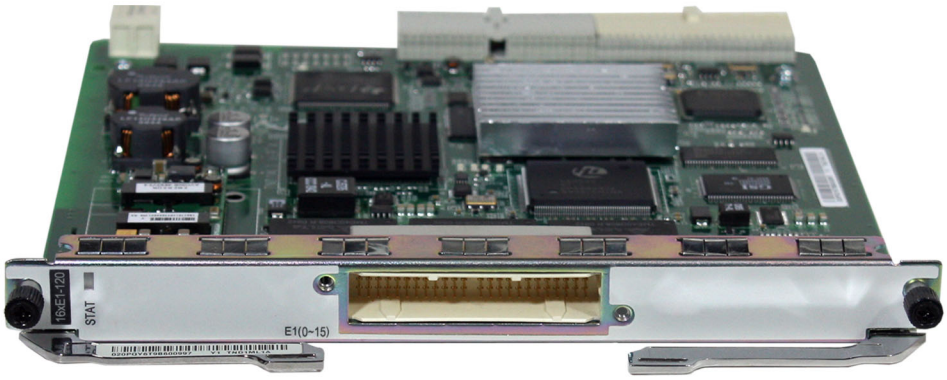
3.6 16-Port E1(120ohm) Flexible Interface Card (FIC)

Overview

The 16-Port E1(120ohm) Flexible Interface Card (FIC)is hot-swappable and provides up to 16 E1 interfaces. The service type of every interface can be configured flexibly.

Figure 3-6 shows the appearance of the 16-Port E1(120ohm) Flexible Interface Card (FIC).

Figure 3-6 Appearance of 16-Port E1(120ohm) Flexible Interface Card (FIC)



Panel Description

Table 3-28 describes the buttons and indicators on the 16-Port E1(120ohm) Flexible Interface Card (FIC).

Table 3-28 Buttons and indicators on the 16-Port E1(120ohm) Flexible Interface Card (FIC)

Indicator	Meaning
STAT	If the indicator is steady green, it indicates that the card works normally. If the indicator is off, it indicates that the card is not powered on or fails to be registered. If the indicator is steady red, it indicates that the hardware of the card is faulty. If the indicator is steady yellow, it indicates that logic is not loaded to the card.

Interface Attributes

Table 3-29 shows the interface attributes of the 16-Port E1(120ohm) Flexible Interface Card (FIC).

Table 3-29 Interface attributes of the 16-Port E1(120ohm) Flexible Interface Card (FIC)

Attribute	Description
Connector type	Anea 96, 120 ohm

Attribute	Description
Nominal bit rate	2048 kbit/s
Interface impedance	120 ohm
Interface code	HDB3
Pulse waveform of the output interface	Compliant with ITU-T G0.703
Attenuation (dB) of the input interface at a point with the frequency of 1024 kHz	0 to 6
Immunity of the input interface	Compliant with ITU-T G0.703
Input jitter tolerance	Compliant with ITU-T G.823
Output jitter	Compliant with ITU-T G.823

Technical Specifications

Table 3-30 shows the technical specifications of the 16-Port E1(120ohm) Flexible Interface Card (FIC).

Table 3-30 Technical specifications of the 16-Port E1(120ohm) Flexible Interface Card (FIC)

Specification	Description
Silkscreen print	16xE1-120
Typical power consumption	15 W
Heat dissipation	49 BTU/hour
Weight	0.45 kg (0.99 lb)
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector type	Anea 96, 120 ohm
Earliest software version	V600R002C03

Product Specifications

Table 3-31 lists the specifications of the 16-Port E1(120ohm) Flexible Interface Card (FIC).

Table 3-31 Specifications of the 16-Port E1(120ohm) Flexible Interface Card (FIC)

Feature	Description
Protocol and services	● ATM/IMA: supporting up to eight IMA groups; 16 E1 links per IMA group ● CES: supporting CES of up to 16 E1 links ● ML-PPP: supporting up to 7 ML-PPP groups
Interface type	Anea 96, 120 ohm
Reliability and availability	Hardware feature ● Hot-swappable
NMS	Supporting command line management interfaces Supporting SNMP and MIBs
Ambient operating conditions	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Ambient storage conditions	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

3.7 Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Overview

The Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2) mainly inputs 4-channel FE electrical signals. The Boolean value input and output interfaces on the card can be connected to the burglarproof sensor (on the cabinet door) and smoke sensor to implement on-site ambient monitoring.

The alarm input interface (ALMI) on the AUXQ is used to input four channels (numbered from 1 to 4) of alarm signals. The ALMI interface can be connected to sensors such as the burglarproof sensor and the smoke sensor on the cabinet door, or to other environment monitoring devices. The environment monitoring device collects the environment monitoring information and outputs the information to the device through the ALMI interface. If any exception occurs in the working environment of the device, the device generates an alarm accordingly and reports the alarm to the NMS for real-time monitoring and management. Users can run a command to configure which channel (1 to 4 channels) and which object (temperature, voltage, current, smoke, and cabinet door) to be monitored. The device then determines whether to report the associated alarm to the NMS based on the configuration performed by users.

NOTE

On one device, only oneAuxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2) can be housed.

The Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2) consists of the service access module, auxiliary interface module, control drive module, clock module, and power module.

- Service access module
  - Inputs 4-channel FE electrical signals.
  - Implements physical-layer interface functions and supports Medium Access Control (MAC) address-based communications.
  - Supports the signal cache function to prevent FE signal loss.
  - Supports the flow control function to control the packet volume.
  - Processes IEEE 1588v2 packets.
- Auxiliary interface module
  - Provides 4-channel alarm input interfaces.
- Control drive module
  - Detects the system status through the management and control bus.
  - Processes alarm signals, orderwire signals, and transparent data signals.
  - Supports hot swapping.
- Clock module
  - Provides clock signals for service access and convergence module.
  - Provides clock signals for the auxiliary interface module.
  - Supports synchronous Ethernet and the Synchronization Status Message (SSM) protocol.
  - Supports IEEE 1588v2.
- Power module
  - Inputs 2-channel -48 V/-60 V DC power.
  - Supplies 3.3 V or 1.2 V power.

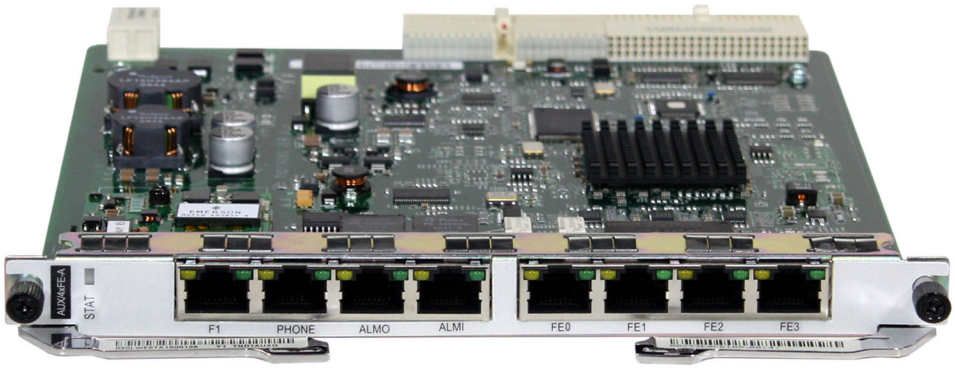
Table 3-32 Description of the interfaces on the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Interface	Type	Description
F1	RJ-45	Reserved
PHONE	RJ-45	Reserved
ALMO	RJ-45	Reserved
ALMI	RJ-45	Interface that inputs four channels of alarm signals
FE0-FE3	RJ-45	Interfaces that input and output FE electrical signals

Interface	Type	Description
NOTE The FE0 to FE3 interfaces, and F1 interface support auto-adaptation to a straight-through network cable or a crossover network cable.		

Figure 3-7 shows the appearance of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2).

Figure 3-7 Appearance of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)



Panel Description

Table 3-33 describes the indicators on the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2).

Table 3-33 Description of the indicators on the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Indicator	Description
STAT	If the indicator is steady green, it indicates that the card works normally. If the indicator is off, it indicates that the card is not powered on or fails to be registered. If the indicator is steady red, it indicates that the hardware on the card is faulty. If the indicator is steady yellow, it indicates that logic is not loaded to the card.

Interface Attributes

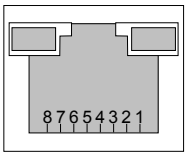
Table 3-34 lists the interface attributes of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2).

Table 3-34 Interface attributes of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Attribute	Description
Connector	RJ45
Working mode	Full-duplex
Standard compliance	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table 3-35 describes the pins of the ALMI interface.

Table 3-35 Pins of the ALMI interface

Front View	Pin	Usage
	1	Alarm input signal 1
	2	Ground for alarm input signal 1
	3	Alarm input signal 2
	4	Alarm input signal 3
	5	Ground for alarm input signal 3
	6	Ground for alarm input signal 2
	7	Alarm input signal 4
	8	Ground for alarm input signal 4

Technical Specifications

Table 3-36 lists the technical specifications of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2).

Table 3-36 Technical specifications of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Item	Description
Silkscreen print	AUX/4xFE-A
Typical power consumption	10 W

Item	Description
Heat dissipation	32 BTU/hour
Weight	0.44 kg (0.97 lb)
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector	RJ45
Earliest software version	V600R002C03

Product Specifications

Table 3-37 lists the product specifications of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2).

Table 3-37 Product specifications of the Auxiliary Flexible Interface Card with 4-Port 100Base-RJ45(FIC, Supporting 1588v2)

Item	Description
Protocol and services	Complies with the IEEE 802.3, and provides four FE electrical interfaces to input 4-channel FE services. Support 4-channel alarm inputs.
Connector	RJ45
Reliability and availability	Hardware features ● Supporting hot swapping ● Supporting temperature and voltage detection
NMS	Supporting command line management interfaces Supporting SNMP and MIBs
Ambient operating conditions	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Ambient storage conditions	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

3.8 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)

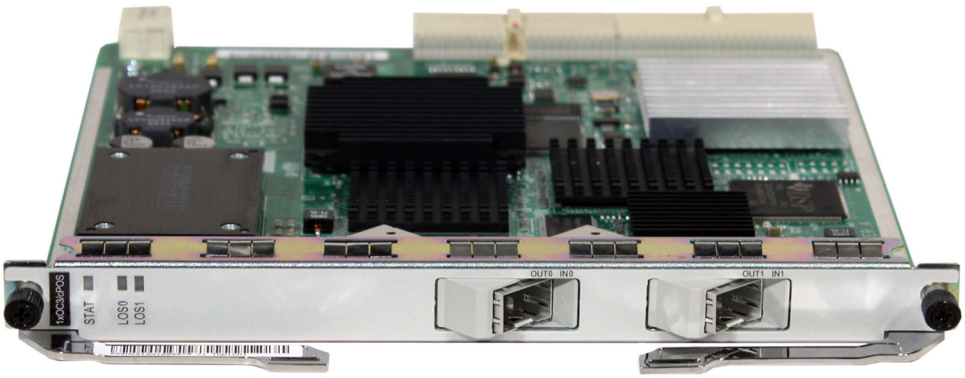
Overview

The 1-port channelized STM-1 flexible card transmits 63-channel E1 signals through 1-channel 155M SDH line, implements the Circuit Emulation Service (CES), Inverse Multiplexing for ATM (IMA), and MultiLink Point-to-Point Protocol (ML-PPP), and supports synchronous Ethernet and hot swapping. The second channelized STM-1 interface on the right of front panel is reserved and cannot be used to carry services.

The 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)consists of the service access module, auxiliary interface module, control drive module, clock module, and power module.

Figure 3-8 shows the appearance of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC).

Figure 3-8 Appearance of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)



Panel Description

Table 3-38 describes the indicators on the1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC) .

Table 3-38 Description of the indicators on the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)

Indicator	Description
STAT	If the indicator is steady green, it indicates that the1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC) works normally. If the indicator is off, it indicates that the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC) is not powered on or fails to be registered. If the indicator is steady red, it indicates that the hardware of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)is faulty. If the indicator is steady yellow, it indicates that logic is not loaded to the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC).
LOS1/LOS2	If the indicator is steady green, it indicates that optical signals are normal. If the indicator is steady red, it indicates that optical signals are lost. If the indicator is off, it indicates that the optical module is not installed.

Interface Attributes

Table 3-39 lists the interface attributes of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC).

Table 3-39 Interface attributes of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)

Attribute	Description
Connector type	LC/PC
Optical interface attribute	Determined by the selected SFP optical module (for attributes of the SFP optical module, see Table 3-40)
Working mode	Full duplex
Link protocol	ML-PPP
Network protocols	IP

Table 3-40 Attributes of the 155-Mbit/s SFP optical module

Attribute	Description			
Transmission distance	2 km (1.24 mi.)	15 km (9.32 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)

Attribute	Description			
Center wavelength	1310 nm	1310 nm	1310 nm	1550 nm
Minimum transmit optical power	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
Maximum transmit optical power	-14.0 dBm	-8.0 dBm	0 dBm	0 dBm
Receiver sensitivity	-30.0 dBm	-31.0 dBm	-37.0 dBm	-37.0 dBm
Overload optical power	-14.0 dBm	-8.0 dBm	-10.0 dBm	-10.0 dBm
Fiber mode	Multi-mode	Single-mode	Single-mode	Single-mode

Technical Specifications

Table 3-41 lists the technical specifications of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC).

Table 3-41 Technical specifications of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)

Item	Description
Silkscreen print	1xOC3/cPOS
Typical power consumption	17 W
Heat dissipation	55 BTU/hour
Weight	0.55 kg (1.21 lb)
Dimensions (W x D x H)	194 mm x 226 mm x 20 mm (7.64 in. x 8.90 in. x 0.79 in.)
Connector type	SFP
Earliest software version	V600R002C03

Product Specifications

Table 3-42 shows the product specifications of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC).

Table 3-42 Product specifications of the 1-Port Channelized OC3c/STM1c POS-SFP Flexible Interface Card (FIC)

Item	Description
Protocol and services	Supporting 63 channels and 7 MP groups Supporting 32 IMA groups and 63 VC-12 timeslots or serial ports in each IMA group
Connector type	SFP
Reliability and availability	Hardware feature ● Supporting hot swapping
NMS	Supporting command line management interfaces Supporting SNMP and MIBs
Ambient operating conditions	Long-term operating temperature: -5°C to 50°C (23°F to 122° F) Short-term operating temperature: -20°C to +60°C (-4°F to 140°F) Long-term relative humidity: 5% to 85% Short-term relative humidity: 5% to 95%
Ambient storage conditions	Storage temperature: -40°C to +70°C (-40°F to 158°F) Storage humidity: 0% to 95%

4 Cables

About This Chapter

This chapter describes the structure and specifications of the external cables.

4.1 DC Power Cables

This section describes the structure and technical specifications of the DC-input power cable.

CAUTION

If no special requirements are imposed on power cables, power cables are delivered according to default configurations. Otherwise, power cables need to be purchased locally. For rules of selecting power cables, refer to the corresponding computation formula in *Power Distribution Guide*.

If a power cable longer than 35 m (114.83 ft) is needed, you need to deploy a Power Distribution Frame (PDF) near the device.

The specifications of the power cable to be delivered are determined by the power distribution distance (the distance between the Router and the Power Distribution Frame) that is surveyed.

6 mm^2 (0.009 in.^2) Power Cable

Table 4-1 describes the specifications of the 6 mm^2 (0.009 in.^2) power cable.

Table 4-1 Terminal and cable specifications of the 6 mm^2 (0.009 in.^2) power cable

Item	Description
Terminal	Naked Crimping Terminal,OT,6mm^2,M6,Tin Plating,Naked Ring Terminal
	Naked Crimping Terminal,OT,6mm^2,M8,Tin Plating,Naked Ring Terminal
Cable	Power Cable,-450/750V,H07Z-K UL3386,6mm^2,Blue,Low Smoke Zero Halogen Cable
	Power Cable,-450/750V,H07Z-K UL3386,6mm^2,Black,Low Smoke Zero Halogen Cable

10 mm^2 (0.02 in.^2) Power Cable

Table 4-2 describes the specifications of the 10 mm^2 (0.02 in.^2) power cable.

Table 4-2 Terminal and cable specifications of the 10 mm^2 (0.02 in.^2) power cable

Item	Description
Terminal	Naked Crimping Terminal,OT,10mm^2,M6,Tin Plating,Naked Ring Terminal

Item	Description
	Naked Crimping Terminal,OT,10mm^2,M8,Tin Plating,Naked Ring Terminal
Cable	Power Cable,-450/750V,H07Z-K UL3386,10mm^2,Blue,Low Smoke Zero Halogen Cable
	Power Cable,-450/750V,H07Z-K UL3386,10mm^2,Black,Low Smoke Zero Halogen Cable

4.2 Chassis and Cabinet Grounding Cable

This section describes the structure and technical specifications of the chassis and cabinet ground cable.

4.2.1 Introduction

The chassis and cabinet ground cables are used to ground a chassis and a cabinet. Before the delivery of a device, ground cables are correctly connected to the front, back and side doors of the cabinet.

4.2.2 Structure

The connector of the chassi and cabinet ground cable is the same as the connector of the DC-input power cable.

4.2.3 Technical Specifications

Table 4-3 lists the technical specifications of the NE40E-X1 and cabinet ground cable..

Table 4-3 Technical specifications of the NE40E-X1 and cabinet ground cable

Item		Description
PGND cable	Terminal	Naked Crimping Terminal,OT,6mm^2,M4,Tin Plating,Naked Ring Terminal
	Cable type	Power Cable,-450/750V,H07Z-K UL3386,6mm^2,olivine
Fireproof class		CM

Table 4-4 lists the technical specifications of the NE40E-X2 and cabinet ground cable..

Table 4-4 Technical specifications of the NE40E-X2 and cabinet ground cable

Item		Description
PGND cable	Terminal	Naked Crimping Terminal,OT,10mm^2,M6,Tin Plating,Naked Ring Terminal
	Cable type	Power Cable,-450/750V,H07Z-K UL3386,10mm^2,olivine
Fireproof class		CM

4.3 Console Port Cable

This section describes the structure and technical specifications of the console interface cable.

4.3.1 Introduction

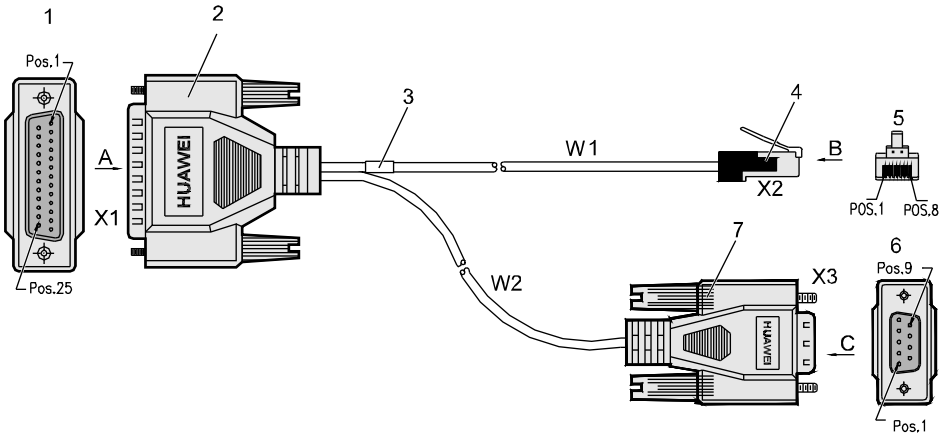
The console interface cable is used to connect the console interface on the NE40E to the serial interface of the console to transmit configuration data of the NE40E.

The console interface cable is an 8-core shielded cable. One end of the cable is an RJ45 connector connected to the console interface on the MPU. The other end has DB9 and DB25 connectors, either of which is connected to the serial interface on a computer.

4.3.2 Structure

Figure 4-1 shows the structure of a console interface cable. **Table 4-5** shows the pin assignment on the console interface cable.

Figure 4-1 Console interface cable



1. Direction A
2. DB25 female connector
3. Label
4. RJ45 connector
5. Direction B
6. Direction C
7. DB9 female connector

W1 and W2 communication cable

Table 4-5 Pin assignment on the console interface cable

RJ45	Direction	DB25	DB9	Signal
1	->	5	8	CTS (Clear to Send)
2	->	6	6	DSR (Data Set Ready)
3	->	3	2	RXD (Receive Data)
4	—	7	5	GND
5	—	8	1	GND
6	<-	2	3	TXD (Transmit Data)
7	<-	20	4	DTR (Data Terminal Ready)
8	<-	4	7	RTS (Request to Send)

4.3.3 Technical Specifications

Table 4-6 lists the technical specifications of the console interface cable.

Table 4-6 Technical specifications of the console interface cable

Item	Description
Connector X1	Network interface connector-crystal connector -8PIN-8bit-shielded plug
Connector X2	Cable connector-D style-25PIN-female
Connector X3	Cable connector-D style-9PIN-female
Cable type	● Symmetrical twisted cable-120-ohm-SEYVPV-0.5mm-24AWG-8core-PANTONE 430U ● Symmetrical twisted cable-100-ohm-SEYVP-0.48mm-26AWG-8core-black
Number of cores	8
Fireproof class	CM
Available length	15 m (49.21 ft) for the 120-ohm cable 3 m (9.84 ft) for the 100-ohm cable

4.4 Auxiliary Port Cable

This section describes the structure and technical specifications of the AUX interface cable.

4.4.1 Introduction

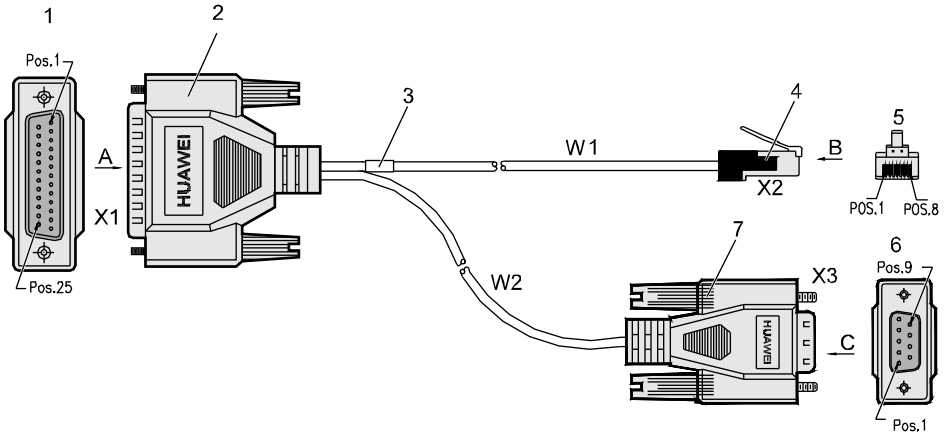
The AUX interface cable is used to connect the AUX interface on the NE40E to a modem to remotely transmit the configuration data of the NE40E.

The AUX interface cable is an 8-core shielded cable. One end of the cable is an RJ45 connector connected to the AUX interface on the MPU. The other end has DB9 and DB25 connectors, either of which is connected to the serial interface on a computer.

4.4.2 Structure

As shown in **Figure 4-2** the structure of the AUX interface cable is the same as that of the console interface cable. **Table 4-7** shows the pin assignment on the AUX interface cable.

Figure 4-2 AUX interface cable



1. Direction A 2. DB25 female connector 3. Label 4. RJ45 connector
5. Direction B 6. Direction C 7. DB9 female connector W1 and W2 communication cable

Table 4-7 Pin assignment on the AUX interface cable

RJ-45	Direction	DB-25	DB-9	Signal
1	->	4	7	RTS
2	->	20	4	DTR
3	->	2	3	TXD
4	—	8	1	GND
5	—	7	5	GND
6	<-	3	2	RXD
7	<-	6	6	DSR
8	<-	5	8	CTS

4.4.3 Technical Specifications

Table 4-8 lists the technical specifications of the AUX interface cable.

Table 4-8 Technical specifications of the AUX interface cable

Item	Description
Connector X1	Network interface connector-crystal connector-8PIN-8bit-shielded plug
Connector X2	Cable connector-D type-25PIN-female
Connector X3	Cable connector-D type-9PIN-female
Cable type	Symmetrical twisted cable-120-ohm-SEYVPV-0.5mm-24AWG-8core-PANTONE 430U Symmetrical twisted cable-100-ohm-SEYVP-0.48mm-26AWG-8core-black
Number of cores	8
Fireproof class	CM
Available length	15 m (49.21 ft) for the 120-ohm cable 3 m (9.84 ft) for the 100-ohm cable

4.5 Clock Cable

This section describes the structure and technical specifications of the clock cable.

4.5.1 Introduction

Clock cable for the 1588v2-supporting MPU

A clock cable is used to connect the clock interface on the NE40E to the clock interface on another device. In this manner, the NE40E can receive 2-Mbit/s clock signals, 2-MHz clock signals, 1 PPS +ASCII time signals, or two channels of DCLS time signals from the upstream device and provides 2-Mbit/s clock signals, 2-MHz clock signals, 1 PPS +ASCII time signals, or two channels of DCLS time signals to the downstream device.

One end of the clock cable is an RJ45 connector connected to the clock interface on the MPU and the other end is connected to the clock interface on an external device. The connector on the other end needs to be prepared as required on site.

An RJ45 connector is used together with the 120-ohm trunk cable.

NOTE

The wire sequence of a trunk cable used as a clock cable differs from the wire sequence of an ordinary twisted cable.

4.5.2 Structure

120-ohm trunk cable

The 120-ohm trunk cable adopts the RJ-45 connector.**Figure 4-3** shows the structure of the 120-ohm trunk cable.

Figure 4-3 120-ohm trunk cable

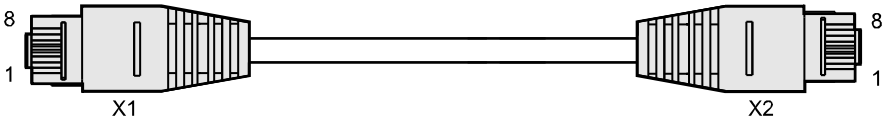


Table 4-9 shows the pin assignments on the 120-ohm trunk cable.

Table 4-9 Pin assignments of the 120-ohm trunk cable

Connector X1	Connector X2	Relationship
X1.5	X2.2	Twisted
X1.4	X2.1	
X1.2	X2.5	Twisted
X1.1	X2.4	
X1.3	X2.7	Twisted
X1.6	X2.8	
X1.7	X2.3	Twisted
X1.8	X2.6	

4.5.3 Technical Specifications

Table 4-10 lists the technical specifications of the 120-ohm trunk cable.

Table 4-10 Technical specifications of the 120-ohm trunk cable

Item		Description
120-ohm cable	Connector	Network interface connector-8 PIN-8 bit-shielded-crystal model plug
	Type	Cable,120ohm,1E1,0.4mm,MP8-II,120CC4P0.4P430U (S),MP8-II,Expert 2.0
	Length	3 m (9.84 ft), 15 m (49.21 ft), 30 m (98.42 ft), 60 m (196.85 ft)and 80 m (262.46 ft)

4.6 Ethernet Cable

Ethernet cables are classigied into two types: straight-through cables and crossover cables.

4.6.1 Introduction

Ethernet cable is of two types: the straight-through cable and the crossover cable.

Straight-through Cable

The straight-through cable is used to connect the Ethernet interfaces between the following devices:

- A Router device and a hub
- A Router device and an Ethernet switch
- A computer and an Ethernet switch
- A computer and a hub

Crossover Cable

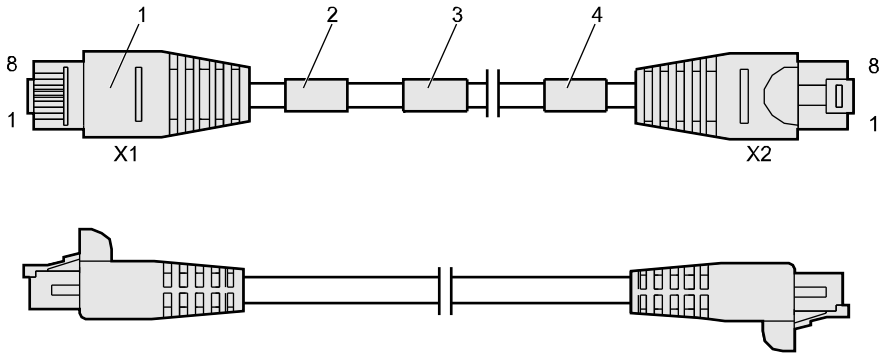
The crossover cable is used to connect the Ethernet interfaces between the following devices:

- A Router device and a CX device
- A Router device and a computer
- A hub and a hub
- A hub and a switch
- A switch and a switch
- A computer and a computer

4.6.2 Structure

As shown in **Figure 4-4**, the straight-through cable and the crossover cable are standard shielded network cables and, adopt an RJ45 connector shown in **Figure 4-5**.

Figure 4-4 Network cable



1. Connector - RJ45 2. Label 1 3. Main label 4. Label 2

Figure 4-5 RJ45 connector

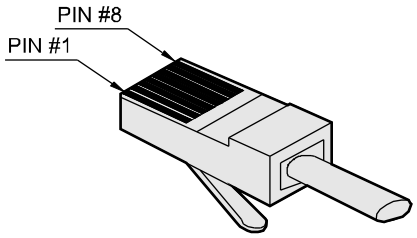


Table 4-11 and **Table 4-12** show the pin assignments of the straight-through cable and the crossover cable respectively.

Table 4-11 Pin assignments of the straight-through cable

Connector X1	Connector X2	Color	Relationship
X1.2	X2.2	Orange	Twisted
X1.1	X2.1	White/orange	
X1.6	X2.6	Green	Twisted
X1.3	X2.3	White/green	
X1.4	X2.4	Blue	Twisted
X1.5	X2.5	White/blue	
X1.8	X2.8	Brown	Twisted
X1.7	X2.7	White/brown	

Table 4-12 Pin assignments of the crossover cable

Connector X1	Connector X2	Color	Relationship
X1.6	X2.2	Orange	Twisted
X1.3	X2.1	White/orange	
X1.2	X2.6	Green	Twisted
X1.1	X2.3	White/green	
X1.4	X2.4	Blue	Twisted
X1.5	X2.5	White/blue	
X1.8	X2.8	Brown	Twisted
X1.7	X2.7	White/brown	

4.6.3 Technical Specifications

Table 4-13 and Table 4-14 show the technical specifications of the straight-through cable and crossover cable respectively.

Table 4-13 Technical specifications of the straight-through cable

Item	Description
Connector X1/X2	Network port connector-crystal connector-8PIN-8bit-shield-plug-24-26AWG-CAT 6/SFTP network cable
Cable type	Communication cable-100±15ohm-shielded enhanced 5 types-CAT5E SFTP 24AWG-8 core PANTONE 445U
Number of cores	8
Fireproof class	CM
Available length	5 m (16.40 ft), 10 m (32.81 ft), 20 m (65.62 ft), and 30 m (98.42 ft)

Table 4-14 Technical specifications of the crossover cable

Item	Description
Connector X1/X2	Network port connector-crystal connector-8PIN-8bit-shield-plug-24~26AWG-CAT 6/SFTP network cable
Cable type	Communication cable-100±15ohm-shielded enhanced 5 types-CAT5E SFTP 24AWG-8 core PANTONE 646U
Number of cores	8

Item	Description
Fireproof class	CM
Available length	5 m (16.40 ft) and 30 m (98.42 ft)

4.7 Optical Fiber

This section describes the structure and technical specifications of the optical fiber.

4.7.1 Introduction

Table 4-15 lists the types of optical fibers that the NE40E uses.

Table 4-15 Types of optical fibers

No.	Description	Local Connector	Remote Connector	Cable Mode
1	Fiber connecting an interface board to the ODF	LC/PC	FC/PC	Single-mode
2	Fiber connecting interface boards	LC/PC	LC/PC or SC/PC	Single-mode / multi-mode
3	Fiber connecting an interface board to another device	LC/PC	LC/PC or SC/PC	Single-mode / multi-mode

CAUTION

The optical transmission module of the multi-transverse mode needs to be connected to the multi-mode fiber. The optical transmitting module of the single-longitudinal mode or multi-longitudinal mode needs to be connected to the single-mode fiber.

4.7.2 Optical Connectors

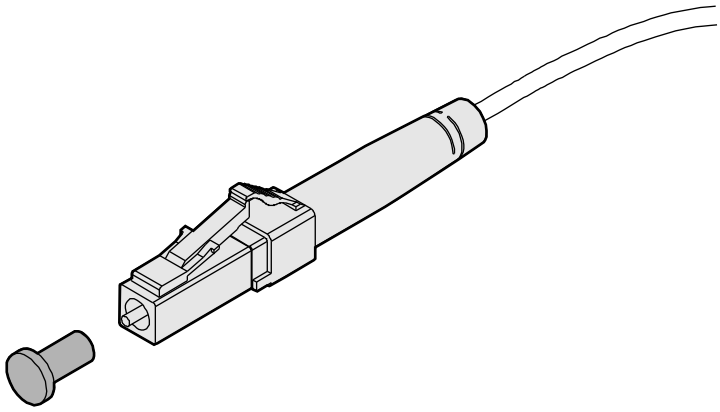
The NE40E uses the LC/PC optical connector.

The outlines and operations of the connector and the precautions that you should take when plugging and unplugging the connector are described in the following sections.

LC/PC Optical Connector

Figure 4-6 shows the outline of the LC/PC optical connector.

Figure 4-6 LC/PC optical connector



The plugging/unplugging of LC/PC optical interface only needs an axial operation instead of a rotation.

The operation procedures and precautions are as follows:

- Cautiously align the head of the fiber jumper with the optical interface on the optical board and push in the fiber with proper strength.
- Press the clip before pulling it out. Push in the fiber connector inward slightly, and then pull out the connector.

4.7.3 Technical Specifications

Table 4-16 shows the technical specifications of the optical fiber.

Table 4-16 Technical specifications of the optical fiber

Item	Description
Fiber transmission mode	Single-mode/Multi-mode
Fiber connector 1	LC/PC and SC/PC
Fiber connector 2	LC/PC, SC/PC and FC/PC
Fiber outer diameter	2 mm (0.08 in.)

4.8 16xE1 Cable

This section describes the structure and technical specifications of the 16xE1 cable.

4.8.1 Overview

The E1 interface on the NE40E uses 75-ohm or 120-ohm trunk cables. One end of the 16xE1 cable is connected to the E1 electrical interface on the device using the Anea 96 connector; the other end of the 16xE1 cable is connected to the Digital Distribution Frame (DDF) using a connector that needs to be made as required on site.

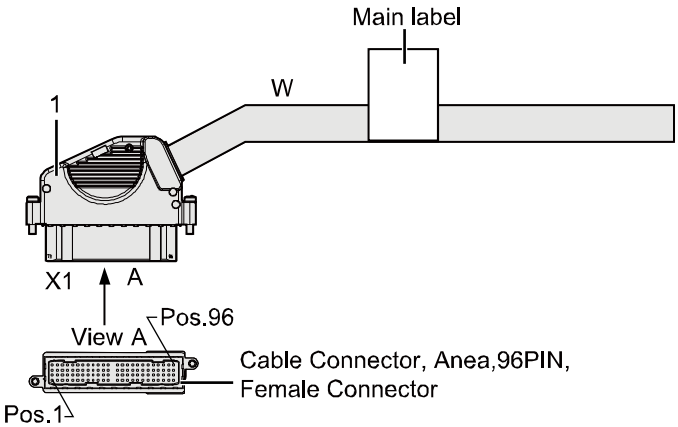
4.8.2 Structure

The 16xE1 cable uses the Anea 96 connector on one end, as shown in **Figure 4-7**.

Figure 4-7 Appearance of the 16×E1 cable

Figure 4-8 shows the structure of the 16xE1 cable.

Figure 4-8 Structure of the 16×E1 cable



- 75-ohm 16×E1 cable wiring

  Table 4-17 describes the wiring of the 75-ohm 16xE1 cable. In the table, Tip indicates the anode and Ring indicates the cathode, and the pairs are numbered from 1 to 32.

Table 4-17 75-ohm 16×E1 cable wiring

Pin	Cable		Remarks	Pin	Cable		Remarks
	Wire	Pair No.			Wire	Pair No.	
1	Tip	1	R0	25	Tip	2	T0

Pin	Cable		Remarks	Pin	Cable		Remarks
	Wire	Pair No.			Wire	Pair No.	
2	Ring			26	Ring		
3	Tip	3	R1	27	Tip	4	T1
4	Ring			28	Ring		
5	Tip	5	R2	29	Tip	6	T2
6	Ring			30	Ring		
7	Tip	7	R3	31	Tip	8	T3
8	Ring			32	Ring		
9	Tip	9	R4	33	Tip	10	T4
10	Ring			34	Ring		
11	Tip	11	R5	35	Tip	12	T5
12	Ring			36	Ring		
13	Tip	13	R6	37	Tip	14	T6
14	Ring			38	Ring		
15	Tip	15	R7	39	Tip	16	T7
16	Ring			40	Ring		
17	Tip	17	R8	41	Tip	18	T8
18	Ring			42	Ring		
19	Tip	19	R9	43	Tip	20	T9
20	Ring			44	Ring		
21	Tip	21	R10	45	Tip	22	T10
22	Ring			46	Ring		
23	Tip	23	R11	47	Tip	24	T11
24	Ring			48	Ring		
49	Tip	25	R12	73	Tip	26	T12
50	Ring			74	Ring		
51	Tip	27	R13	75	Tip	28	T13
52	Ring			76	Ring		
53	Tip	29	R14	77	Tip	30	T14

Pin	Cable		Remarks	Pin	Cable		Remarks
	Wire	Pair No.			Wire	Pair No.	
54	Ring			78	Ring		
55	Tip	31	R15	79	Tip	32	T15
56	Ring			80	Ring		
Outer layer	Shielding layer						

- 120-ohm 16xE1 cable wiring

  Table 4-18 describes the wiring of the 120-ohm 16xE1 cable.

Table 4-18 120-ohm 16×E1 cable wiring

Pin	Cable		Remarks	Pin	Cable		Remarks
	Wire	Type			Wire	Type	
1	White	Twisted	R0	25	White	Twisted	T0
2	Blue			26	Orange		
3	White	Twisted	R1	27	White	Twisted	T1
4	Green			28	Brown		
5	White	Twisted	R2	29	Red	Twisted	T2
6	Grey			30	Blue		
7	Red	Twisted	R3	31	Red	Twisted	T3
8	Orange			32	Green		
9	Red	Twisted	R4	33	Red	Twisted	T4
10	Brown			34	Grey		
11	Black	Twisted	R5	35	Black	Twisted	T5
12	Blue			36	Orange		
13	Black	Twisted	R6	37	Black	Twisted	T6
14	Green			38	Brown		
15	Black	Twisted	R7	39	Yellow	Twisted	T7
16	Grey			40	Blue		
17	White	Twisted	R8	41	White	Twisted	T8
18	Blue			42	Orange		

Pin	Cable		Remarks	Pin	Cable		Remarks
	Wire	Type			Wire	Type	
19	White	Twisted	R9	43	White	Twisted	T9
20	Green			44	Brown		
21	White	Twisted	R10	45	Red	Twisted	T10
22	Grey			46	Blue		
23	Red	Twisted	R11	47	Red	Twisted	T11
24	Orange			48	Green		
49	Red	Twisted	R12	73	Red	Twisted	T12
50	Brown			74	Grey		
51	Black	Twisted	R13	75	Black	Twisted	T13
52	Blue			76	Orange		
53	Black	Twisted	R14	77	Black	Twisted	T14
54	Green			78	Brown		
55	Black	Twisted	R15	79	Yellow	Twisted	T15
56	Grey			80	Blue		
Outer layer	Shielding layer						

4.8.3 Technical Specifications

Technical Specifications of the 75-ohm 16xE1 Cable

Table 4-19 lists the technical specifications of the 75-ohm 16xE1 cable.

Table 4-19 Technical specifications of the 75-ohm 16xE1 cable

Item	Description
Cable name	Trunk cable - 75ohm-16E1-1.6mm-(Anea 96F-I)-(SYFVZP75-1.1/0.26*32(S))- +45deg
Connector model	Cable Connector,Anea,96PIN,Suite Of Female Connector And Shielding Case,IDC Type,For 28~30 AWG Solid Wire,1A
Cable model	Coaxial Cable - SYFVZP-MC 75-1-1*32-75ohm-12.4mm-1.1mm-0.26mm-Pantone Warm Gray 1U

Item	Description
Diameter of the protection layer - diameter of the internal insulation - diameter of the internal conductor	12.4 mm - 1.6 mm - 0.26 mm (0.49 in. - 0.06 in. - 0.01 in.)
Number of cores	32
Cable length	5 m (16.40 ft), 10 m (32.81 ft), 15 m (49.21 ft), 20 m (65.62 ft), 25 m (82.02 ft), 30 m (98.42 ft), 35 m (114.83 ft), 40 m (131.23 ft), 45 m (147.64 ft), and 50 m (164.04 ft)

Technical Specifications of the 120-ohm 16xE1 Cable

Table 4-20 lists the technical specifications of the 120-ohm 16xE1 cable.

Table 4-20 Technical specifications of the 120-ohm 16xE1 cable

Item	Description
Cable name	Trunk cable - 120ohm-16E1-0.4mm-(Anea 96F-I)-(120CC32P0.4P430U(S))- +45deg
Connector model	Cable Connector,Anea,96PIN,Suite Of Female Connector And Shielding Case,IDC Type,For 24~26 AWG Solid Wire-1A
Cable model	Twisted-Pair Cable,120ohm,SEYVP,0.4mm,26AWG, 32Pairs,Pantone 430U
Core diameter of the internal conductor	0.4 mm (0.02 in.)
Number of cores	32 twisted pairs
Cable length	5 m (16.40 ft), 10 m (32.81 ft), 15 m (49.21 ft), 20 m (65.62 ft), 25 m (82.02 ft), 30 m (98.42 ft), 35 m (114.83 ft), 40 m (131.23 ft), 45 m (147.64 ft), and 50 m (164.04 ft)

4.9 Alarm Input/Output Cables

This section describes the structure and technical specifications of the Alarm Input/Output Cables.

4.9.1 Introduction

On the device, the RJ-45 connectors are used to input the alarm signals from the external equipment and output the local alarm signals to the equipment that monitors all the alarms.

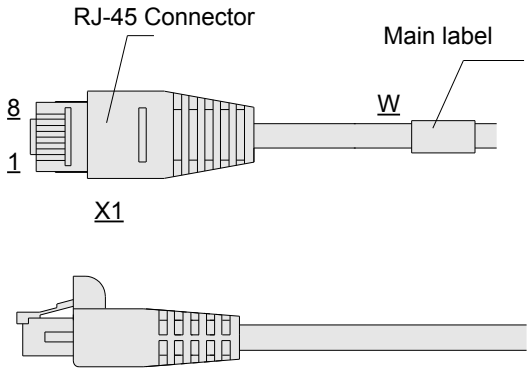
At one end of the alarm input/output cable, the RJ-45 connector is used to connect to the ALMI or ALMO interface on the equipment; at the other end, a connector (made as required on site) is used to connect to the external equipment or the equipment that monitors all the alarms.

4.9.2 Structure

Structure

Figure 4-9 shows the structure of the alarm input/output cable.

Figure 4-9 Structure of the alarm input/output cable



Pin Assignment

Table 4-21 lists the pin assignment of the alarm input/output alarm cable connector.

Table 4-21 Pin assignment of the alarm input/output cable

Connector Pin	Color	Relation	Description	
			ALMI Interface Cable	ALMO Interface Cable
1	White-orange	Twisted pair	Alarm input 1	Positive of alarm output 1
2	Orange		Ground for alarm input 1	Negative of alarm output 1
3	White-green	Twisted pair	Alarm input 2	Positive of alarm output 2
6	Green		Ground for alarm input 2	Negative of alarm output 2
4	Blue	Twisted pair	Alarm input 3	Positive of alarm concatenation 1

Connector Pin	Color	Relation	Description	
			ALMI Interface Cable	ALMO Interface Cable
5	White-blue		Ground for alarm input 3	Negative of alarm concatenation 1
7	White-brown	Twisted pair	Alarm input 4	Positive of alarm concatenation 2
8	Brown		Ground for alarm input 4	Negative of alarm concatenation 2

4.9.3 Technical Specifications

Technical Specifications

Table 4-22lists the technical specifications of the alarm input/output cable.

Table 4-22 Technical specifications of the alarm input/output cable

Item	Specification
Connector X1	Network Interface Connector, 8-Bit 8PIN, Crystal Model Connector
Cable type	Twisted-Pair Cable, 100 ohm, Category 5e, 0.52 mm, 24AWG, 8 Cores, 4 Pairs, PANTONE 430U

A List of Indicators

This chapter presents the list of indicators.

A.1 Indicators on the NE40E-X1

This section describes the indicators on the NE40E-X1.

A.1.1 Indicators on a Fan Module

Table A-1 describes the indicators on a fan module.

Table A-1 Description of the indicators on a fan module

Indicator	Color	Description
FAN	Green	If the indicator is steady green, it indicates that the fan module works normally. If the indicator is off, it indicates that the fan module fails to be unregistered, is not powered on, or has a hardware fault.
	Red	If the indicator is steady red, it indicates that the fan module is faulty.

A.1.2 Indicators on a PSU

The indicators of the PSU are located on the plastic panel. Table A-2 describes the indicators on a DC PSU.

Table A-2 Description of the indicators on a DC PSU

Indicator	Color	Description
IN	Green	If the indicator is steady green, it indicates that the power input is normal. If the indicator is off, it indicates that the device is not supplied with -48 V or -60 V power.
OUT	Green	If the indicator is steady green, it indicates that the DC PSU works normally and supplies stable power. If the indicator is off, it indicates that the DC PSU is switched off or has a hardware fault.
	Red	If indicator is steady red, it indicates that the hardware of the DC PSU fails or the device is not supplied with -48 V or -60 V power.

A.1.3 Indicators on an MPU

Table A-3 describes the indicators on an MPU.

Table A-3 Description of the buttons and indicators on the MPU panel

Indicator/ Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the MPU works normally. If the indicator blinks green, it indicates that the MPU is being registered. If the indicator is off, it indicates that the MPU is not powered on or fails to be registered.
	Red	If the indicator is steady red, it indicates that the hardware of the MPU is faulty.
ACT indicator	Green	If the indicator is steady green, it indicates that the MPU functions as the master MPU. If the indicator is off, it indicates that the MPU functions as the slave MPU or fails to be registered.
USB indicator	Green	If the indicator is steady green, it indicates that a mobile storage device can be identified. If the indicator blinks, it indicates that a mobile storage device is being accessed or written. If the indicator is off, it indicates that the USB interface is not installed with a mobile storage device.
	Red	If the indicator is steady red, it indicates that a mobile storage device cannot be identified or fails to be accessed or written.
ETH LINK indicator	Green	If the indicator is steady green, it indicates that the ETH link is Up. If the indicator is off, it indicates that the ETH link is Down.
ETH ACT indicator	Yellow	If the indicator blinks yellow, it indicates that data is being transmitted. If the indicator is off, it indicates that no data is being transmitted.
RST button	-	The button is used for resetting the MPU. Pressing the RST button resets the MPU.

A.1.4 Indicators on an NPU

Table A-4 describes the indicators on an NPU.

Table A-4 Description of the buttons and indicators on the NPU panel

Indicator/Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the NPU works normally. If the indicator blinks green, it indicates that the NPU is being registered. If the indicator is off, it indicates that the NPU is not powered on or fails to be registered.
	Red	If the indicator is steady red, it indicates that the hardware of the NPU is faulty.
ACT indicator	Green	If the indicator is steady green, it indicates that the NPU is in the master state. If the indicator is off, it indicates that the NPU is in the slave state or fails to be registered.
OFL indicator	Red	If the indicator is steady red, it indicates that the NPU is powered off and can be safely removed. If the indicator is off, it indicates that the NPU works normally.
L/A0 indicator	Green	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
L/A1 indicator	Green	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
OFL button	-	This button indicates the removal of the NPU. Before removing the NPU, you need to press and hold the OFL button for six seconds until the OFL indicator is turned on. Then, the board can be removed safely.

A.1.5 Indicators on a Flexible Card

Table A-5 describes the indicators on a flexible card.

Table A-5 Description of the buttons and indicators on a flexible card

Indicator/ Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the flexible card works normally. If the indicator is off, it indicates that the flexible card is not powered on or fails to be registered.
	Yellow	If the indicator is steady yellow, it indicates that the FPIC is installed in a slot for a HIC and an alarm is reported or the FPIC is not loaded with the logic.
	Red	If the indicator is steady red, it indicates that the hardware of the flexible card is faulty.
LINK/ACT	Green	If the indicator is steady green, it indicates that the link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the link is Down.
LOS1/LOS2	Green	If the indicator is steady green, it indicates that optical signals are normal. If the indicator is off, it indicates that the optical module is not installed.
	Red	If the indicator is steady red, it indicates that optical signals are lost.

A.2 Indicators on the NE40E-X2

This section describes the indicators on the NE40E-X2.

A.2.1 Indicators on a Fan Module

Table A-6 describes the indicators on a fan module.

Table A-6 Description of the indicators on a fan module

Indicator	Color	Description
FAN	Green	If the indicator is steady green, it indicates that the fan module works normally. If the indicator is off, it indicates that the fan module fails to be unregistered, is not powered on, or has a hardware fault.
	Red	If the indicator is steady red, it indicates that the fan module is faulty.

A.2.2 Indicators on a PSU

The indicators of the PSU are located on the plastic panel. **Table A-7** describes the indicators on a DC PSU.

Table A-7 Description of the indicators on a DC PSU

Indicator	Color	Description
IN	Green	If the indicator is steady green, it indicates that the power input is normal. If the indicator is off, it indicates that the device is not supplied with -48 V or -60 V power.
OUT	Green	If the indicator is steady green, it indicates that the DC PSU works normally and supplies stable power. If the indicator is off, it indicates that the DC PSU is switched off or has a hardware fault.
	Red	If indicator is steady red, it indicates that the hardware of the DC PSU fails or the device is not supplied with -48 V or -60 V power.

A.2.3 Indicators on an MPU

Table A-8 describes the indicators on an MPU.

Table A-8 Description of the buttons and indicators on the MPU panel

Indicator/ Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the MPU works normally. If the indicator blinks green, it indicates that the MPU is being registered. If the indicator is off, it indicates that the MPU is not powered on or fails to be registered.
	Red	If the indicator is steady red, it indicates that the hardware of the MPU is faulty.
ACT indicator	Green	If the indicator is steady green, it indicates that the MPU functions as the master MPU. If the indicator is off, it indicates that the MPU functions as the slave MPU or fails to be registered.
USB indicator	Green	If the indicator is steady green, it indicates that a mobile storage device can be identified. If the indicator blinks, it indicates that a mobile storage device is being accessed or written. If the indicator is off, it indicates that the USB interface is not installed with a mobile storage device.
	Red	If the indicator is steady red, it indicates that a mobile storage device cannot be identified or fails to be accessed or written.
ETH LINK indicator	Green	If the indicator is steady green, it indicates that the ETH link is Up. If the indicator is off, it indicates that the ETH link is Down.
ETH ACT indicator	Yellow	If the indicator blinks yellow, it indicates that data is being transmitted. If the indicator is off, it indicates that no data is being transmitted.
RST button	-	The button is used for resetting the MPU. Pressing the RST button resets the MPU.

A.2.4 Indicators on an NPU

Table A-9 describes the indicators on an NPU.

Table A-9 Description of the buttons and indicators on the NPU panel

Indicator/Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the NPU works normally. If the indicator blinks green, it indicates that the NPU is being registered. If the indicator is off, it indicates that the NPU is not powered on or fails to be registered.
	Red	If the indicator is steady red, it indicates that the hardware of the NPU is faulty.
ACT indicator	Green	If the indicator is steady green, it indicates that the NPU is in the master state. If the indicator is off, it indicates that the NPU is in the slave state or fails to be registered.
OFL indicator	Red	If the indicator is steady red, it indicates that the NPU is powered off and can be safely removed. If the indicator is off, it indicates that the NPU works normally.
L/A0 indicator	Green	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
L/A1 indicator	Green	If the indicator is steady green, it indicates that the corresponding link is Up. If the indicator blinks, it indicates that data is being transmitted. If the indicator is off, it indicates that the corresponding link is Down.
OFL button	-	This button indicates the removal of the NPU. Before removing the NPU, you need to press and hold the OFL button for six seconds until the OFL indicator is turned on. Then, the board can be removed safely.

A.2.5 Indicators on a Flexible Card

Table A-10 describes the indicators on a flexible card.

Table A-10 Description of the buttons and indicators on a flexible card

Indicator/ Button	Status	Description
STAT indicator	Green	If the indicator is steady green, it indicates that the flexible card works normally. If the indicator is off, it indicates that the flexible card is not powered on or fails to be registered.
	Yellow	If the indicator is steady yellow, it indicates that the FPIC is installed in a slot for a HIC and an alarm is reported or the FPIC is not loaded with the logic.
	Red	If the indicator is steady red, it indicates that the hardware of the flexible card is faulty.
LINK/ACT	Green	If the indicator is steady green, it indicates that the link is Up. If the indicator blinks green, it indicates that data is being transmitted. If the indicator is off, it indicates that the link is Down.
LOS1/LOS2	Green	If the indicator is steady green, it indicates that optical signals are normal. If the indicator is off, it indicates that the optical module is not installed.
	Red	If the indicator is steady red, it indicates that optical signals are lost.

B List of Boards

This chapter presents the list of boards.

B.1 List of Boards

Table B-1 shows the basic configurations of the NE40E. **Table B-2** lists the physical interface cards supported by the NE40E.

Table B-1 Basic configurations

Product Name	Order Name	Full Name
NE40E-X1	CR5B0BKP0170	**NE40E-X1 integrated chassis components**
	CR5D00MPUG70	**Main Processing Unit**
	CR5DNPUI2070	**Network Processing Unit**
	CR5M001FBX70	**FAN Module**
	CR5D00PSUD70	**DC Power Supply Module**
NE40E-X2	CR5B0BKP0270	**NE40E-X2 integrated chassis components**
	CR5D00MPUG70	**Main Processing Unit**
	CR5DNPUI2070	**Network Processing Unit**
	CR5M002FBX70	**FAN Module**
	CR5D00PSUD70	**DC Power Supply Module**

Table B-2 Flexible cards

Board Type	Order Name	Full Name
PIC	CR5D00E8GF70	**8-port 100/1000Base-X-SFP HIC**
	CR5D0E8GFA70	**8-port 100/1000Base-X-SFP 1588v2 HICA**
	CR5D00E8FF10	**8-port 100Base-X-SFP 1588v2 flexible card**
	CR5D00E8FE10	**8-port 100Base-RJ45 1588v2 flexible card**
	CR5D000DE110	**16-port E1 flexible card (75 ohms)**

Board Type	Order Name	Full Name
	CR5D000DE111	16-port E1 flexible card (120 ohms)
	CR5D00AUXQ10	4-port 100Base-RJ45 1588v2 flexible card (supporting AUXQ)
	CR5D00C1CF10	1-port channelized OC3c/STM1c POS-SFP flexible card

B.2 Board Power Consumption and Weight

Table B-3 lists the nominal power consumption and weight of each type of board supported by the NE40E.

Table B-3 board power consumption and weight

Full Name	Power Consumption	Heat Dissipation	Weight
Main process Unit MPUG	24 W	78 BTU/hour	0.64 kg (1.41 lb)
Network processing Unit NPUI20	200 W	649 BTU/hour	2.62 kg (5.78 lb)
8-port 100/1000Base-X-SFP HIC	17 W	55 BTU/hour	0.62 kg (1.37 lb)
8-port 100/1000Base-X-SFP 1588v2 HICA	22 W	71 BTU/hour	0.69 kg (1.52 lb)
8-port 100Base-X-SFP 1588v2 flexible card	13 W	42 BTU/hour	0.45 kg (0.99 lb)
8-port 100Base-RJ45 1588v2 flexible card	9 W	29 BTU/hour	0.43 kg (0.95 lb)
16-port E1 flexible card (75 ohms)	15 W	49 BTU/hour	0.45 kg (0.99 lb)
16-port E1 flexible card (120 ohms)	15 W	49 BTU/hour	0.45 kg (0.99 lb)
4-port 100Base-RJ45 1588v2 flexible card (supporting AUXQ)	10 W	32 BTU/hour	0.44 kg (0.97 lb)
1-port channelized OC3c/STM1c POS-SFP flexible card	17 W	55 BTU/hour	0.55 kg (1.21 lb)

C List of Interface Attributes

This chapter presents the list of Interface Attributes.

C.1 Interface Attributes of 100Base-TX/1000Base-T-RJ45

Table C-1 lists the interface attributes of 100Base-TX/1000Base-T-RJ45.

Table C-1 Interface attributes of the 100Base-TX/1000Base-T-RJ45

Attributes	Description
Connector type	RJ45
Working mode	100M/1000M auto-sensing and half-duplex and full-duplex
Cable specification	When the interface rate is 1000 Mbit/s, Category 5 unshielded twisted pair (UTP) cable is recommended. When the interface rate is 1000 Mbit/s, Super category 5 Shielded Twisted Pair (STP) cable is recommended.
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

C.2 Interface Attributes of 1000Base-X-SFP

Table C-2 lists the interface attributes of 1000Base-X-SFP.

Table C-2 Interface attributes of the 1000Base-X-SFP

Attributes	Description
Connector type	LC/PC
Interface attributes	Compliant with the selected SFP optical module. (For the attributes of SFP modules, see Table C-3 and Table C-4.)
Working mode	Full-duplex
Compliant standard	IEEE 802.3-2002
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table C-3 Attributes of 1000M SFP optical modules

Attributes	Description					
Transmission distance	0.55 km (0.31 mi)	10 km (6.21 mi)	40 km (24.86 mi)	40 km (24.86 mi)	80 km (49.71 mi)	100 km (62.14 mi)

Attributes	Description					
Center wavelength	850 nm	1310 nm	1310 nm	1550 nm	1550 nm	1550 nm
Minimum transmitting power	-9.5 dBm	-9.5 dBm	-4.5 dBm	-4.0 dBm	-2.0 dBm	0 dBm
Maximum transmitting power	-2.5 dBm	-3.0 dBm	3.0 dBm	1.0 dBm	5.0 dBm	5.0 dBm
Receiving sensitivity	-17.0 dBm	-20.0 dBm	-22.5 dBm	-21.0 dBm	-23.0 dBm	-30.0 dBm
Overload power	0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-3.0 dBm	-9.0 dBm
Optical fiber type	Multi-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

Table C-4 Attributes of 1000M colorized optical modules

Attributes	Description							
Transmission distance	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)	70 km (43.50 mi)
Center wavelength	1470 nm	1490 nm	1510 nm	1530 nm	1550 nm	1570 nm	1590 nm	1610 nm
Minimum transmitting power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
Maximum transmitting power	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm	5 dBm
Receiving sensitivity	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm	-23.0 dBm
Overload power	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
Optical fiber type	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode	Single-mode

C.3 Interface Attributes of 10GBase LAN/WAN-XFP

The interface attributes of 10GBase LAN/WAN-XFP see **Table C-5**.

Table C-5 Interface attributes of the 10GBase LAN/WAN-XFP

Attributes	Description
Connector type	LC/PC
Interface attributes	Compliant with the selected XFP optical module. (For the attributes of XFP modules, see **Table C-6**.)
Working mode	Full-duplex
Compliant standard	IEEE 802.3ae
Frame format	Ethernet_II, Ethernet_SAP, and Ethernet_SNAP
Network protocol	IP

Table C-6 Attributes of 10G XFP optical modules

Attributes	Description			
Transmission distance	0.3 km (0.19 mi)	10 km (6.21 mi)	40 km (24.86 mi)	80 km (49.71 mi)
Center wavelength	850 nm	1310 nm	1550 nm	1550 nm
Minimum transmitting power	-7.3 dBm	-6.0 dBm	-1.0 dBm	0 dBm
Maximum transmitting power	-1.3 dBm	-1.0 dBm	2.0 dBm	4.0 dBm
Receiving sensitivity	-7.5 dBm	-11.0 dBm	-15.0 dBm	-24.0 dBm
Overload power	-1.0 dBm	0.5 dBm	-1.0 dBm	-7.0 dBm
Optical fiber type	Multi-mode	Single-mode	Single-mode	Single-mode

C.4 Interface Attributes of OC-3c/STM-1c POS-SFP

Table C-7 lists the interface attributes of OC-3c/STM-1c POS-SFP.

Table C-7 Interface attributes of the OC-3c/STM-1c POS-SFP

Attributes	Description
Connector type	LC/PC
Interface attributes	Compliant with the selected SFP optical module. (For the attributes of SFP modules, see **Table C-8**.)
Working mode	Full-duplex
Link protocol	PPP and HDLC
Network protocol	IP

Table C-8 Attributes of 155M SFP optical modules

Attributes	Description			
Transmission distance	2 km (1.24 mi.)	15 km (9.32 mi.)	40 km (24.86 mi.)	80 km (49.71 mi.)
Center wavelength	1310 nm	1310 nm	1310 nm	1550 nm
Minimum transmitting power	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
Maximum transmitting power	-14.0 dBm	-8.0 dBm	0 dBm	0 dBm
Receiving sensitivity	-30.0 dBm	-31.0 dBm	-37.0 dBm	-37.0 dBm
Overload power	-14.0 dBm	-8.0 dBm	-10.0 dBm	-10.0 dBm
Optical fiber type	Multi-mode	Single-mode	Single-mode	Single-mode

C.5 E1 Interface Attributes

Table C-9 lists E1 interface attributes.

Table C-9 E1 interface attributes

Attribute	Description
Connector type	Anea96

Attribute	Description
Nominal bit rate (kbit/s)	2048
Interface impedance	75-ohm or 120-ohm
Interface code	HDB3
Pulse waveform of the output interface	Compliant with ITU-T G.703
Attenuation (dB) of the input interface at a point with the frequency of 1024 kHz	0 to 6
Immunity of the input interface	Compliant with ITU-T G.703
Input jitter tolerance	Compliant with ITU-T G.823
Output jitter	Compliant with ITU-T G.823

D Optical Module

This chapter presents the optical module.

D.1 Instructions on How to Use an Optical Module

NOTE

Use only the modules supplied by HUAWEI.

Precautions for the loosened optical module

- When installing an optical module, force it into position. If a crack sound is heard or a slight tremor is felt, it indicates that the latch boss is secured. When the latch boss is not secured, the connecting finger is unstably connected to the connector on the board, and the link may become Up. On the condition that the optical module tremors or collides with another object, however, the optical module will be loosened or the optical signals will be temporarily cut off.
- When inserting the optical module, make sure that the tab is closed. (At this time, the latch boss locks the optical module.) After the optical module is inserted, try pulling it out to see if it is installed in position. If the optical module cannot be pulled out, it is secured.

The tab is closed

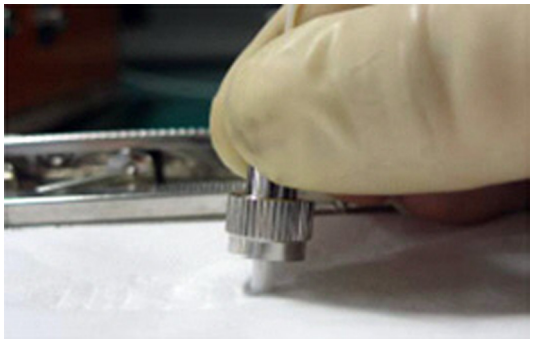
The tab is open

Precautions for receptacle contamination

- Clean tissues must be prepared for the deployment on site. You need to clean the optical connector before inserting it in the receptacle. This protects the receptacle against the contamination on the end surface of the optical connector.

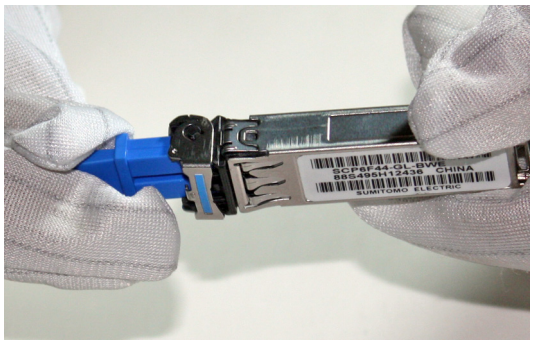
  NOTE

  Use at least three cleaning tissues. Wipe the end of an optical connector horizontally in one direction, and then move the connector end to the unused part of the cleaning tissue to continue. Generally, one cleaning tissue can be used once for cleaning an optical connector.

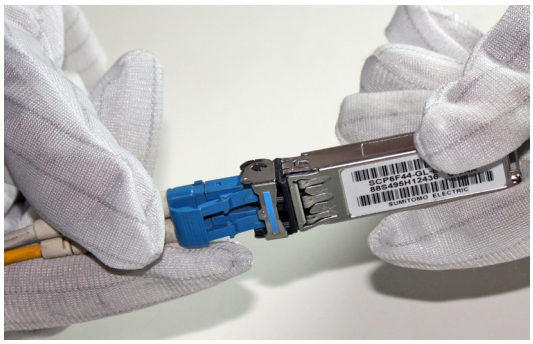
  

- To prevent contamination, the optical module should be covered with either a dust cap or an optical connector.

  Cover an optical module with a dust cap



Cover an optical module with an optical connector

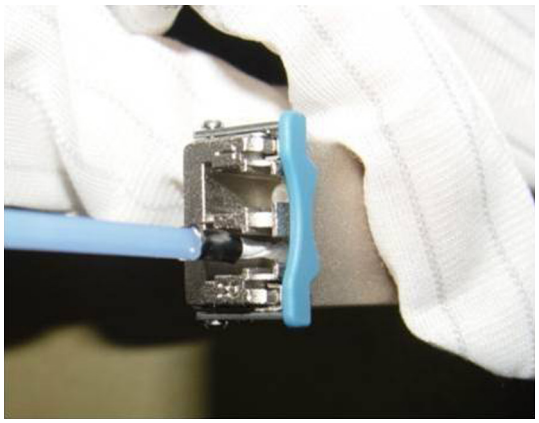


- Lay the optical fibers on the Optical-fiber Distribution Frame (ODF) or coil them up in a fiber management tray. Make sure that the optical fibers are not squeezed.

- If a receptacle or an optical connector has not been used for a long time and not covered with a dust cap, you should clean it before using it. A cotton swab is used to clean a receptacle, and a cleaning tissue is used to clean an optical connector.

  NOTE

  During the cleaning process, insert the cotton swab and turn it slowly in the receptacle. Do not use too much strength, because the receptacle may be damaged.



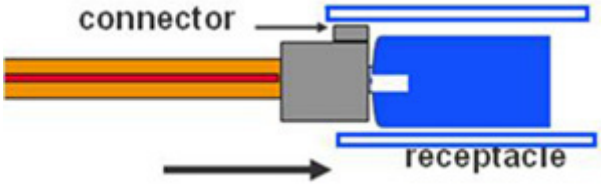
- If optical signals are lost during the operation of a device, use the preceding method to clean the receptacle or the optical connector. In this manner, the possibility of contamination can be excluded.

Precautions for the overload-caused burnt optical module

- When using an OTDR to test the connectivity or the attenuation of optical signals, disconnect the optical connector from the optical module. Otherwise, the optical module is probably burnt.
- When performing a self-loop test, use an optical attenuator. Do not loosen the optical connector instead.
- It is required that a long-distance optical module input optical power smaller than -7 dBm. If the input optical power is larger than -7 dBm, you need to add an optical attenuator. For example, if the transmiting optical power is X dBm and the optical attenuation is Y dB, the receiving optical power is X-Y, which must be smaller than -7dBm (X-Y<-7 dBm).

Other precautions

- The optical connector should be horizontally inserted in the receptacle to avoid damages to the receptacle.



- Mixed use of multi-mode and single-mode optical fibers is prohibited. Otherwise, faults such as signal loss may occur.

D.2 155 Mbit/s SFP/eSFP Optical Module

The STM-1 SFP optical module, with the transmission rate ranging from 100 Mbit/s to 155 Mbit/s, the wavelength being 1310 nm or 1550 nm, and the transmission distance ranging from 2 km (1.24 mi.) to 100 km (62.14 mi.), can be applied to the STM-1/OC-3 POS interface, ATM interface, or FE optical interface .

Table D-1 lists the currently available 155 Mbit/s SFP/eSFP optical modules.

Table D-1 155 Mbit/s SFP/eSFP Optical Modules

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
SFP-STM1-MM1310-2Km	34060287	STM-1 I-1	2 (1.24 mi.)	Multimode	1310	-
SFP-STM1-SM1310-15Km	34060053	STM-1 S-1.1	15 (9.32 mi.)	Single-mode	1310	-
eSFP-STM1-SM1310-15Km	34060276	STM-1 S-1.1	15 (9.32 mi.)	Single-mode	1310	Preferred
eSFP-STM1-SM1310-15Km	34060299	STM-1 S-1.1	15 (9.32 mi.)	Single-mode	1310	-
eSFP-FE-SMTx1310/ Rx1550-15km	34060363	IEE802.3ah	15 (9.32 mi.)	Single-mode	TX1310/ RX1550	It is connected to a single fiber that has a transmitting end and a receiving end.
eSFP-STM1-SM1310-40Km	34060281	STM-1 L-1.1	40 (24.86 mi.)	Single-mode	1310	Preferred When performing a self-loop test, use an optical attenuator
eSFP-STM1-SM1310-40Km	34060300	STM-1 L-1.1	40 (24.86 mi.)	Single-mode	1310	When performing a self-loop test, use an optical attenuator

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
eSFP-STM1-SM1550-80Km	34060282	STM-1 L-1.2	80 (49.71 mi.)	Single-mode	1550	Preferred When performing a self-loop test, use an optical attenuator
eSFP-STM1-SM1550-80Km	34060301	STM-1 L-1.2	80 (49.71 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator
eSFP-STM1-SM1550-100Km	34060283	STM-1 L-1.2	100 (62.14 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator

Table D-2 Basic features of 155 Mbit/s SFP/eSFP optical modules and the compliant standards

Item	Description	Remarks
Interface standard	ITU-T G.957 STM-1, SFP MSA,IEE802.3ah	-
Bit Error Ratio (BER)	< 1 x 10E $^{-12}$	-
Temperature	0-70°C (32°F to 158°F)	-
Digital diagnosis	SFF-8472(exclude SFP optical modules)	-
Environment standard	RoHS(exempted)	-
Security standard	FCC class B, IEC 60825-1 Class 1	-
ESD	>500V	Human body model Class 1

Table D-3 Specifications of the SFP-STM1-MM1310-2K optical module

Parameter	Unit	Value
Interface standard	-	STM-1 I-1, OC-3
Transmission rate	Mbit/s	155.52
Interface type	-	LC
Transmission distance	km	2 (1.24 mi.)
Optical transmitter		
Optical source type		LED
Center wavelength	nm	1310
Operating wavelength range	nm	1270-1380
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	63
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-14
Minimum transmit optical power	dBm	-19
Minimum extinction ratio	dB	10.0
Optical receiver		
Operating wavelength range	nm	1270-1380
Receiver sensitivity	dBm	< -30
Overload power	dBm	-14
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-4 Specifications of the eSFP-STM1-SM1310-15K optical module

Parameter	Unit	Value
Interface standard	-	STM-1 S-1.1, OC-3
Transmission rate	Mbit/s	155.52
Interface type	-	LC
Transmission distance	km	15 (9.32 mi.)
Optical transmitter		
Optical source type		FP Laser
Center wavelength	nm	1310
Operating wavelength range	nm	1261-1360
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	7.7
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-8
Minimum transmit optical power	dBm	-15
Minimum extinction ratio	dB	8.2
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -28
Overload power	dBm	-7
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-5 Specifications of the eSFP-FE-SMTx1310/Rx1550-15km optical module

Parameter	Unit	Value
Interface standard	-	IEE802.3ah
Transmission rate	Mbit/s	155
Interface type	-	LC/PC
Transmission distance	km	15 (9.32 mi.)
Optical transmitter		
Optical source type		FP Laser
Center wavelength	nm	TX1310/RX1550
Operating wavelength range	nm	TX1260-1360 RX1480-1580
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	7.7
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-8
Minimum transmit optical power	dBm	-15
Minimum extinction ratio	dB	8.5
Optical receiver		
Operating wavelength range	nm	1480-1580
Receiver sensitivity	dBm	-32
Overload power	dBm	-8
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-6 Specifications of the eSFP-STM1-SM1310-40K optical module

Parameter	Unit	Value
Interface standard	-	STM-1 L-1.1, OC-3
Transmission rate	Mbit/s	155.52
Interface type	-	LC
Transmission distance	km	40 (24.86 mi.)
Optical transmitter		
Optical source type		FP Laser
Center wavelength	nm	1310
Operating wavelength range	nm	1263-1360
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	4
Maximum spectral width (-20dB)	nm	1
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	0
Minimum transmit optical power	dBm	-5
Minimum extinction ratio	dB	10
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -37
Overload power	dBm	-10
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-7 Specifications of the eSFP-STM1-SM1550-80K optical module

Parameter	Unit	Value
Interface standard	-	STM-1 L-1.2, OC-3
Transmission rate	Mbit/s	155.52
Interface type	-	LC
Transmission distance	km	80 (49.71 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1550
Operating wavelength range	nm	1500-1580
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	0
Minimum transmit optical power	dBm	-5
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -37
Overload power	dBm	-10
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-8 Specifications of the eSFP-STM1-SM1550-100K optical module

Parameter	Unit	Value
Interface standard	-	STM-1 L-1.2, OC-3
Transmission rate	Mbit/s	155.52
Interface type	-	LC
Transmission distance	km	100 (62.14 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1550
Operating wavelength range	nm	1480-1580
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	2
Minimum transmit optical power	dBm	-3
Minimum extinction ratio	dB	10.5
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -37
Overload power	dBm	-10
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	-25

Table D-9 Applications of 155 Mbit/s SFP/eSFP Optical Modules

Product Model	BOM Number	Applications
SFP-STM1-MM1310-2Km	34060287	● OC-3 SFP transceivers are designed for ATM LAN and WAN applications such as: – ATM switches and routers – SONET/SDH switch infrastructure ● Multimode fiber ATM backbone links ● Fast Ethernet
SFP-STM1-SM1310-15Km	34060053	● ATM ● SONET/SDH ● Ethernet ● Switches ● Routers ● Hubs
eSFP-STM1-SM1310-15Km	34060276	● ATM ● SONET/SDH ● Ethernet ● Switches ● Routers ● Hubs
eSFP-STM1-SM1310-15Km	34060299	● Telecommunications – SONET/SR, IR, LR SDH/IO,SH, LH Application – ATM Application – Subscriber Loop – Metropolitan Area Network ● Data communication – High Speed Rack-to-Rack Data Links
eSFP-FE-SMTx1310/Rx1550-15km	34060363	● ATM ● SONET/SDH ● Fast Ethernet

Product Model	BOM Number	Applications
eSFP-STM1-SM1310-40Km	34060281	● Telecommunications – SONET/SR,IR,LR SDH/IO,SH,LH Application – ATM Application – Subscriber Loop – Metropolitan Area Network ● Data communications – High Speed Rack-to-Rack Data Links
eSFP-STM1-SM1310-40Km	34060300	● Telecommunications – SONET/SR,IR,LR SDH/IO,SH,LH Application – ATM Application – Subscriber Loop – Metropolitan Area Network ● Data communications – High Speed Rack-to-Rack Data Links
eSFP-STM1-SM1550-80Km	34060282	● ATM ● SONET/SDH ● Ethernet ● Switches ● Routers ● Hubs
eSFP-STM1-SM1550-80Km	34060301	● Telecommunications – SONET/SR,IR,LR SDH/IO,SH,LH Application – ATM Application – Subscriber Loop – Metropolitan Area Network ● Data communications – High Speed Rack-to-Rack Data Links
eSFP-STM1-SM1550-100Km	34060283	● Telecommunications – SONET/SR,IR,LR SDH/IO,SH,LH Application – ATM Application – Subscriber Loop – Metropolitan Area Network ● Data communications – High Speed Rack-to-Rack Data Links

D.3 1 Gbit/s Electrical Transceiver

The 1 Gbit/s electrical transceiver can be applied to the GE electrical interfaces. At present, there are two types of electrical transceivers, namely, GBIC/RJ45 and SFP/RJ45.

Table D-10 lists the currently available 1 Gbit/s electrical transceivers.

Table D-10 1 Gbit/s electrical transceivers

Product Model	BOM Number	Interface Standard	Transmission Distance	Mode	Auto-negotiation	Remarks
GBIC/RJ45-GE-100m	34100044	1000BASE-T	100 m (328.08 ft)	RJ-45	Not supported	-
SFP/RJ45-GE-100m	34100052	1000BASE-T	100 m (328.08 ft)	RJ-45	Supported	-
SFP/RJ45-GE-100m	34100080	1000BASE-T	100 m (328.08 ft)	RJ-45	Supported	-

Table D-11 Basic features of 1 Gbit/s electrical transceivers and the compliant standards

Item	Description	Remarks
Interface standard	IEEE Std 802.3z, IEEE Std 802.3ab GBIC R5.5(34100044) SFP MSA(34100052, 34100080)	-
Temperature	0-75°C (32°F - 167°F)	-
Digital diagnosis	N/A	-
Environment standard	RoHS(exempted)	-
Security standard	FCC class B, IEC 61000-4-3	-
ESD	>500V	Human body model

Table D-12 Specifications of 1 Gbit/s Electrical Transceivers

Parameter	Unit	Value	Remarks
Interface standard	-	1000BASE-T	-
Transmission rate	Mbit/s	10-1000	Complying with IEEE802.3
Interface type	-	RJ-45	
Transmission distance	m	100 (328.08 ft)	Category 5 UTP, BER < 10^{-10}, (GBIC/RJ45-GE-100)
			Category 5 UTP, BER < 10^{-12}, (SFP/RJ45-GE-100)

Table D-13 Applications of 1 Gbit/s electrical transceivers

Product Model	BOM Number	Applications
GBIC/RJ45-GE-100m	34100044	1.25 Gigabit Ethernet over Cat 5 cable
SFP/RJ45-GE-100m	34100052	● Switch to switch interface ● Switched backplane applications ● File server interface
SFP/RJ45-GE-100m	34100080	● Switch to switch interface ● Switched backplane applications ● File server interface

D.4 1.25 Gbit/s SFP/eSFP Optical Module

The 1.25 Gbit/s SFP/eSFP optical modules of different levels can be applied to the GE interface . The wavelength of the common 1.25 Gbit/s SFP/eSFP optical modules can be 850 nm, 1310 nm, or 1550 nm and the transmission distance ranges from 0.5 (0.31 mi.) km to 100 km (62.14 mi.). The wavelength of the 1.25 Gbit/s SFP/eSFP CWDM optical module ranges from 1470 nm to 1610 nm and the transmission distance is 70 km.

Table D-14 lists the currently available 1.25 Gbit/s SFP/eSFP optical modules.

Table D-14 1.25 Gbit/s SFP/eSFP optical modules

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
eSFP-GE-MM850-500m	34060286	1000BASE-SX	0.5 (0.31 mi.)	Multimode	850	Preferred
SFP-GE-MM850-500m	34060049	1000BASE-SX	0.5 (0.31 mi.)	Multimode	850	-
eSFP-GE-SM1310-10Km	34060219	1000BASE-LX	10 (6.21 mi.)	Single-mode	1310	-
eSFP-GE-SM1310-10Km	34060473	1000BASE-LX	10 (6.21 mi.)	Single-mode	1310	Preferred
eSFP-GE-SMTx1310/ Rx1490-10km	34060470	1000BASE-LX	10 (6.21 mi.)	Single-mode	Tx1310/ Rx1490	It is connected to a single fiber that has a transmitting end and a receiving end.
eSFP-GE-SMTx1490/ Rx1310-10km	34060475	1000BASE-LX	10 (6.21 mi.)	Single-mode	Tx1490/ Rx1310	It is connected to a single fiber that has a transmitting end and a receiving end.
eSFP-GE-SMTx1310/ Rx1490-40km	34060539	1000BASE-LX	40 (24.86 mi.)	Single-mode	Tx1310/ Rx1490	It is connected to a single fiber that has a transmitting end and a receiving end.

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
eSFP-GE-SMTx1490/ Rx1310-40km	34060540	1000BASE-LX	40 (24.86 mi.)	Single-mode	Tx1490/ Rx1310	It is connected to a single fiber that has a transmitting end and a receiving end.
eSFP-GE-SM1310-40Km	34060298	1000BASE-LX	40 (24.86 mi.)	Single-mode	1310	Preferred When performing a self-loop test, use an optical attenuator
SFP-GE-SM1310-40Km	34060207	1000BASE-LX	40 (24.86 mi.)	Single-mode	1310	When performing a self-loop test, use an optical attenuator
SFP-GE-SM1550-40Km	34060069	1000BASE-ZX	40 (24.86 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator
eSFP-GE-SM1550-40Km	34060333	1000BASE-ZX	40 (24.86 mi.)	Single-mode	1550	Preferred When performing a self-loop test, use an optical attenuator

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
eSFP-GE-SM1550-80Km	34060360	1000BASE-ZX	80 (49.71 mi.)	Single-mode	1550	Preferred When performing a self-loop test, use an optical attenuator
eSFP-GE-SM1550-80Km	34060274	1000BASE-ZX	80 (49.71 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator
eSFP-GE-SM1550-100Km	34060295	1000BASE-ZX	100 (62.14 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator

Table D-15 Basic features of 1.25 Gbit/s SFP/eSFP optical modules and the compliant standards

Item	Description	Remarks
Interface standard	IEEE802.3, SFP MSA	-
Bit Error Ratio (BER)	< 1 x 10E $^{-12}$	-
Temperature	0°C to +70°C (32°F to 158°F)	-
Digital diagnosis	SFF-8472(exclude SFP optical modules)	-
Environment standard	RoHS(exempted)	-
Security standard	FCC class B, IEC 60825-1 Class 1	-
ESD	>500V	Human body model

Table D-16 Specifications of the eSFP-GE-MM850-500 optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-SX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	m	500 (1640.4 ft) (50/125 um MMF)
	m	200 (656.16 ft)(62.5/125 um MMF)
Optical transmitter		
Optical source type		VCSEL
Center wavelength	nm	850
Operating wavelength range	nm	830-860
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	0.85
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-2.5
Minimum transmit optical power	dBm	-9.5
Minimum extinction ratio	dB	9.0
Optical receiver		
Operating wavelength range	nm	770-860
Receiver sensitivity	dBm	< -17
Overload power	dBm	0
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-17 Specifications of the eSFP-GE-SM1310-10K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-LX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	10 (6.21 mi.)
Optical transmitter		
Optical source type		FP Laser
Center wavelength	nm	1310
Operating wavelength range	nm	1270-1355
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	4
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-3
Minimum transmit optical power	dBm	-9
Minimum extinction ratio	dB	9.5
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -20
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-18 Specifications of the eSFP-GE-SMTx1310/Rx1490-10K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-LX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	10 (6.21 mi.)
Optical transmitter		
Optical source type		DFB Laser
Center wavelength	nm	Tx1310/Rx1490
Operating wavelength range	nm	1260-1360
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	-3
Minimum transmit optical power	dBm	-9
Minimum extinction ratio	dB	6
Optical receiver		
Operating wavelength range	nm	1480-1500
Receiver sensitivity	dBm	< -19.5
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-19 Specifications of the eSFP-GE-SMTx1490/Rx1310-10K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-LX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	10 (6.21 mi.)
Optical transmitter		
Optical source type		DFB Laser
Center wavelength	nm	Tx1490/Rx1310
Operating wavelength range	nm	1480-1500
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	-3
Minimum transmit optical power	dBm	-9
Minimum extinction ratio	dB	6
Optical receiver		
Operating wavelength range	nm	1260-1360
Receiver sensitivity	dBm	< -19.5
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-20 Specifications of the eSFP-GE-SM1310-40K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-LX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	40 (24.86 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1310
Operating wavelength range	nm	1275-1335
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	0(34060298)
		5(34060207)
Minimum transmit optical power	dBm	-5(34060298)
		-2(34060207)
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -23
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-21 Specifications of the eSFP-GE-SM1550-40K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-ZX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	40 (24.86 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1550
Operating wavelength range	nm	1480-1580
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	1
Minimum transmit optical power	dBm	-4
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1260-1580
Receiver sensitivity	dBm	< -21
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-22 Specifications of the eSFP-GE-SM1550-80K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-ZX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	80 (49.71 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1550
Operating wavelength range	nm	1540-1570
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	5
Minimum transmit optical power	dBm	-2
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1270-1570
Receiver sensitivity	dBm	< -23
Overload power	dBm	-3
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-23 Specifications of the eSFP-GE-SM1550-100K optical module

Parameter	Unit	Value
Interface standard	-	1000BASE-ZX
Transmission rate	Mbit/s	1.25 G
Interface type	-	LC
Transmission distance	km	100 (62.14 mi.)
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1550
Operating wavelength range	nm	1540-1570
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	5
Minimum transmit optical power	dBm	0
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1270-1600
Receiver sensitivity	dBm	< -30
Overload power	dBm	-9
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	N/A

Table D-24 Applications of 1.25 Gbit/s SFP/eSFP optical modules

Product Model	BOM Number	Applications
eSFP-GE-MM850-500m	34060286	● 1.25 Gb/s 1000Base-SX Ethernet ● Dual Rate 1.063/2.125 Gb/s Fibre Channel
SFP-GE-MM850-500m	34060049	● Switch to switch interface ● Switched backplane applications ● File server interface ● iSCSI applications
eSFP-GE-SM1310-10Km	34060219	● 1.25Gb/s 1000Base-LX Ethernet ● 1.06 Gb/s Fibre Channel
eSFP-GE-SM1310-10Km	34060473	● Switch to Switch interface ● Switched backplane applications ● Router/Server interface ● Other optical transmission systems
eSFP-GE-SMTx1310/Rx1490-10km	34060470	● Gigabit Ethernet Application ● Point-to-Point FTTX Application
eSFP-GE-SMTx1490/Rx1310-10km	34060475	● Gigabit Ethernet Application ● Point-to-Point FTTX Application
eSFP-GE-SM1310-40Km	34060298	● Gigabit Ethernet ● Fiber Channel
SFP-GE-SM1310-40Km	34060207	● 1.25Gb/s 1000Base-LX Ethernet ● Dual Rate 1.06/2.125 Gb/s Fibre Channel
SFP-GE-SM1550-40Km	34060069	● Ethernet switches ● Multi-service switches and routers ● Broadband aggregation and wireless infrastructure ● Switched backplane applications ● High Speed Interface for server farms ● Metro access switch GbE connections
eSFP-GE-SM1550-40Km	34060333	● Gigabit Ethernet ● Gigabit Fiber Channel ● Switch to switch interface ● Switched backplane applications

Product Model	BOM Number	Applications
eSFP-GE-SM1550-80Km	34060360	● Gigabit Ethernet 1000Base-ZX ● Gigabit Fiber Channel ● Switch to switch interface ● Switched backplane applications
eSFP-GE-SM1550-80Km	34060274	● Gigabit Ethernet ● Fiber Channel
eSFP-GE-SM1550-100Km	34060295	● Gigabit Ethernet ● 1X and 2X Fibre Channel

D.5 10 Gbit/s XFP Optical Module

The 10 Gbit/s XFP optical modules of different levels can be applied to the OC-192/STM-64 POS interface and 10 GE interface. The wavelength of the these 10 Gbit/s XFP optical modules can be 850 nm, 1310 nm, or 1550 nm and the transmission distance ranges from 0.3 km (0.19 mi.) to 80 km (49.71 mi.) .

Table D-25 lists the currently available 10 Gbit/s XFP optical modules.

Table D-25 10 Gbit/s XFP optical modules

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
XFP-10G-MM850-300m	34060362	10GBASE-SR/SW	0.3 (0.19 mi.)	Multimode	850	-
XFP-10G-SM1310-10Km	34060313	10GBASE-LR/LW STM-64/OC-192	10 (6.21 mi.)	Single-mode	1310	-
XFP-10G-SM1550-40Km	34060322	10GBASE-ER/EW STM-64/OC-192	40 (24.86 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator

Product Model	BOM Number	Interface Standard	Transmission Distance (km)	Mode	Wavelength (nm)	Remarks
XFP-10G-SM1550-80Km	34060361	10GBASE-ZR/ZW STM-64/ OC-192	80 (49.71 mi.)	Single-mode	1550	When performing a self-loop test, use an optical attenuator

Table D-26 Basic features of 10 Gbit/s XFP optical modules and the compliant standards

Item	Description	Remarks
Interface standard	IEEE802.3ae 10GE, SONET OC-192/SDH STM-64, XFP MSA	XFP-10G-MM850-300 do not support SONET OC-192/ SDH STM-64
Bit Error Ratio (BER)	< 1 x 10E $^{-12}$	
Temperature	0-70°C (32°F to 158°F)	-
Digital diagnosis	XFP MSA INF8077i	-
Environment standard	RoHS(exempted)	-
Security standard	FCC class B, IEC 60825-1 Class 1 laser eye safe	-
ESD	>500V	Human body model

Table D-27 Specifications of the XFP-10G-MM850-300 optical module

Parameter	Unit	Value
Interface standard	-	10GBASE-SR/SW
Transmission rate	Mbit/s	10.3125 (10GBASE-SR/ SW)
Interface type	-	LC
Transmission distance	m	300 (984.24 ft)(50/125um MMF, OM3)
	m	33 (108.27 ft)(62.5/125um MMF, OM1)
Optical transmitter		

Parameter	Unit	Value
Optical source type		VCSEL
Center wavelength	nm	850
Operating wavelength range	nm	840-860
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	0.45
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	N/A
Average transmit optical power		
Maximum transmit optical power	dBm	-1.3
Minimum transmit optical power	dBm	-7.3
Minimum extinction ratio	dB	3.0
Optical receiver		
Operating wavelength range	nm	840-860
Receiver sensitivity	dBm	< -7.5
Overload power	dBm	-1
Maximum optical channel cost	dB	N/A
Maximum reflection factor	dB	-12

Table D-28 Specifications of the XFP-10G-SM1310-10K optical module

Parameter	Unit	Value
Interface standard	-	10GBASE-LR/LW, STM-64/OC-192
Transmission rate	Gbit/s	9.95328 (STM-64/OC-192)
		10.3125 (10GBASE-LR/LW)
Interface type	-	LC
Transmission distance	km	10 (6.21 mi.)

Parameter	Unit	Value
Optical transmitter		
Optical source type		DFB-LD
Center wavelength	nm	1310
Operating wavelength range	nm	1290-1330
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	N/A
Maximum spectral width (-20dB)	nm	1.0
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	-1
Minimum transmit optical power	dBm	-6
Minimum extinction ratio	dB	6
Optical receiver		
Operating wavelength range	nm	1270-1565
Receiver sensitivity	dBm	< -14.4
Overload power	dBm	0.5
Maximum optical channel cost	dB	1
Maximum reflection factor	dB	-14

Table D-29 Specifications of the XFP-10G-SM1550-40K optical module

Parameter	Unit	Value
Interface standard	-	10GBASE-ER/EW, STM-64/OC-192
Transmission rate	Gbit/s	9.95328 (STM-64/OC-192)
		10.3125 (10GBASE-ER/EW)
Interface type	-	LC

Parameter	Unit	Value
Transmission distance	km	40 (24.86 mi.)
Optical transmitter		
Optical source type		EML
Center wavelength	nm	1550
Operating wavelength range	nm	1530-1565
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	1.0
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	2
Minimum transmit optical power	dBm	-1
Minimum extinction ratio	dB	8.2
Optical receiver		
Operating wavelength range	nm	1270-1565
Receiver sensitivity	dBm	< -15
Overload power	dBm	-1
Maximum optical channel cost	dB	2
Maximum reflection factor	dB	-26

Table D-30 Specifications of the XFP-10G-SM1550-80K optical module

Parameter	Unit	Value
Interface standard	-	10GBASE-ER/EW, STM-64/OC-192
Transmission rate	Gbit/s	9.95328 (STM-64/OC-192)
		10.3125 (10GBASE-ZR/ ZW)

Parameter	Unit	Value
Interface type	-	LC
Transmission distance	km	80 (49.71 mi.)
Optical transmitter		
Optical source type		EML
Center wavelength	nm	1550
Operating wavelength range	nm	1530-1565
Spectral characteristics		
Maximum root mean square (RMS) Spectral Width	nm	1.0
Maximum spectral width (-20dB)	nm	N/A
Minimum side mode suppression ratio (SMSR)	dB	30
Average transmit optical power		
Maximum transmit optical power	dBm	4
Minimum transmit optical power	dBm	0
Minimum extinction ratio	dB	9
Optical receiver		
Operating wavelength range	nm	1270-1600
Receiver sensitivity	dBm	< -24
Overload power	dBm	-7
Maximum optical channel cost	dB	2
Maximum reflection factor	dB	-27

Table D-31 Applications of 10 Gbit/s XFP optical modules

Product Model	BOM Number	Applications
XFP-10G-MM850-300m	34060362	● 10GBASE-SR/SW 10G Ethernet ● 1200-Mx-SN-I 10G Fibre Channel

Product Model	BOM Number	Applications
XFP-10G-SM1310-10Km	34060313	● SONET OC-192 SR-1 SDH STM I-64.1 ● 10GBASE-LR/LW 10G Ethernet ● 1200-SM-LL-L 10G Fibre Channel ● 10GBASE-LR/LW with FEC ● 1200-SM-LL-L 10G Fibre Channel with FEC
XFP-10G-SM1550-40Km	34060322	● SONET OC-192 IR-2 SDH STM S-64.2b SONET OC-192 IR-3 SDH STM S-64.3b ITU-T G.709 ● 10GBASE-ER/EW ● 40km 10G Fibre Channel
XFP-10G-SM1550-80Km	34060361	● SONET OC-192 / SDH STM-64 ITU-T G.959.1 P1L1-2D2 ● 10GBASE-ZR/ZW 80km 10G Ethernet ● Extended 80km 10G Fibre Channel

E Glossary

A	
Asynchronization	Asynchronization does not use the exact data signals timed by the clock. The signals have different frequencies and phases. The asynchronizatioin usually encapsulates the bits into the control flag, which specifies the beginning and end of the bits.
D	
DCE	Data Circuit-terminating Equipment is a network device composing the UNI. DCE provides the physical connection to the network, forwards the data, and provides the clock signals for the DTE.
DRAM	Dynamic Random Access Memory. The information stored in the RAM must be refreshed periodically. When the contents of the DRAM are being refreshed, a user cannot access it. Delay can thus occur.
DTE	Data terminal equipment is a user device composing the UNI. The DTE accesses the data network through the DCE equipment (for example, model) and usually uses the clock signals produced by DCE.
E	
EMC	Electro magnetic compatibility is the 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.
F	
Flash	Flash is a kind of special Erasable Programmable Read Only Memory (EEPROM), which can be completely erased and rewritten one time instead of only one byte.
N	

NVRAM	Nonvolatile Random Access Memory. The data in NVRAM cannot be lost when the system is Down.
R	
RAM	Random Access Memory is a memory that can be lost easily, and read and rewritten by the micro processor.
ROM	Read Only Memory is a memory that cannot be lost easily, and can only be read, but not written by the micro processor.
S	
SRAM	Static Random Access Memory is a type of random access memory. Its contents can be saved only if the SRAM is provided with the uninterrupted power supply. Unlike the DRAM, the SRAM does not need to be refreshed repeatedly.

F Acronyms and Abbreviations

A	
AC	Alternating Current
ATM	Asynchronous Transfer Mode
AUX	Auxiliary (port)
C	
CAN	Control Area Network
CE1	Channelized E1
CF	Compact Flash
CLK	Clock Card
CPU	Central Processing Unit
CT1	Channelized T1
CTS	Clear to Send
D	
DC	Direct Current
DCE	Data Circuit-terminating Equipment
DSR	Data Set Ready
DTE	Data Terminal Equipments
DTR	Data Terminal Ready
E	
EMC	Electro Magnetic Compatibility
F	

FAD	Fabric Adaptor
FC	Patch Cord (Connector + Fiber)
FCB	Fan Control Board
FPIC	Flexible Plug-in Card
G	
GND	Ground
I	
IEC	International Electrotechnical Commission
L	
LC	Lucent Connector
LPU	Line Processing Unit
M	
MPU	Main Processing Unit
N	
NEG	Negative
NPU	Network Processing Unit
NVRAM	Non-Volatile Random Access Memory
O	
ODF	Optical Distribution Frame
OFL	Offline
P	
PC	Personal Computer
PCB	Printed Circuit Board
PCS	Physical Coding Sublayer
PGND	Protection Ground
PMD	Physical Medium Dependent
R	
RJ45	Registered Jack 45
RTS	Request to Send

RXD	Receive Data
S	
SC	Square Connector
SDRAM	Synchronous Dynamic Random Access Memory
SFU	Switch Fabric Unit
SMB	Sub-miniature B
SRU	Switch Router Unit
T	
TXD	Transmit Data
U	
UART	Universal Asynchronous Receiver/Transmitter
UTP	Unshielded Twisted Pair
V	
VRP	Versatile Routing Platform