

1 Overview

Thank you for choosing DHODT-LMXE.VX PTN/SDH/PCM Hybrid Multiplexer. For the best service from this product, please read this manual carefully.

1.1 Introduction

DHODT-LMXE.VX Hybrid Multiplexer is positioned on the IP/MPLS/PTN/SDH metro edge access layer. It unifies IP/MPLS/PTN and SDH/MSTP transportation technologies into a single platform, intended for smooth transition from SDH to IP/MPLS/PTN. It connects to an IP/MPLS/PTN network through GE/10GE NNI optical interfaces, supporting large switching capacity of Ethernet services, service-based end-to-end OAM, fine management etc.; When connecting to an SDH network, uplink interfaces can be optical STM-4, STM-16 and STM-64 ports and supports various UNI services such as E1, C37.94, RS232, pass-through and switched ETH. These UNI's may be used to connect to SDH terminals, PDH terminals, and media converters. DHODT-LMXE.VX supports different network topologies like chain, star, ring, tangent rings, and intersecting rings.

DHODT-LMXE.VX hybrid multiplexer comprises of aggregation side cards and tributary side cards. It is a 4U tall device, containing 22 slots

which include two power supply card slots, 2 TDM master-control cross-connect card slots, 2 PKT cross-connect aggregation card slots, 10 TDM service slots and 6 PKT service slots.

Packet Switch

Packet switch is built on packet service aggregation switch card (MX02) which provides large capacity of Ethernet switching capacity, whose maximum switching capacity is 100Gbps. Through configuring Ethernet optical interface cards of various types, Ethernet bandwidth between Ethernet optical interface card and packet service aggregation switch card can achieve 100Mbps/1Gbps/2Gbps/4Gbps/10Gbps. Apart from providing basic VLAN and layer-2 switching functions, MX02 card also supports various functions, such as MPLS-TP, synchronous Ethernet (SyncE) and ELPS/ERPS Ethernet protection switching and OAM management. Two packet service aggregation switch cards can independently bear non-protective service and realize 1+1 protection.

Multi-service Access

As a core card on the TDM plane, TX02 can realize 100G cross connection of SDH service, and the cross connection of 2.5G/622M/155M/2M service.

TDM cross-connect aggregation card or SDH cross-connect card supports SDH optical ports of STM-4, STM-16 and STM-64. They can connect to backbone layer SDH/MSTP network, aggregating the tributaries' VC-12, VC-3, or VC-4 services to the uplink SDH signal. SDH aggregation card or SDH cross-connect card can also construct complex transmission network independently. Two TDM cross-connect aggregation cards or SDH cross-connect cards can independently bear non-protective services of VC-12 or VC-3, VC-4, or conduct Sub-Network Connection Protection of VC-12, VC-3, and VC-4 level, supporting protection between two ports on the same card and protection between optical ports on different aggregation cards. On the card, there are built-in TUPP and cross-connect functions, providing channel cross-connect and cascading of VC-12, VC-3, and VC-4 levels between tributary cards, tributary card and aggregation card, and

aggregation cards. On each TDM cross-connect aggregation card and SDH cross-connect card, there is built-in SDH device clock unit of ITU-T G.813 standard, providing a channel of clock input and a channel of clock output. The cross-connects and clock units of two cards can construct 1+1 backup protection. In order to facilitate opening and maintenance, on each TDM cross-connect aggregation card and SDH cross-connect card there are two built-in E1 error testers, capable of simultaneously testing SDH optical tributary's uplink (aggregation) direction and downlink (tributary) direction.

4-channel STM-16 tributary optical card and 4-channel STM-4 tributary optical card are mainly used to interconnect with terminal SDH devices or any devices with standard STM-4/STM-16 optical ports to provide point to multipoint optical fiber aggregation access, or used to construct ring-shape or more complex tributary network with ADM device.

Reliability and Management

To improve reliability and decrease system risk, DHODT-LMXE.VX hybrid multiplexer adopts multiple redundancy protection measures, its two independent power supply cards, two TDM cross-connect aggregation cards with built-in main cross-connect units and clock units, and two packet service aggregation switch cards support 1+1 redundancy backup. All cards support hot plugging. The damage, removal or place the network management card (MX02) does not affect the current service. MX02 can get device configuration information from network management site or aggregation card.

DHODT-LMXE.VX supports various loopback methods, which are convenient for opening, maintenance, and troubleshooting of the device. For instance, optical port line loopback, E1 port line side and device side loopback, and cross-connect ingress and egress VC loopback, including high order and low order VC and group loopback as VCG member.

DHODT-LMXE.VX supports software and firmware remote online update of network management card and other unit cards.

DHODT-LMXE.VX hybrid multiplexer can realize remote management. The NMS has the following features:

- Popular “C/S+ database” structure, which supports multi-client management and can conduct synchronization, update, backup, and restoration of data and specify different authorities and management ranges for different clients.
- “System–area–network–device” four-layer view, through which the browsing and searching of device can be conducted rapidly.
- Complete alarm management. Rich alarm query conditions are provided, and real-time output and print of alarm can be customized. Individual screening (suppression) and classified screening can be conducted, LOS alarm reversion of optical interface cards can be supported and the level of an alarm can be established.
- Client resource management. The link between device and client can be achieved conveniently. Especially when fault occurs, the influenced clients can be quickly ascertained, and corresponding measures can be taken.

We can use external Ethernet interface of MX02 and device backboard network bus to realize network monitoring. As for the requirement of management of scattered nodes under interconnection with core SDH, the built-in network management network has three options: the SDH overhead data channel D1~D12 that can be assigned; a VC-12 channel specially assigned for network management and a timeslot of an E1 designated as the monitoring channel. The network management network built in SDH transmission network can use star or ring topologies. As for the requirement of management of scattered nodes under interconnection with core IP/MPLS/PTN, Ethernet built-in monitoring method can be used to manage. This device uses automatic gateway search. When fault occurs in the network, backup gateway can be searched automatically without independent setting.

1.2 Typical Application

DHODT-LMXE.VX hybrid multiplexer blends the current technologies such as SDH, MSTP, PDH, Ethernet, PTN etc. and can provide integrated bearing of TDM and Ethernet service so as to quickly satisfy the operator's various application requirements such as multiservice access and transmission network packetized. Figure 1-1, Figure 1-2, Figure 1-3, and Figure 1-4 respectively shows topology diagram of an DHODT-LMXE.VX based PTN network, as SDH access aggregation layer device, packet transmission network access aggregation layer device, and typical network structure to realize SDH and packet transmission dual uplink.

Figure 1-1 Topology diagram of an DHODT-LMXE.VX based PTN network

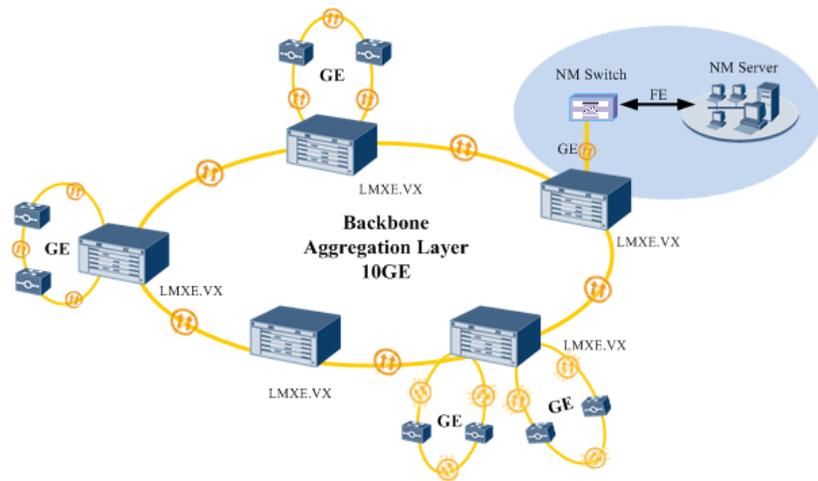


Figure 1-2 Typical application diagram of DHODT-LMXE.VX as SDH access aggregation layer device

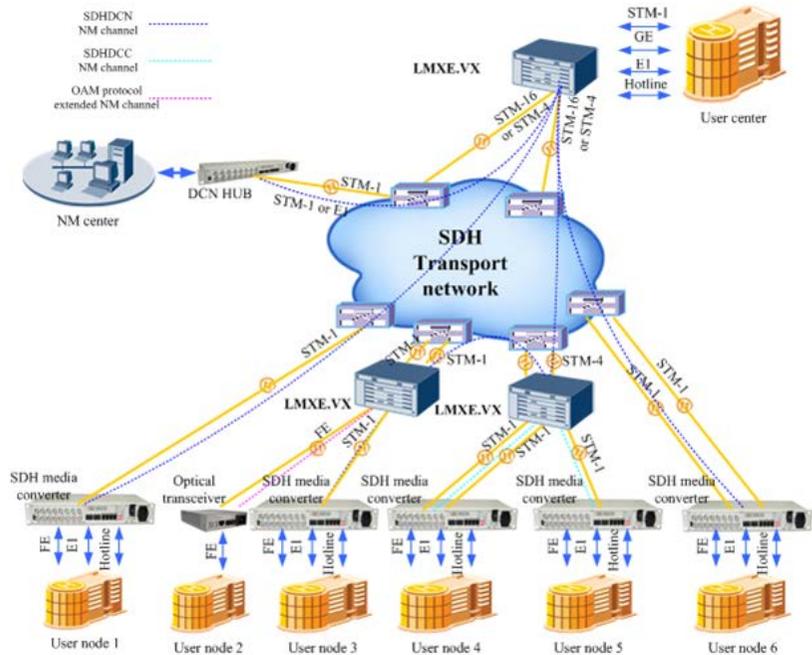


Figure 1-3 Typical application diagram of DHODT-LMXE.VX as packet transmission network access aggregation layer device

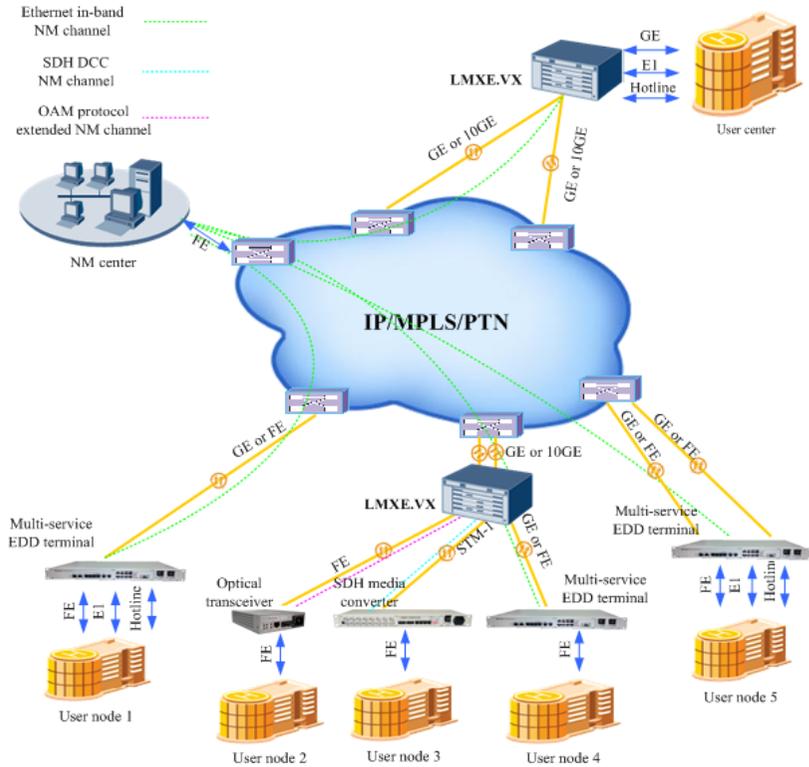
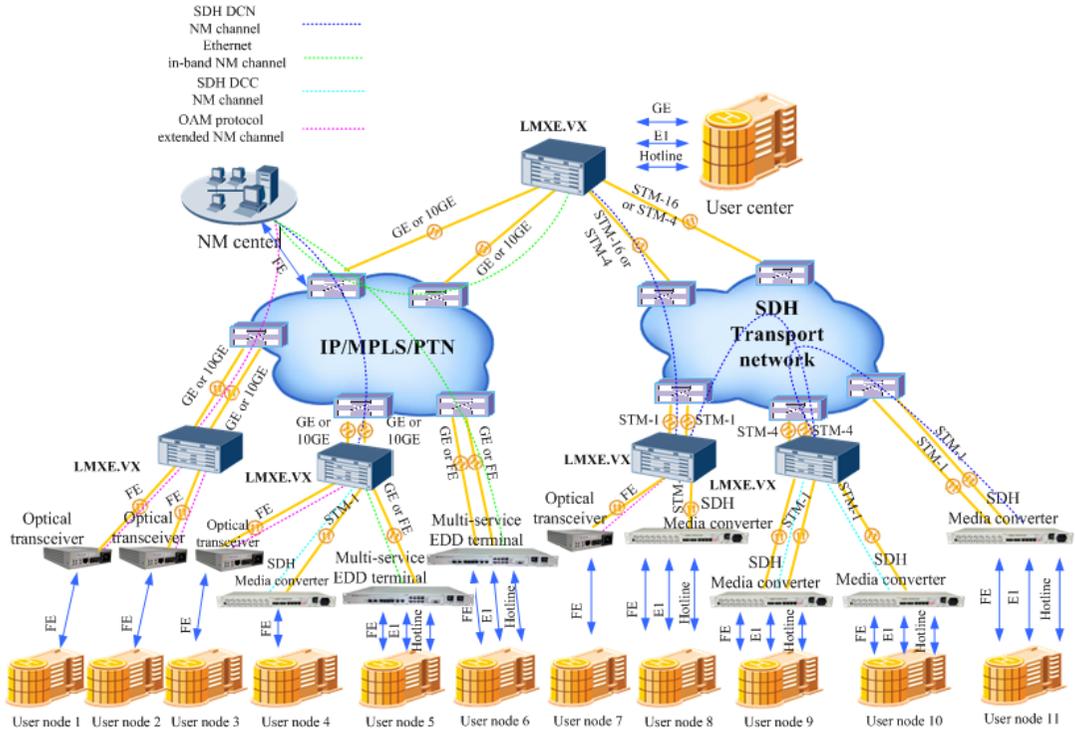


Figure 1-4 Typical application diagram of DHODT-LMXE.VX realizing SDH and packet transmission network dual uplink



2 Usage

2.1 Configuration

DHODT-LMXE.VX hybrid multiplexer uses plug-in design, and contains 22 cards, including two power supply cards (PWR01A/PWR02A), 2 TDM cross-connect aggregation cards (TX02), 2 PKT aggregation switching cards (MX02), 16 tributary service cards. All cards support hot swapping.

The tributary cards of T-plane are: 4-channel STM-1 tributary optical card (OS01Q), 4-channel STM-16 tributary optical card (OS16Q), 4-channel STM-4 tributary optical card (OS04Q), 24E1 PDH interface card (EP01/EP01A), 12E1 interface card (EP03), low-speed interface card (SD03), order/overhead/clock interface card (LA01), 4Tx interface channel EoS card (FE01), 1-port switching EoTS FE electrical interface card (FE64), multi-functional voice interface card (CHU02), 10 FXS port card with line fault detection (CHU03), EM signaling & 2W/4W voice card (CH4W02), 2W/4W voice & EM interface card with digital gain adjustment (CH4W03), 64K co-directional interface card (CHD01), C37.94 interface card (C37D), asynchronous data card (SD02), relay signaling interface card (DIO04), STM-1 interface emulation card (SC01Q) and 16E1 emulation card (EC16).

DHODT-LMXE.VX hybrid multiplexer's power supply cards, network management card, two packet service aggregation switching cards and two TDM cross-connect aggregation cards or SDH cross-connect cards are put in fixed slots. The other 12 slots are used for tributary cards.

DHODT-LMXE.VX uses double back panel bus design, including back panel Ethernet bus and back panel SDH bus.

When packet service aggregation switch cards (MX02) are configured to Slot16 and Slot17, back panel Ethernet buses are assigned as follows:

- There is one group of 4G Ethernet buses between slot 18/19/20 and packet service aggregation switch card;
- There are two groups of 4G Ethernet buses between slot 21/22/23 and packet service aggregation switch card;

When TX02 aggregation optical cards are configured to Slot8 and Slot9, back panel SDH buses are assigned as follows:

- When STM-64 (TX02) is configured to the aggregation slot, there are two groups of 5G SDH buses between each high-speed slot (slot 6/7/10/11) and each TDM cross-connect aggregation card; there is one group of 5G SDH buses between each high-speed slot (slot 12/13) and each TDM cross-connect aggregation card; there is one group of 155/622M SDH buses between each low-speed slot and each TDM cross-connect aggregation card. **Note that high-speed slots only support OS04Q or OS16Q tributary card.**

The chassis slot assignment is shown in Figure 2-1.

Figure 2-1 Chassis slot assignment diagram

FAN(1)	TB (2)	TB (3)	MX (16)
	TB (4)	TB (5)	MX (17)
	TA (6)	TA (7)	PA (18)
	TX (8)	TX (9)	PA (19)
	TA (10)	TA (11)	PA (20)
	TC (12)	TC (13)	PA (21)
	PWR (14)	PWR (15)	PB (22)
		PB (23)	

The cards can be configured to DHODT-LMXE.VX and their slot assignment is shown in Table 2-1.

Table 2-1 Chassis card configuration list

Card type	Card name	Slot
DC power supply card (-48V)	PWR01A	PWR slot
DC power supply card (-48V)	PWR02A	PWR slot
TDM cross-connect aggregation card	TX02	8/9 slot
Master-control PK switching card	MX02	16/17 slot
4-channel STM-1 tributary card	OS01Q	2~7/10~13 slot
4-channel STM-4 tributary card	OS04Q	6/7/10~13 slot
4-channel STM-16 tributary card	OS16Q	6/7/10~13 slot
24E1 PDH interface card	EP01	4-7/12/13 slot
24E1 PDH interface card	EP01A	2~7/10~13 slot
12E1 interface card	EP03	2~7/10~13 slot
Low-speed interface card	SD03	2~7/10~13 slot
Order/overhead/clock interface card	LA01	2~7/10~13 slot
4Tx channel EoS card	FE01	2~7/10~13 slot
Relay signaling interface card	DIO04	2~7/10~13 slot
1-port switching EoTS FE electrical interface card	FE64	2~7/10~13 slot
Multi-functional voice interface card	CHU02	2~7/10~13 slot
10 FXS port card with line fault detection	CHU03	2~7/10~13 slot

Card type	Card name	Slot
EM signaling & 2W/4W voice card	CH4W02	2~7/10~13 slot
2W/4W voice & EM interface card with digital gain adjustment	CH4W03	2~7/10~13 slot
64K co-directional interface card	CHD01	2~7/10~13 slot
Dual C37.94 interface card	C37D	2~7/10~13 slot
Asynchronous data card	SD02	2~7/10~13 slot
8-port GE electrical interface card	GE08E	18~23 slot
8-port GE optical interface card	GE08	18~23 slot
10GE optical interface card	XGE02	18~23 slot
8-port 8-channel EoS card	ES08	18~23 slot
32-channel EoS card	ES32S	18~23 slot
STM-1 interface emulation card	SC01Q	18~23 slot
16E1 interface emulation card	EC16	18~23 slot

2.2 Card Introduction

This section introduces the functions and usage of all cards on DHODT-LMXE.VX hybrid multiplexer. Some ports and LEDs may be added or removed according to selected configuration.

2.2.1 DC-48V Power Supply Card (PWR01A) and AC220V Power Supply Card (PWR02A)

Power supply card (PWR01A/PWR02A) is used to provide working power and fan power for device cards. One suitable power supply card can provide the power needed by the whole device. To improve reliability of

the device, user can select two power supply cards, providing 1+1 hot backup. Device of each end can be configured with two power supply cards (slots marked with PWR): DC+DC power supply cards, AC+AC power supply cards, or DC+AC power supply cards. To improve system reliability, a cooling fan is fixed on the left of the chassis. The fan can effectively lower operating temperature of power supply card and extend usage life.

DC -48V power supply card (PWR01A): the input voltage is -48V; the output voltage is 5V/100W or 12V/200W. AC220V power supply card (PWR02A): the input voltage is ~220V; the output voltage is 5V/100W or 12V/200W.

On the front panel of DC -48V power supply card (PWR01A), there is one DC power socket and one LED. On the front panel of AC 220V power supply card (PWR02A), there is one standard AC power supply socket and one LED. The front panels are shown in Figure 2-2, and the LED functional descriptions are shown in Table 2-2.

Figure 2-2 Power supply card panel diagram

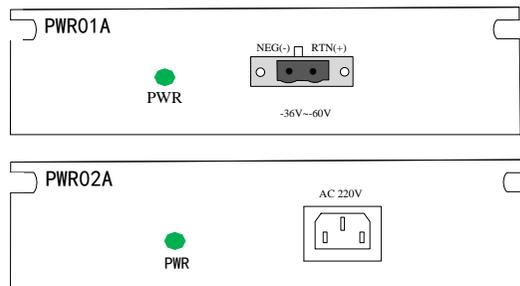


Table 2-2 LED functional descriptions

Mark	Color	LED functional description
PWR	Green	Power supply indication: On: running normally Off: running abnormally



CAUTION

To ensure safety of this device and personnel, the grounding terminal of the chassis (on the left mounting ear) must be connected to the on-site protection ground.

2.2.2 Master-control PK Switching Card (MX02)

MX02 is the master-control switching card in DHODT-LMXE.VX, providing Ethernet network management interfaces. It is used for monitoring and configuring the device and its downlink terminal device. It can display the working status of the whole device (including power supply status and fan status) and various cards, configuration, management, status, and performance monitoring of remote device, and power failure testing. MX02 card is fixed on slot 16/slot17.

MX02 can work with Ethernet interface card (GE08/GE08E/XGE02) to realize 100Gbps Ethernet service aggregation & switching through the backplane Ethernet bus. Two MX02 cards can be configured to achieve protection between MX02 cards.

MX02 card supports MPLS-TP (Multiprotocol Label Switching-Transport Profile) technique, including static LSP, L2VPN, MPLS-TP OAM and MPLS-TP APS. Static LSP function supports 256 LSP items and 64 LSP protection groups; L2VPN supports E-Line, E-LAN, E-Tree, and 256 Tunnels and 256 PWs at most; MPLS-TP OAM supports OAM in PW layer, LSP layer, and Section layer; MPLS-TP APS supports 1:1 bidirectional protection switching.

MX02 card supports IEEE 1588v2 protocol and SyncE function. It also supports the following 3 clock source types:

- BITS interface clock source

Access 2MHz, 2Mbit/s clock signal through BITS interface on the front panel of MX02 card.

- Ethernet line clock source

Extract 25MHz, 125MHz clock signal from Ethernet line signal of GE08/GE08E/XGE02 card.

- Local clock source

Provide clock signal from the crystal oscillator inside the device.

MX02 card can choose the best clock source automatically according to G.781 protocol, as well as choose the specified clock source manually.

OAM supports IEEE 802.3ah, IEEE 802.1ag and ITU-T Y.1731 protocols. Such as IEEE802.3ah-compliant OAM active/passive mode, OAM link discovery, OAM remote loop, OAM link event, fault display, performance statistics, remote power failure alarm functions; IEEE 802.1ag/ITU-T Y.1731-compliant performance detection and fault management. It also supports SLA function, which can carry out statistics on response time, network jitter, delay, packet loss rate of network information.

QoS management of MX02 card is composed of a series of traffic management technologies: flow rate limit (based on port, on VLAN ID and on port+VLAN ID), priority trust (based on DSCP priority, CoS priority), flow classification (based on port, DSCP priority, ToS priority, CoS priority, VLAN ID, ACL rules, source or destination MAC, source or destination IP, source or destination TCP/UDP port number, MPLS LSP or PW tags, MPLS LSP or PW EXP), flow behavior (redirection, retagging, flow mirroring, CAR), priority mapping (based on DSCP, CoS priority, MPLS EXP), queue scheduling (SP, WRR, WDRR, SP+WRR, SP+WDRR), WRED based congestion avoidance, queue based traffic shaping, flow based traffic statistics. At the same time, the MX02 also supports port mirroring function, we can set the mirroring source port and destination port.

MX02 card supports static MAC address table and dynamic MAC address table. Static MAC table entry supports up to 2K entries; dynamic MAC table entry supports up to 32K entries. MAC address learning number limit is based on port or VLAN, which can limit 1~32K MAC address entries. MAC address aging time is in the range of 0~1000000s, 0 represents no aging and the default is 300s. We can use NMS to query user data packet MAC address, and MAC address, port and VLAN ID.

MX02 card supports RMON (Remote Network Monitoring) function. We can configure RMON event group, RMON alarm group, RMON statistics group, RMON history group and etc.

On the front panel of MX02 card, there is an NM port, a CONSOLE port, a BITS external clock input/output port, a 1PPS TOS port, an alarm output port, four LEDs, a reset button and a group of 4-bit DIP-switch. The front panel diagram is shown by Figure 2-3, and the LED functional descriptions are shown in Table 2-3.

Figure 2-3 The front panel diagram of MX02

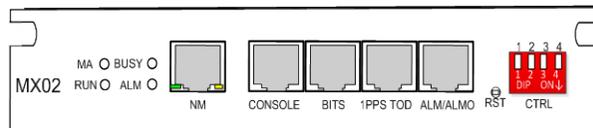


Table 2-3 LED functional description of MX02

Mark	Color	Functional description
RUN	Green	Operation indication:(flash rate 1s) Blink: running normally Off: running abnormally
MA	Green	Primary/standby status indication: On: in primary status Off: in standby status

Mark	Color	Functional description
ALM	Red	Alarm status indication: On: alarm occurs Off: no alarm occurs
BUSY	Red	System card data synchronization instruction: On: Data is being synchronized between the system cards Off: No data is being synchronized between the system cards
Green LED at NM port	Green	Link and Active indication: On: Ethernet port is effectively connected; Off: no network connection at Ethernet port; Blink: Ethernet port is in communication
Yellow LED at NM port	Yellow	Ethernet port Speed indication: On: port link to 100M Off: port link to 10M or not connected Blink: data sent or received

Table 2-4 Switch definition

Switch No.	Mark	Definition
1 st bit	1	Switch down (ON): zero-touch plan
2 nd bit	2	Card confirmation
3 rd bit	3	Synchronization configuration
4 th bit	4	Reserved

Management Interface:

MX02 card provides 1 NM port and 1 CONSOLE port as its network management ports, marks and definitions are shown in Table 2-5. Network management ports use standard RJ-45 socket whose connector diagram is shown in Figure 2-4, NM is the FE electrical port; see its socket definition in Table 2-6. CONSOLE port pin definition is shown in Table 2-7.

Table 2-5 Marks and definitions of management ports

Mark	Definition
NM	Out-of-band management port, using Telnet or EzView to manage device
CONSOLE	RS232 management port, using hyper terminal to manage device

Figure 2-4 Pin definition of RJ45 connector

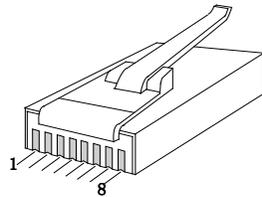


Table 2-6 RJ-45 socket definition at NM port

Pin	1	2	3	4	5	6	7	8
Definition	TxD+	TxD-	RxD+	-	-	RxD-	-	-

Table 2-7 RJ45 socket definition of CONSOLE management port

Pin	1	2	3	4	5	6	7	8
Definition	-	-	TxD	GND	GND	RxD	-	-

External Clock Input/output Port

MX02 card provides 1-channel of external clock input/output port, supporting 2MHz, 2Mbit/s clock mode. It is marked with “BITS”, using RJ45 socket. RJ-45 connector diagram and pin definition are shown in Figure 2-4 and Table 2-8.

Table 2-8 Definition of external clock input/output ports

Pin	Definition	Description
1	IN+	IN is Rx OUT is Tx
2	IN-	
3	CGND	
4	OUT+	
5	OUT-	
6	CGND	
7	-	
8	-	

External Clock Synchronous Port

MX02 card provides 1 1PPS TOD port with configurable input and output. It is marked with “1PPS TOD”, using RJ45 socket. RJ-45 connector diagram and pin definition are shown in Figure 2-4 and Table 2-9.

Table 2-9 External clock synchronous port definition

Pin	Definition	Description
1	-	-
2	-	-

Pin	Definition	Description
3	RS-422_1_N	1PPS -
4	GND	GND
5	GND	GND
6	RS-422_1_P	1PPS+
7	RS-422_2_N	TOD time information
8	RS-422_2_P	TOD time information

Reset Button

There is a reset button marked with “RST” on the front panel of MX02 card, which is used to reset the card manually, as shown in Figure 2-5.

Figure 2-5 Reset button



2.2.3 TDM Cross-connect Aggregation Card (TX02)

TDM cross-connect aggregation card is the core card of TDM plane in DHODT-LMXE.VX. It realizes both STM-64 uplink interface function and cross connection unit/SDH device clock unit functions. Two TX02 cards in DHODT-LMXE.VX (slot8/9) support 1+1 protection.

Each TX02 card provides two STM-64 interfaces. These interfaces are used to interconnect with backbone layer SDH/MSTP network and aggregate the VC-12 service or VC-3/VC-4 service of tributaries to the uplink SDH signals, or independently construct a complex transmission network. Depends on the selected tributary card and terminal type of the remote end, the service born by VC-12 can be E1 or Ethernet.

The four STM-64 ports in two TX02 cards can independently bear non-protective service with 1664VC-4, 864VC-3, or 18144VC-12

bandwidth, or perform SNCP (Sub-Network Connection Protection) of VC-12, VC-3, or VC-4 level to specified service. Protection between two interfaces in a card and between optical ports of different cards can be conducted.

TX02 supports revertive SNCP and non-revertive SNCP.

TX02 card has built-in TUPP and powerful cross connection function, providing channel cross connection and cascading of VC-12, VC-3, or VC-4 level between all tributary cards, tributary card and aggregation card, and aggregation cards. The supported cross connection directions include aggregation card to tributary card, tributary card to aggregation card, aggregation card to aggregation card, and tributary card to tributary card. The cross connection types supported include unidirectional, bidirectional, multicast/broadcast, and loopback. The cross connection capacity of TX02 is 832 VC-4 level high-order full cross and 144 VC-4 level low-order full cross capacity.

When TX02 is configured to the aggregation slot, it supports 6 high-speed slots (6/7/10/11/12/13), and 4 low-speed slots (2/3/4/5) on the TDM plane. There are two groups of 5G SDH buses between each high-speed slot (slot 6/7/10/11) and each TDM cross-connect aggregation card; there is one group of 5G SDH buses between each high-speed slot (slot 12/13) and each TDM cross-connect aggregation card; there is one group of 155/622M SDH buses between each low-speed slot and each TDM cross-connect aggregation card. **Note that high-speed slots only support OS04Q or OS16Q tributary card.**

TX02 has a built-in ITU-T G.813 compliant SDH device clock unit with 1-channel clock input and 1-channel clock output. The clock interface is connected to the front panel of order overhead card. The clock mode supports 2Mbit or 2MHz. The device clock can be locked to uplink STM-N line clock, external input clock, tributary clock, or internal oscillator according to the priority and maintain a high-precision clock frequency when reference clock is lost (holdover). The cross connections and clock units in two TX02 cards construct a 1+1 backup protection.

TX02 has two built-in E1 error testers, testing optical tributary's uplink (aggregation) direction and downlink (tributary) direction simultaneously. TX02 also has two built-in E1 monitoring channels, used to transmitting management information. E1 error tester and E1 monitoring channel can be inserted through cross matrix.

NOTE

- When E1 error tester is used to test the optical transmission of aggregation slots (8/9), all the four E1 error testers can be used. But when E1 error tester is used to test the optical transmission of tributary slots, only two of them in the main slots can be used.

For the convenience of maintenance, optical cards of all series support LOS alarm inversion function, which can be enabled, automatically or manually restored through NMS.

Optical ports of TX02 use LC dual-fiber SFP optical module and single-fiber SFP optical module is also available.

On the front panel of TX02, there are 7 LEDs and 2 STM-64 optical port sockets. The front panel diagram is shown by Figure 2-6, and LED functional descriptions are shown in Table 2-10.

Figure 2-6 The front panel diagram of TX02

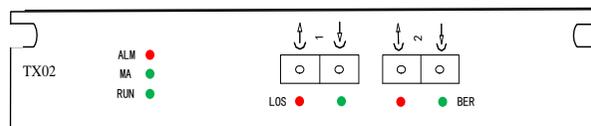


Table 2-10 LED functional description of TX02

Mark	Color	Functional Description
ALM	Red	On: emergency alarm occurs Blinks : no emergency alarm occurs Off: no alarm occurs

Mark	Color	Functional Description
RUN	Green	Operation indication: Blinks: running normally
MA	Green	Primary/standby indication: On: this card is in primary status Off: this card is in standby status
LOS	Red	Optical port signal status indication: On: optical signal loss Off: normal optical signal reception
BER	Red	Optical line error indication: On: error rate is at 10^{-3} order of magnitude Blinks: error rate is at 10^{-6} order of magnitude Off: error rate is lower than 10^{-6} order of magnitude

 **NOTE**

- TX02 has high power consumption. When using these cards, you should ensure the device fan is running normally. If there are empty slots, blind card should be configured to ensure an unimpeded air passage.
- When the aggregation card (TX02) is configured with ESFP optical module, the DDM function (Digital Diagnosis Monitoring) is supported, to conduct real-time monitoring of status and quality of optical port connection, and light emission power, light reception power, temperature, working voltage, laser bias current, and other parameters of intelligent optical module

2.2.4 4-channel STM-1 Tributary Optical Card (OS01Q)

4-channel STM-1 tributary optical card (OS01Q) is mainly used to interconnect with SDH devices from VeeCOM DHODT-LM series or any SDH device produced by other companies with standard STM-1 optical port, providing point to multipoint star optical fiber access, or to construct hanging ring network or more complex tributary network with ADM devices. OS01Q can be configured to slot 2-7 or slot 10-13.

The non-blocking cross between two optical ports of OS01Q is used for 1+1 MSP and SNCP protection of the tributary optical ports in card. The cross-connect types include unidirectional, bidirectional, multicast/broadcast, and loopback. Two E1 error testers and two E1 monitoring channels can be inserted through cross matrix.

SDH tributary optical card OS01Q supports two tributary timed extraction function.

The optical ports of STM-1 tributary optical card (OS01Q) use LC dual-fiber SFP optical module and single-fiber SFP optical module is also available.

The front panel diagram of the tributary optical card (OS01Q) is shown by Figure 2-7, and LED functional descriptions are shown by Table 2-11. In the optical card there is no part that can be set by the user. The internal jumper is only used for production debugging and firmware upgrade. Changes are strictly prohibited; otherwise the optical card will fail.

Figure 2-7 The front panel diagram of the tributary optical card (OS01Q)

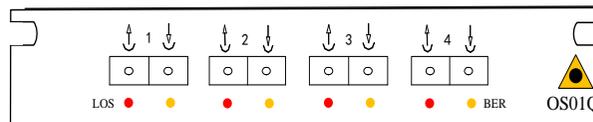


Table 2-11 LED functional description of tributary optical card (OS01Q)

Mark	Color	Functional description
LOS	Red	Optical port signal status indication: On: optical signal loss Off: normal optical signal reception
BER	Yellow	Optical line error indication: On: error rate is at 10^{-3} order of magnitude Blink: error rate is at 10^{-6} order of magnitude Off: error rate is lower than 10^{-6}

 **NOTE**

- When tributary optical card OS01Q configures with ESFP optical module, it supports DDM function (Digital Diagnosis Monitoring) to conduct real-time monitoring of optical port connection status and quality and light emission power, light reception power, temperature, working voltage, laser bias current, and other parameters of intelligent optical module.

2.2.5 4-channel STM-4 Tributary Optical Card (OS04Q)

4-channel STM-4 tributary optical card (OS04Q) is mainly used to interconnect with SDH devices from VeeCOM DHODT-LM series or any SDH device produced by other companies with standard STM-4 optical port, providing point to multipoint star optical fiber access, or to construct hanging ring network or more complex tributary network with ADM devices. OS04Q can be configured to slot 6/7/10-13.

The non-blocking cross between two optical ports of OS04Q is used for 1+1 MSP and SNCP protection of the tributary optical ports in card. The cross-connect types include unidirectional, bidirectional,

multicast/broadcast, and loopback. Two E1 error testers and two E1 monitoring channels can be inserted through cross matrix.

SDH tributary optical card OS04Q supports two tributary timed extraction function.

The optical ports of STM-4 tributary optical card (OS04Q) use LC dual-fiber SFP optical module and single-fiber SFP optical module is also available.

The front panel diagram of the tributary optical card (OS04Q) is shown by Figure 2-8, and LED functional descriptions are shown by Table 2-12. In the optical card there is no part that can be set by the user. The internal jumper is only used for production debugging and firmware upgrade. Changes are strictly prohibited; otherwise the optical card will fail.

Figure 2-8 The front panel diagram of the tributary optical card (OS04Q)

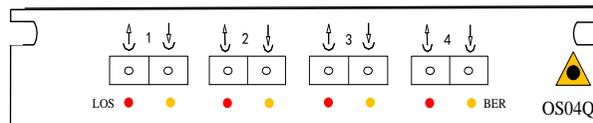


Table 2-12 LED functional description of tributary optical card (OS04Q)

Mark	Color	Functional description
LOS	Red	Optical port signal status indication: On: optical signal loss Off: normal optical signal reception

BER	Yellow	Optical line error indication: On: error rate is at 10^{-3} order of magnitude Blink: error rate is at 10^{-6} order of magnitude Off: error rate is lower than 10^{-6}
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 **NOTE**

- When tributary optical card OS04Q configures with ESFP optical module, it supports DDM function (Digital Diagnosis Monitoring) to conduct real-time monitoring of optical port connection status and quality and light emission power, light reception power, temperature, working voltage, laser bias current, and other parameters of intelligent optical module.



CAUTION

The STM-4 tributary optical card (OS04Q) has high power consumption. When using this card, you should ensure the device fan is running normally. If there are empty slots, blind card should be configured to ensure an unimpeded air passage.

2.2.6 4-channel STM-16 Tributary Optical Card (OS16Q)

4-channel STM-16 tributary optical card (OS16Q) is mainly used to interconnect with SDH devices from VeeCOM DHODT-LM series or any SDH device produced by other companies with standard STM-16 optical port. When OS16Q works with TX02, it can provide the access of STM-4/STM-16 subnet and can be put into high-speed slot (6/7/10/11/12/13).

When the device configures TX02 card, the SDH buses between the STM-16 (OS16Q) and each TX02 card are 32 groups of VC4. **Note that, OS16Q can be only put into high-speed slot (6/7/10/11/12/13).**

OS16Q supports ALS (automatic laser shutdown) function, which is disabled by default but can be enabled through NMS.

The non-blocking cross between two optical ports (OS16Q) of this card is used for 1+1 MSP and SNCP protection of the tributary optical ports in card. The cross-connect types include unidirectional, bidirectional, multicast/broadcast, and loopback. Two E1 error testers and two E1 monitoring channels can be inserted through cross matrix.

SDH tributary optical cards (OS16Q) support two tributary timed extraction function.

The optical ports of OS16Q use LC dual-fiber SFP optical module, and single-fiber or SFP optical module is also available. The front panel diagram is shown by Figure 2-9, and LED functional descriptions are shown by Table 2-13. In the optical card there is no part that can be set by the user. The internal jumper is only used for production debugging and firmware upgrade. Changes are strictly prohibited; otherwise the optical card will fail.

Figure 2-9 Tributary optical card (OS16Q) front panel diagram

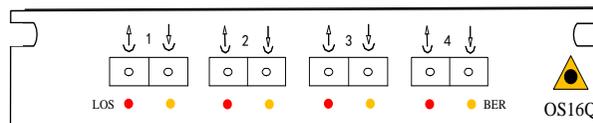


Table 2-13 Tributary optical card (OS16Q) LED functional description

Mark	Color	Functional description
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LOS	Red	Optical port signal status indication: On: optical signal loss Off: normal optical signal reception
BER	Yellow	Optical line error indication: On: error rate is at 10^{-3} order of magnitude Blinks: error rate is at 10^{-6} order of magnitude Off: error rate is lower than 10^{-6}

 **NOTE**

- When tributary optical card OS16Q configures with ESFP optical module, it supports DDM function (Digital Diagnosis Monitoring) to conduct real-time monitoring of optical port connection status and quality and light emission power, light reception power, temperature, working voltage, laser bias current, and other parameters of intelligent optical module.



CAUTION

The OS16Q has high power consumption. When using this card, you should ensure the device fan is running normally. If there are empty slots, blind card should be configured to ensure an unimpeded air passage.

2.2.7 24 E1 PDH Interface Card (EP01/EP01A) and 12 E1 Interface Card (EP03)

When DHODT-LMXE.VX works with 24E1 or 12E1 interface cards, it can directly transmit service, and realizes access of 24E1 or 12E1. 24E1 PDH interface card (EP01) takes two slots, which is inserted into slots 4-7/12-13; 24E1 PDH interface card (EP01A) and 12E1 interface card (EP03) only

takes one slot, which is inserted into slot 2-7/10-13. PDH interface card (EP01/EP01A/EP03) can select any E1 tributary input as clock reference source.

The front panel diagrams of PDH interface cards (EP01/EP01A/EP03) are shown by Figure 2-10. Both EP01 and EP03 use dual-E1 interfaces. Every dual-E1 socket corresponds to 2-channel E1. The signal definition is shown in Table 2-14. E1 interface of EP01A uses DMS-60M interface. The signal definition is shown in Table 2-15.

Figure 2-10 PDH interface card (EP01/EP03/EP01A) front panel diagram

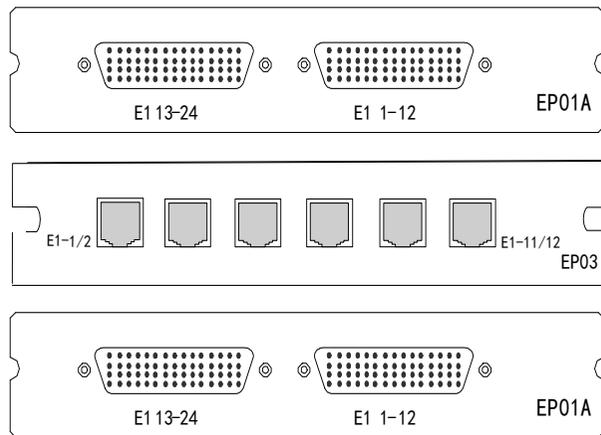


Table 2-14 PDH interface card (EP01/EP03) Dual-E1 socket E1 signal line definition

Dual-E1 Pin	E1 line	Twisted pair	The recommended color of class 5 twisted pair
1	E1_IN(1)-	Paired	Blue
2	E1_IN(1)+		Blue and white
3	E1_OUT(1)+	Paired	Orange

4	E1_OUT(1)-		Orange and white
5	E1_IN(2)-	Paired	Green
6	E1_IN(2)+		Green and white
7	E1_OUT(2)+	Paired	Brown
8	E1_OUT(2)-		Brown and white

The E1 interface impedance of EP01/EP03 card can be selected between 75Ω and 120Ω. On EP01 interface card, 6 groups of 4-bit DIP switches K1~K6 are used to set interface impedance: ON is 75Ω; OFF is 120Ω. On EP03 interface card, 3 groups of 4-bit DIP switches K4~K6 are used to set interface impedance: ON is 75Ω; OFF is 120Ω. **The requirements for device impedance are usually defined during purchase. Changing settings should be avoided in usage.**

When 120Ω impedance is used, the E1 interfaces of EP01 use dual-E1 connector which is crimped with 120Ω twisted pair, shown in Table 2-14. **When cable is being made, please ensure the input and output line pairs respectively use a twisted pair, or interference would be introduced.** When the 75Ω impedance is used, the E1 interfaces of EP01 require accessory cable ZJN. BH4.850.123 or cable ZJN. BH4.850.107, which realizes conversion from dual-E1 connector to BNC socket or dual-E1 connector to user's cable. **“+” connects to core and “-” connects to skin.**



CAUTION

The dual-E1 socket of E1 interface on EP01 and EP03 cards are for two channels of E1. This is a private definition. Do not mix the interface with 120Ω standard RJ-48C socket, or the interface may be damaged.

Figure 2-11 Dual-E1 connector diagram

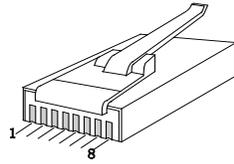


Table 2-15 PDH interface card (EP01A) DMS-60M socket E1 signal line definition

Label	Type	BH4.850.124-D			
	Cable	24 pairs of voice cable			
	Connector type	D.JC.DMS-60M 1			
	Pair #	Color	PIN	TYPE	SIGNAL
1	1	White	17	INPUT	E1 Channel 1 Receive Tip (+)
		Blue	14	INPUT	E1 Channel 1 Receive Ring (-)
	2	White	47	OUTPUT	E1 Channel 1 Transmit Tip (+)
		Orange	44	OUTPUT	E1 Channel 1 Transmit Ring (-)
	3	White	13	INPUT	E1 Channel 2 Receive Tip (+)
		Green	18	INPUT	E1 Channel 2 Receive Ring (-)
	4	White	48	OUTPUT	E1 Channel 2 Transmit Tip (+)
		Brown	43	OUTPUT	E1 Channel 2 Transmit Ring (-)
	5	White	12	INPUT	E1 Channel 3 Receive Tip (+)
		Gray	19	INPUT	E1 Channel 3 Receive Ring (-)
	6	Red	49	OUTPUT	E1 Channel 3 Transmit Tip (+)
		Blue	42	OUTPUT	E1 Channel 3 Transmit Ring (-)
	7	Red	11	INPUT	E1 Channel 4 Receive Tip (+)
		Orange	20	INPUT	E1 Channel 4 Receive Ring (-)
	8	Red	50	OUTPUT	E1 Channel 4 Transmit Tip (+)
		Green	41	OUTPUT	E1 Channel 4 Transmit Ring (-)

Label	Type	BH4.850.124-D			
2	1	White	9	INPUT	E1 Channel 5 Receive Tip (+)
		Blue	22	INPUT	E1 Channel 5 Receive Ring (-)
	2	White	52	OUTPUT	E1 Channel5 Transmit Tip (+)
		Orange	39	OUTPUT	E1 Channel 5 Transmit Ring (-)
	3	White	8	INPUT	E1 Channel 6 Receive Tip (+)
		Green	23	INPUT	E1 Channel 6 Receive Ring (-)
	4	White	53	OUTPUT	E1 Channel 6 Transmit Tip (+)
		Brown	38	OUTPUT	E1 Channel 6 Transmit Ring (-)
	5	White	7	INPUT	E1 Channel 7 Receive Tip (+)
		Gray	24	INPUT	E1 Channel 7 Receive Ring (-)
	6	Red	54	OUTPUT	E1 Channel 7 Transmit Tip (+)
		Blue	37	OUTPUT	E1 Channel 7 Transmit Ring (-)
	7	Red	6	INPUT	E1 Channel 8 Receive Tip (+)
		Orange	25	INPUT	E1 Channel 8 Receive Ring (-)
	8	Red	55	OUTPUT	E1 Channel 8 Transmit Tip (+)
		Green	36	OUTPUT	E1Channel8Transmit Ring (-)
3	1	White	4	INPUT	E1 Channel 9 Receive Tip (+)
		Blue	27	INPUT	E1 Channel 9 Receive Ring (-)
	2	White	57	OUTPUT	E1 Channel 9 Transmit Tip (+)
		Orange	34	OUTPUT	E1 Channel 9 Transmit Ring (-)
	3	White	3	INPUT	E1 Channel 10 Receive Tip (+)

Label	Type	BH4.850.124-D			
		Green	28	INPUT	E1 Channel 10 Receive Ring (-)
	4	White	58	OUTPUT	E1 Channel 10 Transmit Tip (+)
		Brown	33	OUTPUT	E1 Channel 10 Transmit Ring(-)
5		White	2	INPUT	E1 Channel 11 Receive Tip (+)
		Gray	29	INPUT	E1 Channel 11 Receive Ring (-)
6		Red	59	OUTPUT	E1 Channel 11 Transmit Tip (+)
		Blue	32	OUTPUT	E1 Channel 11 Transmit Ring(-)
7		Red	1	INPUT	E1 Channel 12 Receive Tip (+)
		Orange	30	INPUT	E1 Channel 12 Receive Ring (-)
8		Red	60	OUTPUT	E1 Channel 12 Transmit Tip (+)
		Green	31	OUTPUT	E1 Channel 12 Transmit Ring(-)

The E1 interface impedance of EP01A is fixed at 120Ω. **When producing cable, it must be ensured that the input line pair and output line pair are different twisted pairs, or interference will be introduced.**

 **NOTE**

- In the table above, only definitions of 1~12 E1 interfaces corresponding with one DMS-60M socket are listed. On the front panel of EP01A interface card there are two DMS-60M sockets, respectively corresponding with 1~12 and 13~24 E1 interfaces.

2.2.8 Low-speed Interface Card (SD03)

Low-speed interface card (SD03) provides 6-channel RS232/V.24 asynchronous low-speed data ports, or interface adaptation function for 2-channel synchronous data ports and 4-channel asynchronous data ports,

conforming to ITU-T X.50 Division 3 and ITU-T X.54 standards, with the highest synchronous rate of 64Kbps and the highest asynchronous rate of 48Kbps. Under multiplexed mode, each voice channel of SD03 card can multiplex 6-channel V.24, while under independent mode, SD03 card fixedly occupies 6 voice channels, which are ordered by interface.

Low-speed interface card (SD03) can be installed in slot 2-7/10-13, with plug-and-play ability.

There are 6 LEDs and 6 RJ-48C sockets on the panel of SD03 card, as shown in Figure 2-12. When the green LED on the panel of SD03 card is on, it indicates link is synchronized, off indicates no link, or the link is not synchronized. See RJ-45 socket definition of SD03 in Table 2-16.

Figure 2-12 Panel diagram of SD03 card

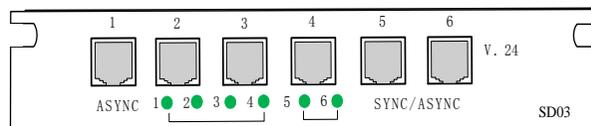


Table 2-16 RJ-45 socket port definition

RJ-45	1	2	3	4	5	6	7	8
Signal name	RC	TC	DTR	S_GN D	RXD	TXD	CTS_DS R_DCD	RT S

2.2.9 Order/Overhead/Clock Interface Card (LA01)

Order/overhead/clock interface card (LA01) is configured with one order wire and F1/E2 overhead channel; it also provides an external clock interface. LA01 can be put into slot 2-7/10-13.

LA01 card uses 64kbit/s PCM code, supports order wire function and ordinary telephone interface dial call. It also supports telephone powering and ringing current. LA01 provides user path byte F1 or E2 overhead byte access, using RS232 interface. This interface card also provides a channel

of external clock input and output interface, the impedance can be selected between 75Ω and 120Ω.

Order/overhead/clock interface card (LA01) front panel diagram is shown by Figure 2-13, and LED functional descriptions are shown in Table 2-17.

Figure 2-13 Order/overhead/clock interface card (LA01) diagram

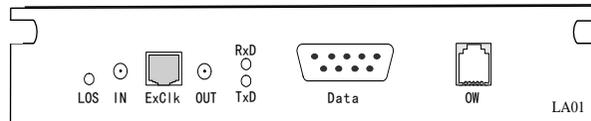


Table 2-17 Order/overhead/clock interface card (LA01) LED functional description

Mark	Color	Functional description
LOS	Red	Clock signal status indication: On: signal loss Off: normal reception
TxD	Green	Data sending indication: Flashing: interface is sending data Off: no data is sent
RxD	Green	Data receiving indication: Flashing: interface is receiving data Off: no data is received

Order Wire Interface

The front panel RJ11 socket (marked with “OW”) is order wire interface, which can connect to standard dual-tone multi-frequency telephone as order wire. Order wire must work at dual-tone multi-frequency mode.

Order wire provides order contact for nodes on ring network or chain network. Through dial, point to point selective call can be realized. When dialing, first dial “#”, and then dial 4-digit called number, i.e. # NNNN. The order wire number of each device can be queried and set by network management software.

Order communication supports E1 or E2 overheads, respectively used for regeneration and multiplexing order contact.

 **NOTE**

- When DHODT-LMXE.VX and DHODT-LMXE.V2/DHODT-LMF are communicating by order wire, both order communication bytes E1 and E2 can be used; when DHODT-LMXE.VX and DHODT-LMXE.V2/DHODT-LMF/DHODT-LMA are communicating by order wire, order communication byte E1 should be used.

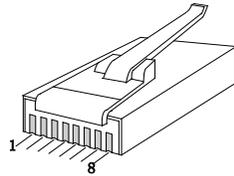
Clock Interface

LA01 card front panel can provide one channel of clock interface of 75Ω or 120Ω. 2MHz or 2Mbit/s clock mode can be set through NMS. 75Ω interface uses CC4 75Ω coaxial cable socket. IN and OUT respectively marks the input and output of clock signal. 120Ω interface uses RJ-48C socket, and the signal definition is shown in Table 2-18.

Table 2-18 Clock interface (RJ-48C) line definition

Pin	1	2	3	4	5	6	7	8
Definition	IN+	IN-	GND	OUT+	OUT-	GND	-	-

The 120Ω interface directly uses RJ-48C connector, which can be crimped with 120Ω twisted pair, shown in Figure 2-14. When producing cable, it must be ensured that the input line pair and output line pair are different twisted pairs.

Figure 2-14 RJ-48C connector diagram

 **NOTE**

The 75Ω interface and 120Ω interface cannot be used at the same time.

RS232 Overhead Interface

On the LA01 card front panel, there is an RS232 interface, which uses DB9 socket, and rate ≤ 19.2 kbps. This interface can be used as asynchronous RS232 interface and provides user path byte F1 or E2 overhead access. The DB9 socket line order definition is shown in Table 2-19. The card DIP switch K1 is defined in Table 2-20.

Table 2-19 DB9 socket signal definition

Pin	Definition	Remark
1	-	1 Asynchronous RS232 interface uses pin-2, pin-3, and pin-5; 2. Asynchronous RS232 interface is controlled by card DIP switch K1. The DIP switch definitions are shown in Table 2-20
2	RxD	
3	TxD	
4	-	
5	GND	
6	-	
7	-	
8	-	
9	-	

Table 2-20 Order/overhead/clock interface card (LA01) DIP switch K1 definition

DIP switch number	Definition	Remark
K1[1]	RS232 Mode options: ON: USRT (synchronous); OFF: UART (asynchronous)	At present, LA01 card does not support synchronous data interface, and K1[1] is by default at OFF (asynchronous serial port)
K1[2]	75Ω clock interface sheath grounding options: ON: clock interface sheath is grounded; OFF: clock interface sheath is not grounded	-
K1[3]	Asynchronous 232 on-off options: ON: enabled UART; OFF: disabled UART	-
K1[4]	For debugging. It is at OFF when used in normal application.	-

 **NOTE**

- LA01 card DIP switch K2 is used for debugging. It is at OFF status when used in normal application.
- LA01 card does not support synchronic data interface.

- When order and user path use E2 overhead at the same time, order has a higher priority and user path will be broken. When order wire is off, user path data will be restored.

2.2.10 4Tx Channel EoS Card (FE01)

4Tx channel EoS card (FE01) is 100M Ethernet electrical port access card, which realizes Ethernet pass-through function. This card can be put into 1 slot 2-7/10-13.

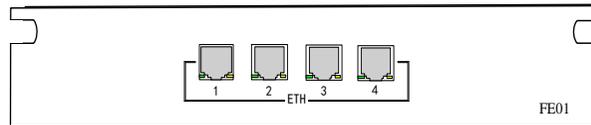
This card supports VC-12 virtual concatenation, VCAT members can be selected from 1~63 VC-12. Four independent ports are adapted into independent virtual concatenation channels respectively. Each channel's bandwidth can be adjusted from 2M~100M by setting the number of VC-12 of VCAT, 46 VC-12 can reach 100M bandwidth.

FE01 card's Ethernet adopts GFP encapsulation and provides various GFP alarms. LCAS function is supported and ineffective members can be automatically deleted from VCAT group temporarily. After the fault is recovered, the members will be automatically added back to the VCAT group. Therefore, VCAT circuit capacity can be automatically adjusted to realize error-free bandwidth adjustment.

Ethernet supports flow control function. In 100M full-duplex mode, after flow control is enabled through NMS, when the reception cache occupation has surpassed the threshold value, pause frame will be automatically sent to the peer device's sending end, pausing its sending to avoid packet loss caused by cache overflow of the receiving device.

FE01 card supports LFP (Link Fault Pass-Through) function. When channel LFP function is enabled, status of any port connection in the link can be automatically detected. When port connection is broken, the other ports connected in the link will be forced to link down, so as to facilitate tracking network connection failure.

The front panel diagram of FE01 is shown by Figure 2-15.

Figure 2-15 Front panel of FE01 card

Four Ethernet ports of FE01 card are standard RJ-45 interfaces and support auto-negotiation mode and forced 100M full-duplex mode. Of the two LEDs at each socket of the Ethernet port, the green one indicates Link and Active: on indicates effective connection has been built; off indicates no network connection is built; flashing indicates there is communication at the port; the yellow one indicates Speed: on indicates 100M. RJ-45 socket definition is shown in Table 2-21.

Table 2-21 RJ-45 Ethernet socket definition

Pin	1	2	3	4	5	6	7	8
Definition	TxD+	TxD-	RxD+	-	-	RxD-	-	-

 **TIP:** In the table above, Rx and Tx are defined based on this device.

 **NOTE**

The 100Base-Tx port of this device features HP auto-MDIX function under auto-negotiation mode and can automatically detect the transceiver line order of the connected network cable and make adaption. So it can be used whether the Ethernet port connected is MDI or MDI-X and whether the network cable used is crossover or straight-through.

2.2.11 1-Port Switching EoTS FE Electrical Interface Card (FE64)

1-port switching EoTS FE electrical interface card (FE64) is 10/100M adaptive Ethernet electrical interface card, which can access and switch

Ethernet frames from four internal channels (through SDH bus) and an external port. This card can be put into slot (2-7/10-13).

The total available bandwidth of 4 internal channels of FE64 card is up to 63 E1s, channel 1 to 4 are respectively corresponds to 1~16, 17~32, 33~48, and 49~63 E1s (the first three channels support up to 16 E1s and the 4th channel supports up to 15 E1s).

4 internal channels of FE64 card are connected to the backplane SDH bus through the way of EoTDM. The encapsulation format of EoTDM is Eo64K or EoPDH. Eo64K format converts Ethernet frame into proprietary $N \times 64K$ frame for transmission and Ethernet packets are encapsulated into $N \times 64K$ ($1 \leq N \leq 496$ or 465) in order. Channels 1 to 3 support up to $496 \times 64K$ (16×31) timeslots, and channel 4 supports up to $465 \times 64K$ (15×31) timeslots. Eo64K encapsulated Ethernet of FE64 card works with TX02 card, realizing the access of $N \times 64K$ Ethernet service. Each channel that adopts EoPDH standard-protocol encapsulation converts Ethernet frame into standard E1 frame into $N \times E1$ ($1 \leq N \leq 16$ or 15) for transmission, realizing Ethernet data transmission based on E1. The first three channels support up to 16 E1s, while the 4th channel supports up to 15. It can interconnect with various EoPDH devices that conform to G.8040 standard.

Main functions:

- VLAN classification based on port, 802.1Q or Q in Q, VLAN supports up to 512 entries, and VLAN ID range is 1~4094;
- QoS management based on port, DS and 802.1P;
- STP/RSTP;
- Ethernet port loopback detection;

Ethernet port loopback detection function and STP/RSTP are bound: the port will support loopback detection only when STP/RSTP is enabled. The device will automatically remove loopback ports (by default) which are determined by the principle that spanning tree only

has backup ports and alternative ports. NMS supports loopback detection and query of removed ports but does not support disabling loopback detection and manual removal of loopback ports;

- Configuration of static MAC address list (64 entries);
- MAC address learning: query of the MAC address of user data packets, up to 2048 entries; the entry content includes MAC address, ports (external and internal ports) and VLAN ID; MAC address aging time can be set to 10~1048575s (the default is 300s);
- Ethernet internal channel Trunking (up to four channels and two groups of Trunking);
- LCAS protocol is supported, which can automatically adjust the bandwidth according to the number of effective E1 channels. Even if errors or loopbacks occur to some E1 channels, it will remove them automatically. This just decreases the data throughout but not breaks the transmission. And when the channels have recovered, the device will automatically restore the transmission bandwidth;
- Maximum packet length of 2032 bytes;
- Electrical ports support management of Ethernet input/output bandwidth (speed limit range can be set to 64Kbps~100Mbps: when the bandwidth is less than 2Mbps, the granule is 64Kbps; when the bandwidth is equal to or more than 2Mbps, the granule is 1Mbps);
- Storm repression for unknown unicast, multicast, and broadcast (the speed limit range and granule are the same with management of input/output bandwidth);
- RMON (Remote Network Monitoring). Query and configuration of relevant content of statistics group and history group;
- The card resetting function.

 **NOTE**

- The total available Ethernet bandwidth is up to 63 E1s, channels 1 to 4 respectively correspond to 1~16, 17~32, 33~48, and 49~63 E1s (the first three channels support up to 16 E1s and the 4th channel supports up to 15 E1s).
- When Eo64K encapsulation is adopted, timeslot 16 can be used to transmit Ethernet data or not.
- When STP is enabled, the ports will be redetected and Ethernet will be broken.
- When LCAS function is disabled, the Ethernet service configurations and channel bindings of both ends must be consistent.
- When VLAN is disabled, one external port and four internal channels of FE64 card are switching ports.

Ethernet electrical ports of FE64 card support auto-negotiation mode and forced 100M full duplex, 100M half-duplex, 10M full duplex and 10M half-duplex mode.

The panel diagram of FE64 card is shown in Figure 2-16, and the LED definition is in Table 2-22. RJ45 socket definition of Ethernet electrical ports is shown in Table 2-23.

Figure 2-16 Panel diagram of FE64 card



Table 2-22 LED definition of FE64 card

Label	Color	LED definition
RUN	Green	System running indication: Blink: the card is running normally; Off: the card is running abnormally
Green LED at Ethernet socket	Green	Link and Active indication: On: electrical port is effectively connected; Off: no network connection at electrical port; Blink: electrical port is in communication
Yellow LED at Ethernet socket	Yellow	Ethernet port FDX indication: On: electrical port is in full-duplex mode; Off: electrical port is in half-duplex mode

Table 2-23 RJ45 socket definition of Ethernet electrical ports

Pin	1	2	3	4	5	6	7	8
Definition	TxD+	TxD-	RxD+	-	-	RxD-	-	-

 **TIP** The definitions of (Rx) and (Tx) are in relation to this device.

 **NOTE**

The 100Base-Tx port has HP auto-MDIX function, which can automatically detect the transceiver line order of the connected network cable. So it can be used whether the connected Ethernet interface is MDI or MDI-X, and whether the network cable used is crossover or straight-through.

2.2.12 Multi-functional Voice Interface Card (CHU02)

Multi-functional voice interface card (CHU02) provides 10-channel FXO, whose interface quantity can be configured flexibly by plugging in voice sub-cards, each voice sub-card provides 1-channel voice and can be put into slot 1-10 of CHU02 card, occupying timeslots 1 to 10. Slot allocation is shown in Figure 2-17. FXO voice sub-card is mainly used to connect to the subscriber line interface of the switch card, whose functions are voice coding and decoding, ring detection, signaling decoding and etc.

When CHU02 is configured to FXO voice interface, it can be installed in slot 2-7/10-13 of the device.

NOTE

Voice level gain value of CHU02 card can be adjusted through NMS. Adjustment value of A/D direction is X ($-18 \text{ dB} \leq X \leq 10 \text{ dB}$); while adjustment value of D/A direction is Y ($-18 \text{ dB} \leq Y \leq 8 \text{ dB}$).

There is one voice interface (DB25 socket) and ten LEDs on the panel of CHU02. See the panel diagram in Figure 2-18. Each LED indicates the status of 1-channel voice services. See LED definition and pin assignment in Table 2-24. DB25 socket is used to connect 2-wire voice cable ZJN.BH4.851.245, whose pin assignment is shown in Table 2-25.

Figure 2-17 Slot allocation of CHU02 voice sub-card

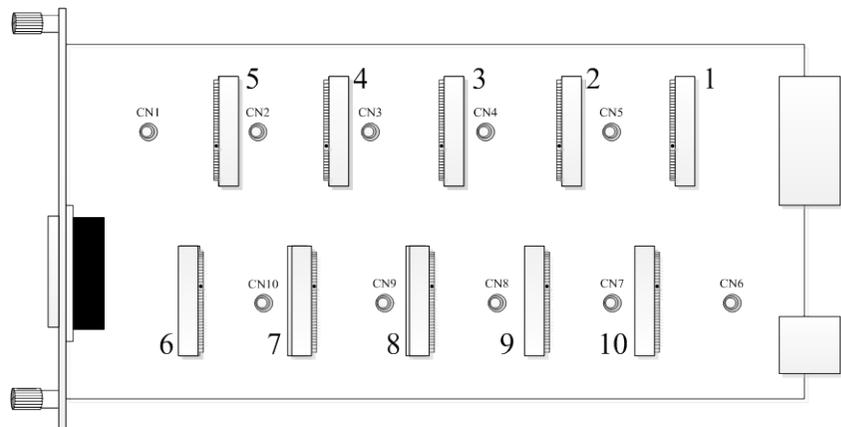
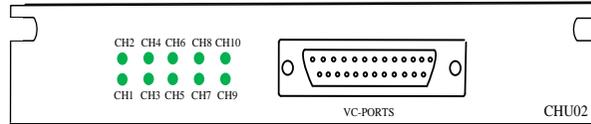


Figure 2-18 Panel diagram of CHU02 card

Table 2-24 LED definition of CHU02 card

LED status of voice channel occupancy status	Description
Solid on	In communication
Off	Not occupied
Blink	Sub-voice-card is unequipped

Table 2-25 Pin assignment of 2-wire voice cable ZJN.BH4.851.245

DB25F	Color	Signal	Combination mode	Note
1	White	T1	Twisted-pair	2-wire-1
14	Blue	R1		
2	White	T2	Twisted-pair	2-wire-2
15	Orange	R2		
3	White	T3	Twisted-pair	2-wire-3
16	Green	R3		
4	White	T4	Twisted-pair	2-wire-4
17	Brown	R4		
6	White	T5	Twisted-pair	2-wire-5

DB25F	Color	Signal	Combination mode	Note
19	Grey	R5		
7	Red	T6	Twisted-pair	2-wire-6
20	Blue	R6		
8	Red	T7	Twisted-pair	2-wire-7
21	Orange	R7		
9	Red	T8	Twisted-pair	2-wire-8
22	Green	R8		
11	Red	T9	Twisted-pair	2-wire-9
24	Brown	R9		
12	Red	T10	Twisted-pair	2-wire-10
25	Grey	R10		

 **TIP** Ti, Ri (i=1~10) means transmitting and receiving voice lines.

2.2.13 10 FXS Port Card with Line Fault Detection (CHU03)

CHU03 is a PCM voice card that provides users with FXS telephone access ports and supports telephone line fault detection, such as open circuit and short circuit detection. We can enable/disable detection function, and set the automatic detection interval and manual detection on CHU03. It provides FXS interfaces, the number of which can be flexibly configured through plugging in voice sub-cards. Each voice sub-card provides 1-channel voice and can be put into slot 1 to 10 in the CHU03, occupying timeslots 1 to 10. Slot allocation is shown in Figure 2-19. FXS voice sub-card is mainly used to connect to the telephone, whose functions are voice coding and decoding, feeding and ringing to the subscriber line, overvoltage protection and etc.

CHU03 can be installed in any universal slot (2-7 or 10-13) of the device. It comes with ring function, so only -48V power supply is enough.

NOTE

Voice level gain value of CHU03 card can be adjusted through NMS. Adjustment value of A/D direction is X ($-18 \text{ dB} \leq X \leq 10 \text{ dB}$); while adjustment value of D/A direction is Y ($-18 \text{ dB} \leq Y \leq 8 \text{ dB}$).

There is one voice interface (DB25 socket) and ten LEDs on the front panel of CHU03. See the panel diagram in Figure 2-20. Each LED indicates the status of 1-channel voice services. See LED definition and pin assignment in Table 2-26. DB25 socket is used to connect 2-wire voice cable ZJN.BH4.851.245, whose pin assignment can be referred to the pin assignment of 2-wire voice cable in Table 2-25.

Figure 2-19 Slot allocation of CHU03 voice sub-card

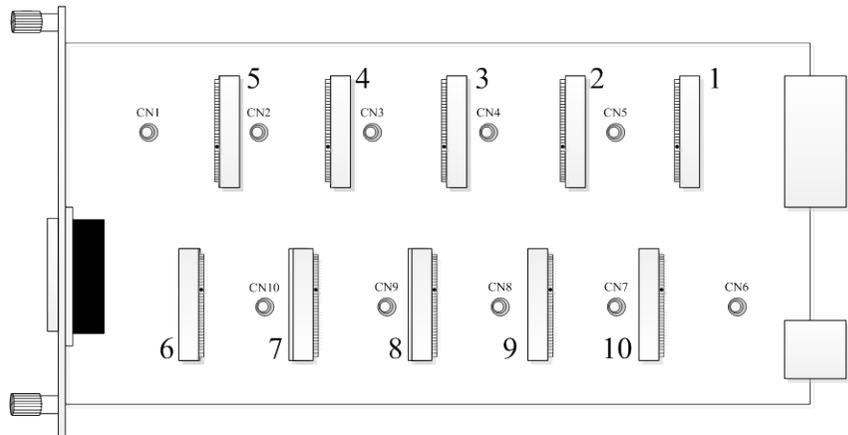


Figure 2-20 Panel diagram of CHU03 card

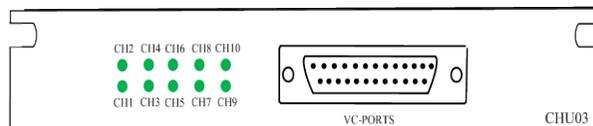


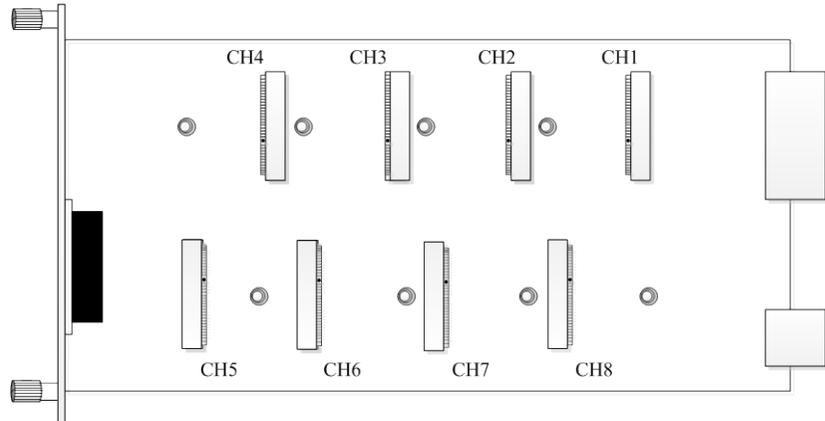
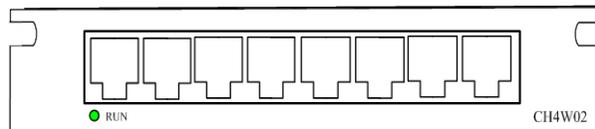
Table 2-26 LED definition of CHU03 card

LED status of voice channel occupancy status	Description
Solid on	In communication
Off	Not occupied
Blink	Sub-voice-card is unequipped

2.2.14 EM Signaling & 2/4-Wire Voice Card (CH4W02)

EM signaling & 2/4-wire voice card (CH4W02) provides 1~8 channels 2/4-wire voice and EM signaling, realizing the access of voice and signaling simultaneously. The number of interfaces can be flexibly configured by inserting the CH4WEM-ADP card. Each CH4WEM-ADP card provides 1-channel 2/4-wire voice and EM signaling, which is inserted in the 1-8 slot of CH4W02 card and occupying 1-8 time slots. The slot layout is shown in Figure 2-21. CH4W02 can be installed in slot 2-7/10-13.

There is one LED and eight RJ11 sockets on the panel of CH4W02 card, as shown in Figure 2-22. When the green RUN LED is on, indicating the power supply is normal, if off, indicating the power supply is running abnormally or is not running. Pin assignments of RJ11 socket is shown in Table 2-27.

Figure 2-21 CH4WEM-ADP slot layout

Figure 2-22 Panel diagram of CH4W02 card

Table 2-27 Pin assignments of RJ11 socket

Pin	Signal	Definition
1	M_IN	EM signaling input
2	Tia	4-wire voice output positive pole
3	Tib	2/4-wire voice input positive pole
4	Rib	2/4-wire voice input negative pole
5	Ria	4-wire voice output negative pole
6	E_OUT	EM signaling output

 Tip: Tia and Ria stand for 4-wire voice output; Tib and Rib stand for 4-wire voice input or 2-wire voice input.

 **NOTE**

- EM signaling of CH4W02 supports 1E1M.
- When setting the electrical level value through NMS, you can adjust the 4-wire Tx and Rx level gain value in -14~+4 dBr.
- You can adjust the 2-wire Tx level gain value in -7~0 dBr, Rx level gain value in -7.5~+2 dBr.

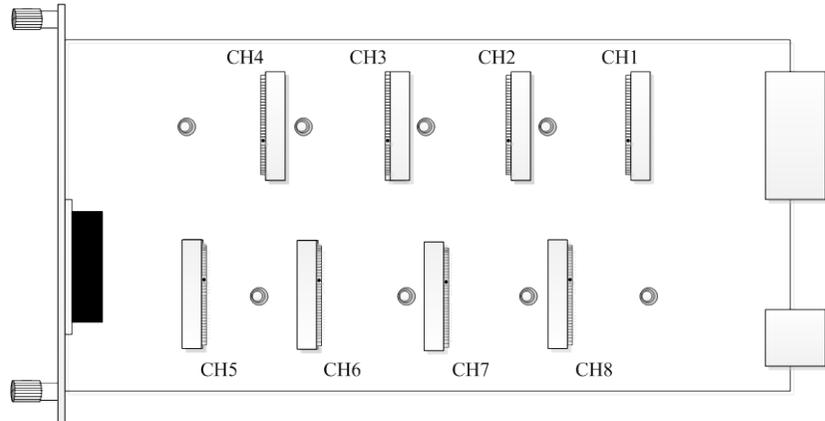
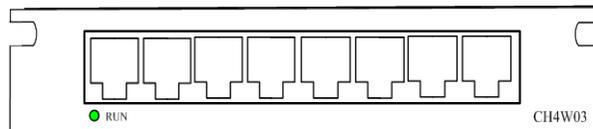
2.2.15 2W/4W Voice &EM Interface Card with Digital Gain Adjustment (CH4W03)

2W/4W voice &EM interface card with digital gain adjustment (CH4W03) provides 1~8 channels 2/4-wire voice and EM signaling, realizing the access of 2/4-wire analog voice and TYPE V mode EM signaling. The number of interfaces can be flexibly configured by inserting the CH4WEM-ADP2 card. Each CH4WEM-ADP2 card provides 1-channel 2/4-wire voice and EM signaling, which is inserted in the slot 1-8 of CH4W03 card and occupying 1-8 time slots. The slot layout is shown in Figure 2-23. CH4W03 can be installed in slot 2-7/10-13.

CH4W03 supports using NMS to switch 2/4-wire and 2/4-wire gain adjustment, which support 1-level of interface analog gain adjustment, 2-wire: A-D:0dB, D-A:0dB and A-D:0dB, D-A:5dB; 4-wire: A-D:0dB, D-A:0dB and A-D:+14dB, D-A:+4dB.

CH4W03 supports digital gain control: range from A-D:-18dB to +10dB, D-A: -18dB to +8dB, STEP can achieve 0.1dB.

There is one LED and eight RJ11 sockets on the panel of CH4W03 card, as shown in Figure 2-24. When the green RUN LED is on, indicating the power supply is normal, if off, indicating the power supply is running abnormally or is not running. Pin assignments of RJ11 socket is shown in Table 2-28.

Figure 2-23 CH4WEM-ADP2 slot layout

Figure 2-24 Panel diagram of CH4W03

Table 2-28 Pin assignments of RJ11 socket

Pin	Signal	Definition
1	M_IN	EM signaling input
2	Tia	4-wire voice output positive pole
3	Tib	2/4-wire voice input positive pole
4	Rib	2/4-wire voice input negative pole
5	Ria	4-wire voice output negative pole
6	E_OUT	EM signaling output

 Tip: Tia and Ria stand for 4-wire voice output; Tib and Rib stand for 4-wire voice input or 2-wire voice input.

2.2.16 64K Co-directional Data Interface Card (CHD01)

64K co-directional data interface card (CHD01) can provide the access of 8-channel ITU-T G.703-compliant 64K co-directional data. This card can be installed in slot 2-7/10-13.

There are 9 LEDs and 4 sockets on the panel of CHD01 card, as shown in Figure 2-25. When the green LED RUN on the panel blinks, it indicates that this card is working normally, when it is off, it indicates that this card is not working or not powered on. The red LED 1~8 correspond to 8-channel 64K co-directional data, on indicates the loss of this channel of 64K co-directional data, blinking indicates AIS and off indicates normal data transmission. Each socket corresponds to 2-channel 64K co-directional data, and their pin assignment is shown in Table 2-29.

Figure 2-25 Panel of 64K co-directional data interface card (CHD01)

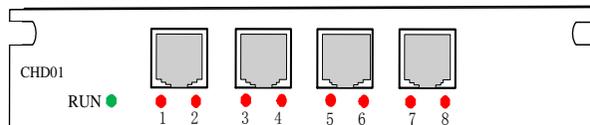


Table 2-29 Pin assignment of 64K co-directional interface card (CHD01)

Dual-E1 socket Pin	64K co-directional data connection	Twisted pair	Recommended twisted pair color
1	IN (1)-	Paired	Blue
2	IN (1)+		Blue-white
3	OUT (1)+	Paired	Orange
4	OUT (1)-		Orange-white
5	IN (2)-	Paired	Green

Dual-E1 socket Pin	64K co-directional data connection	Twisted pair	Recommended twisted pair color
6	IN (2)+		Green-white
7	OUT (2)+	Paired	Brown
8	OUT (2)-		Brown-white

64K co-directional data interface cable can directly use dual-E1 connector (please refer to Figure 2-11 in 2.2.7), which can be directly crimped with 120Ω twisted pair. **When cable is being made, please ensure the input and output line pairs respectively use a twisted pair, or interference would be introduced.**



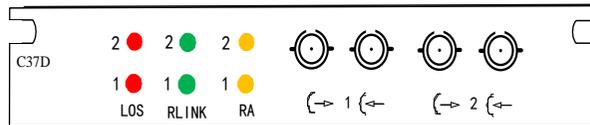
CAUTION

Each socket of CHD01 card is for two channels of 64K co-directional data. This is a private definition. Do not mix the interface with 120Ω standard RJ-48C socket, or the interface may be damaged.

2.2.17 2-channel C37.94 Interface Card (C37D)

When C37D is configured to DHODT-LMXE.VX device, it provides 2-channel service inputs complying with the IEEE C37.94TM-2002 standard, and can be installed in slot 2-7/10-13.

There are 4 optical sockets and 6 LEDs on the panel of C37D card, as shown in Figure 2-26. And see the LED definition in Table 2-30.

Figure 2-26 Panel diagram of C37D card

Table 2-30 LED definition of C37D card

Mark	Color	LED definition	Remark
LOS 1~2	Red	Signal status indication of optical ports: On: signal loss; Off: normal reception	Respectively indicates signal status of two optical ports
RLINK 1~2	Green	Connection status indication of a remote channel: On: the connection between the local and remote channels is established; Off: the connection between the local and remote channels is not established.	Respectively indicates connection status of 2 remote channels
RA 1~2	Yellow	Remote signal alarm indication: On: remote signal loss; Off: normal remote reception	Respectively indicates signal alarm of 2 remote channels

2.2.18 Asynchronous Data Card (SD02)

Asynchronous data card (SD02) realizes asynchronous to synchronous conversion and interface adaptation. It provides 16-channel RS-232/V.24 and 2-channel RS-422/485/V.11, occupying 18 common channels with the highest rate of 19.2kbit/s.

Asynchronous data card (SD02) can be installed in slot 2-7/10-13, with plug-and-play ability.

There are one LED and one DB62 socket on the panel of SD02 card, as shown in Figure 2-27. When the green PWR LED on the panel of SD02 card is on, it indicates normal power supply; off indicates disconnected or abnormal power supply. DB62 socket on the panel of SD02 card is used to connect 16 RS232 and dual RS-422/485 cables ZJN.BH4.851.148. See pin assignments of SD02 in Table 2-31.

Figure 2-27 Panel diagram of SD02 card

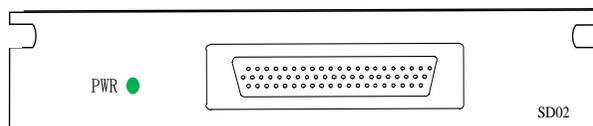


Table 2-31 Pin assignment of ZJN.BH4.851.148

DRAS6 2F Pin	Signal	Color	Combination	DRAS6 2F Pin	Signal	Color	Combination	DRAS6 2F Pin	Signal	Color	Combination	
232-1	22	TXD1	Blue	232-7	28	TXD7	Green	232-13	34	TXD13	Brown	Twisted pair Orange tie 2
	43	GND	White		49	GND	Black		55	GND	Red	
	43	GND	White		49	GND	Black		55	GND	Red	Twisted pair Orange tie 2
	1	RXD1	Orange		7	RXD7	Brown		13	RXD13	Gray	
232-2	23	TXD2	Green	232-8	29	TXD8	Gray	2-1	35	TXD14	Blue	Twisted pair

	44	GND	White	blue tie 1		50	GND	Black	blue tie 2		56	GND	Black	Orange tie 2
	44	GND	White	Twisted pair blue tie 1		50	GND	Yellow	Twisted pair blue tie 2		56	GND	Black	Twisted pair Orange tie 2
	2	RXD 2	Brown	blue tie 1		8	RXD 8	Blue	blue tie 2		14	RXD 14	Orange	Orange tie 2
232-3	24	TXD 3	Gray	Twisted pair blue tie 1	232-9	30	TXD9	Blue	Twisted pair Orange tie 1	232-15	36	TXD 15	Green	Twisted pair Orange tie 2
	45	GND	White	Twisted pair blue tie 1		51	GND	White	Twisted pair Orange tie 1		57	GND	Black	Twisted pair Orange tie 2
	45	GND	Red	Twisted pair blue tie 1		51	GND	White	Twisted pair Orange tie 1		57	GND	Black	Twisted pair Orange tie 2
	3	RXD 3	Blue	blue tie 1		9	RXD 9	Orange	blue tie 1		15	RXD 15	Brown	Orange tie 2
232-4	25	TXD 4	Orange	Twisted pair blue tie 1	232-10	31	TXD 10	Green	Twisted pair Orange tie 1	232-16	37	TXD 16	Gray	Twisted pair Orange tie 2
	46	GND	Red	Twisted pair blue tie 1		52	GND	White	Twisted pair Orange tie 1		58	GND	Black	Twisted pair Orange tie 2
	46	GND	Red	Twisted pair blue tie 1		52	GND	White	Twisted pair Orange tie 1		58	GND	Yellow	Twisted pair Orange tie 2
	4	RXD 4	Green	blue tie 1		10	RXD 10	Brown	blue tie 1		16	RXD 16	Blue	Orange tie 2
232-5	26	TXD 5	Brown	Twisted pair blue tie 2	232-11	32	TXD 11	Gray	Twisted pair Orange tie 1	422/485-1	18	TXD1 +	Orange	Twisted pair
	47	GND	Red	Twisted pair blue tie 2		53	GND	White	Twisted pair Orange tie 1		39	TXD1 -	Orange-white	
	47	GND	Red	Twisted pair blue tie 2		53	GND	Red	Twisted pair Orange tie 1		19	RXD 1+	Green	Twisted pair
	5	RXD 5	Gray	blue tie 2		11	RXD 11	Blue	blue tie 1		40	RXD 1-	Green-white	
232-6	27	TXD 6	Blue	Twisted pair blue tie 2	232-12	33	TXD 12	Orange	Twisted pair Orange tie 1	422/485-2	20	TXD2 +	Brown	Twisted pair
	48	GND	Black	Twisted pair blue tie 2		54	GND	Red	Twisted pair Orange tie 1		41	TXD2 -	Brown-white	
	48	GND	Black	Twisted pair blue tie 2		54	GND	Red	Twisted pair Orange tie 1		21	RXD 2+	Blue	Twisted pair
	6	RXD 6	Orange	blue tie 2		12	RXD 12	Green	blue tie 1		42	RXD 2-	Blue-white	

🔑 **TIP:** In the table above, TxDi (i = 1 to 16) indicates the output line of RS-232 signals and RxDi (i= 1 to 16) indicates the input line of RS-232 signals. When a port works in RS-422/485 (full duplex) mode, TxDi+/- (i = 1 to 2) indicates the output line of RS-422/485 (full duplex) signals and RxDi+/- (i= 1 to 2) indicates the input line of RS-422/485 (full duplex) signals. When a port works in RS-485 (half duplex) mode, RxDi+/- (i = 1 to 2) indicates the input line of RS-485 signals.

DIP Switch Description

4-bit DIP switches K1 and K2 on SD02 card respectively correspond to 2-channel RS-422/485 ports, position 1, 2, and 4 of K1 and K2 control RS-422/485 interface mode: when 1, 2 and 4 are switched to OFF (by default), the port can be set to work in RS-422 (full-duplex) or RS-485 (full-duplex) mode by the NMS; when 1, 2 and 4 are switched ON, the interface is working in RS-485 (half-duplex) mode. Bit-3 determines whether 120Ω build-out resistors are connected: ON means to connect the resistor; OFF means to disconnect the resistor. You can determine whether to connect build-out resistors based on the onsite environment.

2.2.19 Relay Signaling Interface Card (DIO04)

Relay signaling interface card (DIO04) is designed to provide communication links for protection commands between teleprotection relays. It can be inserted into slot 2-7/10-13 of the device.

Relay signaling interface card (DIO04) supports 4 DC signal input detections, and 4 solid-state relay I/O signal output for dry contacts. The input trip voltage level can be set from DC 24V to DC 250V through NMS, available in 7 configurations: DC 24V, DC 48V, DC 60V, DC 110V, DC 125V, DC 220V and DC 250V, which can be set according to 4 input service ports. The secure and dependable signal transmission of DIO04 is compliant with IEC60834-1 standards of teleprotection equipment of power systems.

Relay signaling interface card (DIO04) supports upgrading and resetting through software.

On the panel of relay signaling interface card (DIO04), there is a system state LED (RUN), four input port state LEDs (1~4) and two standard (5.04mm spacing) 8PIN green phoenix terminal interfaces (IN/OUT). The panel diagram is shown in Figure 2-28. The LED functional descriptions are shown in Table 2-32.

Figure 2-28 The panel diagram of relay signaling interface card (DIO04)

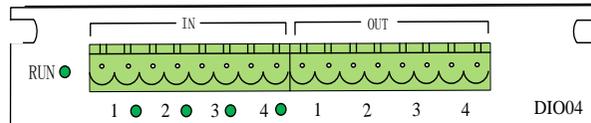


Table 2-32 The LED functional descriptions of relay signaling interface card (DIO04)

Mark	Color	Functional descriptions
RUN	Green	System running indication: Blink (1s interval): running normally On: running abnormally Off: not running or LED failure
1~4	Green	Input port state indication: On: voltage is inputted Off: no voltage is inputted

The input /output signaling ports of relay signaling interface card (DIO04) are respectively marked with IN and OUT, using 8PIN phoenix terminal, services can be transmitted in 4 directions. See input/output port definitions Table 2-33.

Table 2-33 Input/output port definitions of DIO04 card

IN	Signal	Definition	OUT	Signal	Definition
1	IN_1+	The 1 st input	9	OUT_1+	The 1 st output
2	IN_1-		10	OUT_1-	
3	IN_2+	The 2 nd input	11	OUT_2+	The 2 nd output
4	IN_2-		12	OUT_2-	
5	IN_3+	The 3 rd input	13	OUT_3+	The 3 rd output
6	IN_3-		14	OUT_3-	
7	IN_4+	The 4 th input	15	OUT_4+	The 4 th output
8	IN_4-		16	OUT_4-	

Input/output port parameters of relay signaling interface card (DIO04) are shown in Table 2-34.

Table 2-34 Input/output port parameters of DIO04 card

Parameter	Standard
4 input voltage	
Operation threshold (trip detection)	DC 24V, DC 48V, DC 60V, DC 110V, DC 125V, DC 220V, DC 250V
4 output voltage	
Command outputs	Solid-state relay; normally open
Max. switching voltage/current	DC 250V/0.25A
Isolation value	2500Vrms

2.2.20 STM-1 Interface Emulation Card (SC01Q)

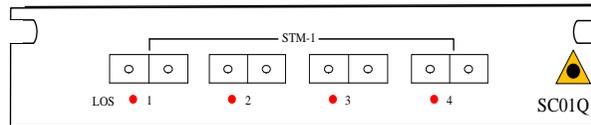
DHODT-LMXE.VX supports STM-1 interface emulation card (SC01Q), which can work with remote H20RN-161E device. The remote E1 is emulated by PWE3, and multiplexed to STM-1 at CO. SC01Q supports 4 STM-1 interfaces, using SFP optical module. Its working mode can be configured to channelizing STM-1 interface emulation card. SC01Q gets the power from the back board of DHODT-LMXE.VX and the backplane bandwidth is not less than 1G. The SC01Q can be inserted in the slot 18-23 of the equipment. The card is cooled by chassis fan.

SC01Q supports LAS (laser automatic shutdown) function. It supports SDH service, including standard SDH frame structure, SDH frame demarcation, clock recovery, processing of segment layer overhead, alarm and performance statistics, and PWE3 service encapsulation load.

SC01Q supports SAToP compliant 126-channel E1 circuit simulation, and works with H20RN-161E device. SDH clock supports synchronization to local clock, to clock at STM-1 optical port and to external clock. The E1 clock recovery function supports local clock, port loop-back clock, adaptive timing and differential timing, and the differential algorithm reference source supports external clock or synchronous Ethernet.

SC01Q supports MSP 1+1 protection, fixed at port 1 and port 2, port 3 and 4 for mutual protection. Port 1 (protection port 2) has 63 VC12; corresponding to CES emulation interface 1-63, it can be used only when there is no protection. Port 3 (protection port 4) has 63 VC12; corresponding to CES emulation interface 64-126, it can be used only when there is no protection.

The panel diagram of SC01Q is shown in Figure 2-29. Definition of LEDs is shown in Table 2-35.

Figure 2-29 The panel diagram of SC01Q**Table 2-35** LED functional descriptions of SC01Q

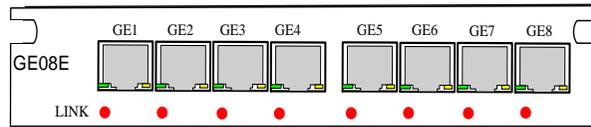
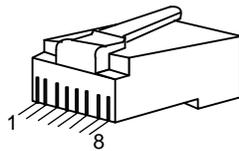
Mark	Color	Functional descriptions
LOS (1~4)	Red	Optical port signal status indication: On: optical signal loss Off: normal optical signal reception

2.2.21 8-port GE Electrical Interface Card (GE08E)

GE08E provides 8 GE Ethernet electrical interfaces. It works with MX02 to complete Gigabit Ethernet service access and switch from 8 GE ports. It can be put into slot 18-23. When it is put into slot 18-20, the first 4 GE ports can be used.

GE08E supports SyncE and the maximum Ethernet's frame length is 16342 Bytes.

Ethernet electrical interfaces of GE08E uses standard RJ45 port, the RJ45 connector diagram is shown in Figure 2-31. Ethernet electrical ports support auto-negotiation mode and forced 1000M full duplex mode and forced 100M full duplex mode. The panel diagram of GE08E is shown in Figure 2-30. Definition of LEDs is shown in Table 2-37. RJ45 socket line definition is shown in Table 2-36.

Figure 2-30 The panel diagram of GE08E

Figure 2-31 RJ45 connector diagram

Table 2-36 RJ45 socket line definition of GE port

Pin	1	2	3	4	5	6	7	8
Definition	BI_A +	BI_A -	BI_B +	BI_C +	BI_C -	BI_B -	BI_D +	BI_D -

TIP

BI stands for bidirectional.



The Ethernet electrical interfaces of GE08E have HP auto-MDIX function, which can automatically detect the transceiver line order of the connected network cable. So it can be used whether the connected Ethernet interface is MDI or MDI-X, and whether the network cable used is crossover or straight-through.

Table 2-37 LED functional descriptions of GE08E card

LED	Color	LED functional descriptions
Green LED at the Ethernet port	Green	Link/Active indication: On: valid connection Off: no connection

LED	Color	LED functional descriptions
Yellow LED at the Ethernet port	Yellow	Ethernet port FDX indication: On: Ethernet ports (electrical and optical) are in full-duplex mode Off: Ethernet ports (electrical and optical) are in half-duplex mode

2.2.22 8-port GE Optical Interface Card (GE08)

GE08 provides 8 GE Ethernet optical interfaces. It works with MX02 to complete Gigabit Ethernet service access and switch from 8 GE ports. It can be put into slot 18-23. When it is put into slot 18-20, the first 4 GE ports can be used.

GE08 supports SyncE and the maximum Ethernet's frame length is 16342 Bytes.

Ethernet optical interfaces of GE08 support auto-negotiation mode and forced 1000M full duplex mode and forced 100M full duplex mode. The panel diagram of GE08 is shown in Figure 2-32. Definition of LEDs is shown in Table 2-38.

Figure 2-32 The panel diagram of GE08

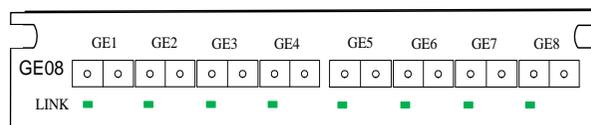


Table 2-38 LED functional descriptions of GE08 card

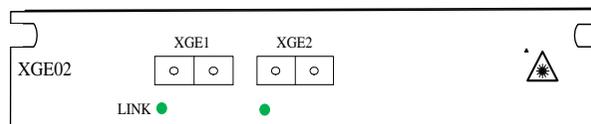
LED	Color	LED functional descriptions
Green LED at the Ethernet port	Green	Ethernet optical port link indication: On: link up Off: link down

2.2.23 10GE Optical Interface Card (XGE02)

XGE02 provides 2 10GE Ethernet optical interfaces. When it works with MX02, it can complete service access and switch of 2 10GE ports. It can be put into slot 18-23. The backplane of slot 18-23 supports 1 10GE port.

XGE02 supports IEEE 1588v2 and SyncE. The maximum Ethernet's frame length is 16342 Bytes.

Ethernet optical interfaces of XGE02 support auto-negotiation mode. The panel diagram of XGE02 is shown in Figure 2-33. Definition of LEDs is shown in Table 2-39.

Figure 2-33 The panel diagram of XGE02

Table 2-39 LED functional descriptions of XGE02 card

LED	Color	LED functional descriptions
LINK	Green	Ethernet optical interface Link indication: On: link up Off: link down

Optical ports of XGE02 use LC dual-fiber SFP+ optical module or single-fiber SFP+ optical module. When single-fiber transceiver module is used, only one optical port exists. The wavelength of single-fiber module is its emission wavelength.

When connector is inserted into optical transceiver module socket, the latching tab should be aligned to the correspondent notch. The bending radius of pigtail fiber should be not less than 50mm. When optical fiber connector is inserted or pulled, do not directly pull the optical fiber. Please reserve the protection plug on SFP optical module. When no optical fiber is connected, please ensure that the protection plug is inserted to prevent dust from entering.



CAUTION

Single-fiber devices with the same emission wavelength cannot interwork. So when single-fiber devices are interworked, the devices with matched emission wavelengths should be used.

2.2.24 8-port 8-channel EoS Card (ES08)

8-port 8-channel EoS card (ES08) is an EoS service card on the PK plane of DHODT-LMXE.VX. It realizes 8GE service accessed from external port, or 8-channel Ethernet service from MX02 bearing on the SDH channel, so as to realize Ethernet over SDH function. This card can be put into slot 18-23.

ES08 card provides 8 external electrical ports, which are encapsulated into independent internal virtual concatenation channels. The bandwidth of each channel can be adjusted by the number of VC-4s of VCAT. Each channel can bind with 1~8 VC-4, and the total bandwidth is 32 VC-4s.

Ethernet uses GFP encapsulation and provides GFP various alarms. LCAS function is supported and ineffective members can be automatically deleted from VCAT group temporarily. After the fault is recovered, the members will be automatically added back to the VCAT group. Therefore, VCAT circuit capacity can be automatically adjusted to realize bandwidth adjustment without interrupting data transmission.

ES08 supports jumbo frame and its maximum Ethernet frame length is 9600Bytes.

Ethernet electrical ports of ES08 use standard RJ-45 connector which supports auto-negotiation and forced 1000M/100M/10M full-duplex modes.

The panel of ES08 is show in Figure 2-34. And the definition of LEDs is show in Table 2-40. RJ-45 connector pin numbers are shown in Figure 2-35. The socket definition is shown in Table 2-41.

Figure 2-34 Panel diagram of ES08 card

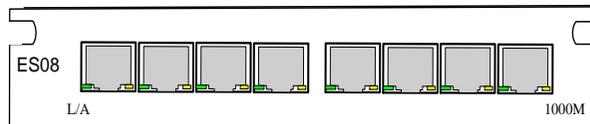
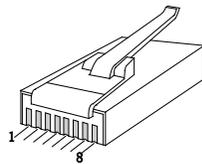


Table 2-40 LED functional descriptions of ES08 card

Mark	Color	LED functional descriptions
Green LED at Ethernet socket	Green	Link and Active indication: On: valid connection has been built at electrical port Off: no connection has been built at electrical port Blink: data transmitting at electrical port

Mark	Color	LED functional descriptions
Yellow LED at Ethernet socket	Yellow	Ethernet port FDX indication: On: Ethernet ports (electrical and optical) at full-duplex mode; Off: Ethernet ports (electrical and optical) at half-duplex mode

Figure 2-35 RJ-45 pin connector

Table 2-41 RJ-45 socket definition

Pins	1	2	3	4	5	6	7	8
Definitions	BI_A +	BI_ A-	BI_B +	BI_C +	BI_ C-	BI_B -	BI_D +	BI_D-

NOTE

- For 1000Base-T standard, four pairs of twisted pairs are required. And cat5 or cat6 should be used, and RJ45 connector should have good quality. The process requirement for RJ45 connector production is high, and operation must closely follow the norms, or the connection would be broken or unstable.
- ES08's Ethernet ports can automatically detect the connected network cable's transceiver line order and make adaptation. Thus whether the Ethernet interface connected is MDI or MDI-X, and whether the network cable used is crossover or straight-through, auto adaptation can be achieved.

2.2.25 32-channel EoS Card (ES32S)

32-channel EoS card (ES32S) is an EoS service card on the PK plane of DHODT-LMXE.VX. It realizes 4-channel Ethernet service from MX02 bearing on the SDH channel, so as to realize Ethernet over SDH function. This card can be put into slot 18-23.

Ethernet uses GFP encapsulation and provides GFP various alarms. 4 channels from MX02 have independent ports, which are encapsulated into independent internal virtual concatenation channels. The bandwidth of each channel can be adjusted by the number of VC-4s of VCAT. Each channel can bind with 1~8 VC-4, and the total bandwidth is 32 VC-4s.

Ethernet can be divided into VLANs (VLAN is disabled by default). VLAN group can support up to 512 entries, the VLAN ID range being 1~4094. VLAN mode can be selected based on port, on 802.1Q and on QinQ. Port-based VLAN adopts port pass-through mode, i.e. ports receive frames with or without VLAN and do not filter frames sent and received based on VLAN. 802.1Q-based VLAN can identify and process 802.1Q tags, configuring VLAN ID and 802.1p priority. QinQ-based VLAN can identify and deal with double tag. ES32S card can realize QoS management based on ports, 802.1p, and DS.

Ethernet supports LCAS function (LCAS is disabled by default) and can temporarily delete ineffective members from virtual concatenation group. After the fault is fixed, the members will automatically be back to the group. So the capacity of virtual concatenation circuit can be automatically adjusted and bandwidth adjustment without error can be realized.

ES32S card supports STP/RSTP function (RSTP is enabled by default), Ethernet port loopback detection function, link aggregation (manual aggregation and static LACP aggregation, link aggregation is disabled by default), setting static MAC address list and aging time of 64 entries, and other layer-2 protocols.

The maximum Ethernet's frame length is 2032Bytes.

The front panel diagram of ES32S is shown by Figure 2-36, and the LED functional descriptions are shown in Table 2-42.

Figure 2-36 The front panel diagram of ES32S



Table 2-42 The LED functional description

Mark	Color	Functional description
RUN	Green	System running indication: Blinks: running normally

 **NOTE**

- When the STP function is enabled, the ports will be detected again and Ethernet will be broken. If some ports do not need detection, please set these ports to edge ports.
- Link aggregation function precautions:
 - Link aggregation function and 802.3ah function or STP/RSTP function cannot be used at the same time.
 - The ports which are added to the same aggregation group should have the same work rate, duplex mode, VLAN, QoS, and RSTP.
 - When the aggregation group is in active status, the port attributes cannot be modified. Only when the aggregation group is in inactive status, can priority, synchronization mode, and timeout mode of ports can be modified.
 - The load balancing algorithm of local end aggregation group should be the same with that of link partner aggregation group.
 - External ports cannot be added to the same aggregation with other ports.

- When link aggregation module is being set, after attributes of aggregation groups or ports are set, please query the setting results after three seconds.

2.2.26 16E1 Emulation Card (EC16)

16E1 emulation card (EC16) supports CES (Circuit Emulation Service), which is implemented based on PWE3 (Edge to Edge Pseudo Wire Emulation) protocol frame work, using SAToP (Structure-Agnostic TDM over Packet). E1 service is used as a serial data bit stream to segment and encapsulate. After that, transfer E1 service on PW line through MPLS, IP and MEF encapsulating formats, pass through the PSN network, Tunnel, reach the PW exit, and then de-capsulate it, finally, reconstruct E1 service flow. EC16 card of H20RN-2000 supports 16 channels of E1 services.

16E1 emulation card (EC16) supports RTP (Real-time Transport Protocol), which is used to define the E1 timestamp (removing jitter and realizing the synchronous) and realize the jitter absorption cache

Clock Synchronization

The clock working modes at the receiving end of DHODT-LMXE.VX are as follows:

- Adaptive timing mode (ACR)

The adaptive timing model is that the receiver reconstructs timing mode over E1 stream transferred from peer end.

- Loopback timing mode

Loopback timing mode refers to extracting clock from E1 input port signal to reconstruct E1 output bit stream. The memorizer inside the network absorbs the drift formed by the network transmission completely. Once the loss of input signal occurs, loop timing mode will switch to the adaptive timing automatically.

- Differentiated timing mode (DCR)

Differentiated clock mode refers to both the sending terminal and the receiving terminal devices are provided with a reference clock. Sending terminal codes the difference between source clock and the reference clock and then transfers it. The receiving terminal compares the difference between the receiver clock and the reference clock according to the difference sent by the sending terminal, so as to adjust clock.

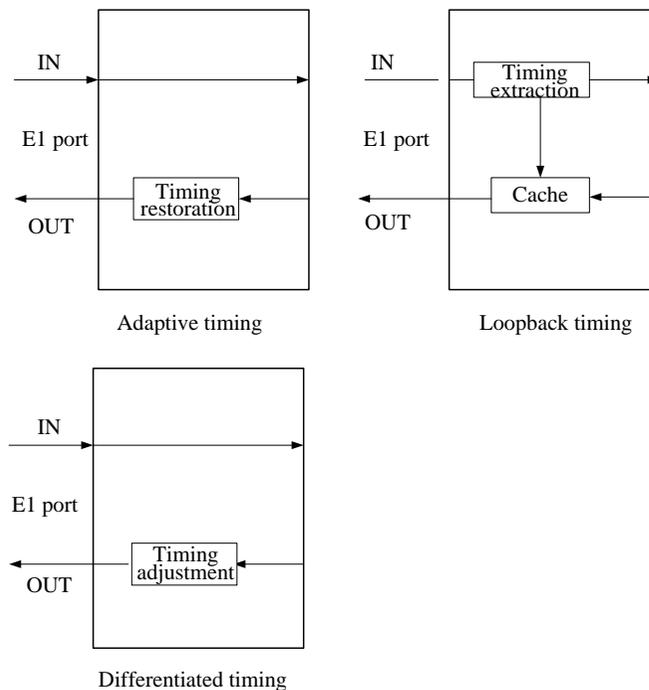
- Restoration timing mode in physical layer signal

The clock reference source can be IEEE 1588, SyncE or GPS.

- Local clock source

The local oscillator (internal free oscillation clock).

Figure 2-37 Timing mode diagram



The clock working modes at the transmitting end of DHODT-LMXE.VX are as follows:

- Loopback clock

Loopback timing mode refers to extracting clock from E1 input port signal to reconstruct E1 output bit stream.

- External clock synchronization port (2MHz, 2Mbit/s)

Access 2MHz, 2Mbit/s clock signal form external clock-source devices through BITS interfaces provided by the device.

- Internal free oscillation clock

The local oscillator (internal free oscillation clock).

16E1 emulation card (EC16) supports 16 E1 ports, using RJ45 ports. E1 port impedance can be selected between 75Ω and 120Ω . Each dual-E1 socket corresponds to 2-channel E1. See the pin assignment of Dual-E1 socket in Table 2-43, the panel diagram in Figure 2-38.

Figure 2-38 16E1 emulation card (EC16)

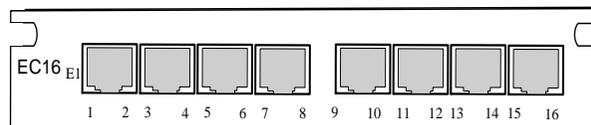
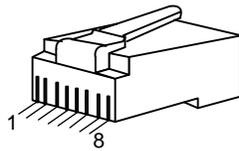


Table 2-43 Pin assignment of Dual-E1 socket

Dual-E1 socket pin	E1 connection	Twisted-pair	Color
1	E1_IN (1)-	Paired	Blue
2	E1_IN (1)+		Blue-white
3	E1_OUT (1)+	Paired	Orange
4	E1_OUT (1)-		Orange-white
5	E1_IN (2)-	Paired	Green
6	E1_IN (2)+		Green-white

Dual-E1 socket pin	E1 connection	Twisted-pair	Color
7	E1_OUT (2)+	Paired	Brown
8	E1_OUT (2)-		Brown-white

Figure 2-39 Dual-E1 connector diagram



When 120Ω impedance is used, we can directly use dual-E1 connector crimped with 120Ω twisted pair. **When a cable is being made, please ensure the input and output line pairs respectively use a twisted pair, or interference would be introduced.** When 75Ω impedance is used, we need to use accessory cable ZJN. BH4.850.123 or ZJN. BH4.850.107. We can use ZJN. BH4.850.123 to realize the conversion from dual-E1 connector to BNC socket. **The output shell of BNC is grounded, but the input shell is not grounded.**

K1~K4 DIP switches are used to set E1 interface impedance, as shown in Table 2-44.

Table 2-44 Definition of E1 interface DIP switches

DIP	Definition	Remark
K1_1/K1_2	ON/ON: select 75Ω for the 1 st E1 channel OFF/OFF: select 120Ω for the 1 st E1 channel	8-bit DIP switches of K1 control E1 impedance

DIP	Definition	Remark
K1_3/K1_4	ON/ON: select 75Ω for the 2 nd E1 channel OFF/OFF: select 120Ω for the 2 nd E1 channel	selections of the 1 st and 4 th channels
K1_5/K1_6	ON/ON: select 75Ω for the 3 rd E1 channel OFF/OFF: select 120Ω for the 3 rd E1 channel	
K1_7/K1_8	ON/ON: select 75Ω for the 4 th E1 channel OFF/OFF: select 120Ω for the 4 th E1 channel	
K2_1/K2_2	ON/ON: select 75Ω for the 5 th E1 channel OFF/OFF: select 120Ω for the 5 th E1 channel	8-bit DIP switches of K2 control E1 impedance selections of the 5 th and 8 th channels
K2_3/K2_4	ON/ON: select 75Ω for the 6 th E1 channel OFF/OFF: select 120Ω for the 6 th E1 channel	
K2_5/K2_6	ON/ON: select 75Ω for the 7 th E1 channel OFF/OFF: select 120Ω for the 7 th E1 channel	

DIP	Definition	Remark
K2_7/K2_8	ON/ON: select 75Ω for the 8 th E1 channel OFF/OFF: select 120Ω for the 8 th E1 channel	
K3_1/K3_2	ON/ON: select 75Ω for the 9 th E1 channel OFF/OFF: select 120Ω for the 9 th E1 channel	8-bit DIP switches of K3 control E1 impedance selections of the 9 th and 12 th channels
K3_3/K3_4	ON/ON: select 75Ω for the 10 th E1 channel OFF/OFF: select 120Ω for the 10 th E1 channel	
K3_5/K3_6	ON/ON: select 75Ω for the 11 th E1 channel OFF/OFF: select 120Ω for the 11 th E1 channel	
K3_7/K3_8	ON/ON: select 75Ω for the 12 th E1 channel OFF/OFF: select 120Ω for the 12 th E1 channel	
K4_1/K4_2	ON/ON: select 75Ω for the 13 th E1 channel OFF/OFF: select 120Ω for the 13 th E1 channel	

DIP	Definition	Remark
K4_3/K4_4	ON/ON: select 75Ω for the 14 th E1 channel OFF/OFF: select 120Ω for the 14 th E1 channel	selections of the 13 th and 16 th channels
K4_5/K4_6	ON/ON: select 75Ω for the 15 th E1 channel OFF/OFF: select 120Ω for the 15 th E1 channel	
K4_7/K4_8	ON/ON: select 75Ω for the 16 th E1 channel OFF/OFF: select 120Ω for the 16 th E1 channel	

2.3 Fan

In order to improve the whole performance of the system, DHODT-LMXE.VX configures the fan card on the left of the chassis, which supports hot swap and gets 12V power from backplane. When the fan with speed monitor function works abnormally, the corresponding alarm will be displayed on the network management interface. Users need to detect timely, and replace the fan card. Fan card provides an ESD jack, which is used for antistatic protection.

3 Cable Introduction

3.1 AC Power Cable

Application

AC power cable transports AC power from power distribution equipment to AC power supply socket, and then transmits power to the entire device.

AC power supply cable depends on local standards, while different regions have different standards, as shown in Table 3-1.

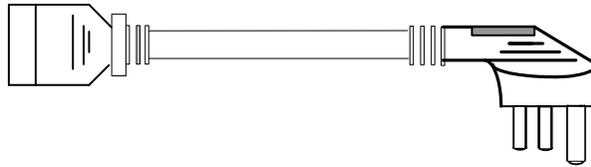
Table 3-1 AC power supply cable list

Regional standard	Cable type
Chinese standard	BH4.855.035-A
German standard	BH4.855.035-B
American standard	BH4.855.035-C
South Africa standard	BH4.855.035-D
Japanese standard	BH4.855.035-E
British standard	BH4.855.035-F
North American standard	BH4.855.035-G

Appearance and Structure

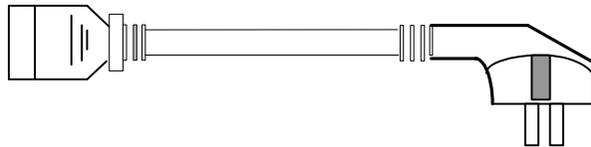
The AC power cable which meets Chinese standard is composed of Chinese standard three-plug connector and pins terminal, as shown in Figure 3-1.

Figure 3-1 Chinese standard AC power cable (ZJN.BH4.855.035-A)



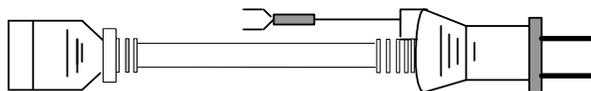
The AC power cable which meets German standard is composed of German standard French-mode two-plug connector and pins terminal, as shown in Figure 3-2.

Figure 3-2 German standard AC power cable (ZJN.BH4.855.035-B)



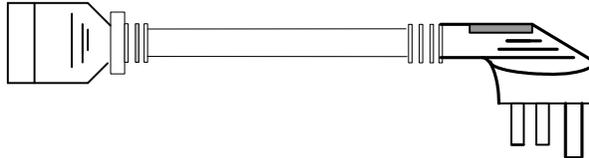
The AC power cable which meets American standard is composed of American standard two-plug connector and pins terminal, as shown in Figure 3-3.

Figure 3-3 American standard AC power cable (ZJN.BH4.855.035-C)



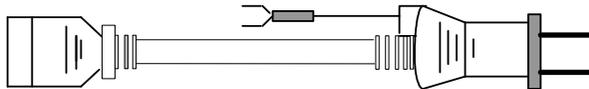
The AC power cable which meets South Africa standard is composed of South Africa standard three-plug connector and pins terminal, as shown in Figure 3-4.

Figure 3-4 South Africa AC power cable (ZJN.BH4.855.035-D)



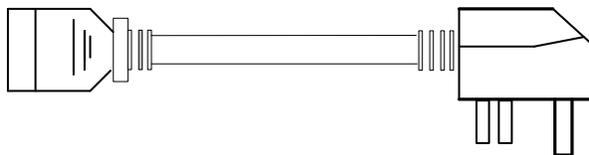
The AC power cable which meets Japanese standard is composed of Japanese standard two-plug connector and pins terminal, as shown in Figure 3-5.

Figure 3-5 Japanese standard AC power cable (ZJN.BH4.855.035-E)

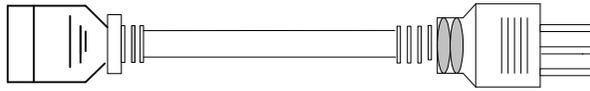


The AC power cable which meets British standard is composed of British standard three-plug connector and pins terminal, as shown in Figure 3-6.

Figure 3-6 British standard AC power cable (ZJN.BH4.855.035-F)



The AC power cable which meets North American standard is composed of North American standard three-plug connector and pins terminal, as shown in Figure 3-7.

Figure 3-7 North American AC power cable (ZJN.BH4.855.035-G)

Technical Specifications

Table 3-2 lists technical specifications of AC power cable

Table 3-2 Technical specifications of AC power cable

Item	Description
Cable type	Electronic and electrical cable
Color	Black
Diameter	$\geq 0.5\text{mm}^2$

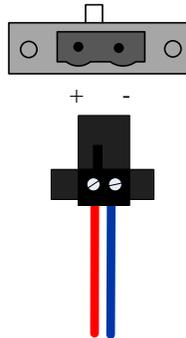
3.2 DC Power Cable (ZJN.BH4.855.093)

Application

DC power cable transports -48V DC power from power distribution equipment to DC power supply socket, and then transmits power to the entire device.

Appearance

DC power cable is composed of 2-pin connector and power cable, as shown in Figure 3-8.

Figure 3-8 DC power cable appearance

Pin Assignments

Table 3-3 lists DC power pin assignments.

Table 3-3 DC power pin assignments

PIN	Color	Signal definition
1	Blue	-48V
2	Red	⏏ CGND

3.3 Protection Ground Cable (BH4.851.016)

Application

Protection ground cable is an important guarantee to lightning protection, shock proof, and anti-interference.

Appearance and Structure

The protection ground cable is composed of wiring terminals and the wire. The wiring terminal is usually an OT bare-press terminal. The wire is

yellow/green copper burn-resistant cable. Figure 3-9 shows the protection ground cable diagram and structure.

Figure 3-9 Protection ground cable diagram

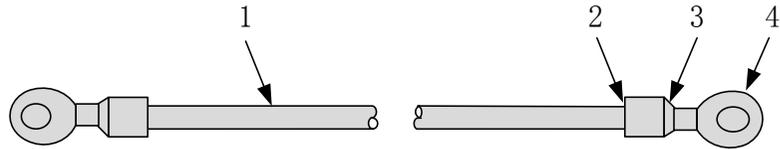


Table 3-4 Protection ground cable structure list

Number	Name
1	Wire
2	Strip end (connected to the OT terminal)
3	Insulating sheath
4	OT terminal

Technical Specifications

Table 3-5 lists technical specifications of the protection ground cable.

Table 3-5 Technical specifications of the protection ground cable

Item	Description
Cable type	Electronic and electrical cable
Cable length	0.4 m
Color	Yellow and green
Connector type	OT/OT

Item	Description
Inner conductor cable standard	Cross-sectional area $\approx 0.75 \text{ mm}^2$
Maximum current	7.5 A

3.4 Fiber

Application

Fiber is used to connect optical port with uplink devices or optical network terminals.

Fiber connectors supported by device depend on different optical modules, as shown in Table 3-6.

Table 3-6 Fiber connector types

Connector	Name	Fiber
LC/PC	LC: Connector used to connect with SFP module	Single-mode fiber
		Multi-mode fiber

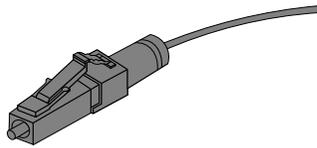
NOTE

Choose the type of fiber connector and fiber length properly as required on site.

Appearance and Operation

A single-mode optical fiber and a multi-mode optical fiber have the same appearance but different colors. A single-mode optical fiber is yellow and a multi-mode optical fiber is orange.

Figure 3-10 shows the LC/PC fiber connector.

Figure 3-10 LC/PC fiber connector

When connecting or removing the LC/PC optical connector, align the connector with the optical interface, and do not rotate the fiber. Note the following points:

- To connect fiber: align the head of the fiber jumper with the optical interface and insert the optical fiber into the interface gently.
- To remove the fiber, press the latch on the connector, push the fiber head inwards, and then pull the fiber out.

Fiber Selection Criteria

Table 3-7 lists the fiber selection criteria.

Table 3-7 Criteria for selecting fibers

Item	Basis for selection
Length	Survey result
Single-mode or multi-mode	Optical module type
Fiber connector type	Square connector: SC/PC, LC/PC

3.5 Ethernet Cable

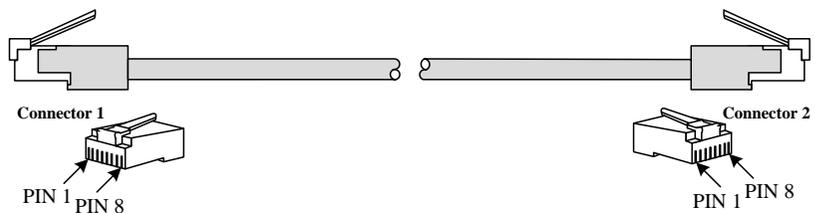
Application

- Used to connect the Ethernet electrical interface with other devices.
- Used to connect the Ethernet monitoring interface on NM card with network interface on NM PC machine.

Appearance

Figure 3-11 shows Ethernet cable appearance.

Figure 3-11 Ethernet cable



Pin Assignments

Ethernet cables are classified into straight-through cables and crossover cables:

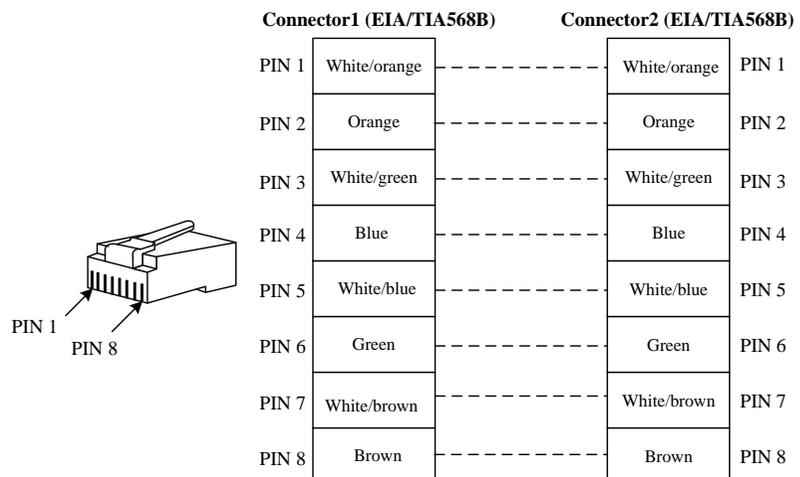
- Straight through cable: the line orders of twisted pair crimped by RJ45 connectors on both ends are EIA/TIA 568B standard line orders.
- Crossover cable: the line order of twisted pair crimped by one end RJ45 connector is EIA/TIA 568A standard line order, the line order of the other end is EIA/TIA 568B standard line order.

Line orders of EIA/TIA 568A and EIA/TIA 568B standards are shown in Table 3-8.

Table 3-8 Line orders of EIA/TIA 568A and EIA/TIA 568B standards

Connector (RJ45)	EIA/TIA 568A	EIA/TIA 568B
PIN 1	White/green	White/orange
PIN 2	Green	Orange
PIN 3	White/orange	White/green
PIN 4	Blue	Blue
PIN 5	White/blue	White/blue
PIN 6	Orange	Green
PIN 7	White/brown	White/brown
PIN 8	Brown	Brown

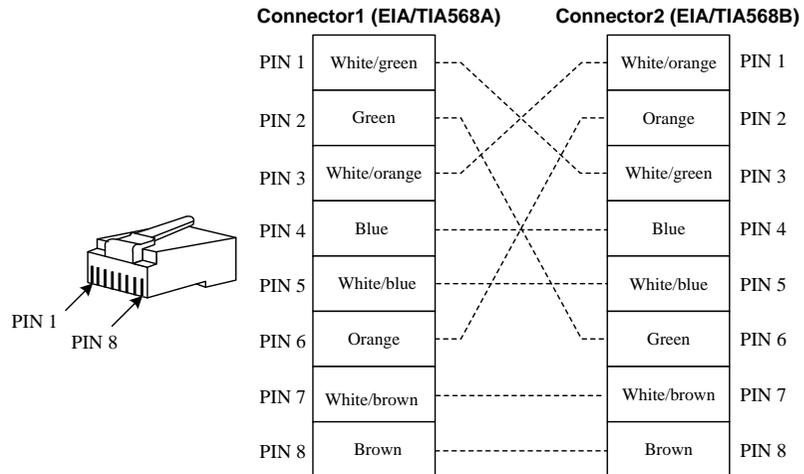
Both two RJ45 connectors of the straight through cable follow EIA/TIA568B standard line order, as shown in Figure 3-12.

Figure 3-12 Line order of the straight-through cable


RJ45 connectors on both ends of crossover cable need to use different standard line orders, usually one RJ45 connector follows EIA/TIA568A standard; the other RJ45 connector follows EIA/TIA568B standard.

Diagrams of crossover cable pin assignments are shown in Figure 3-13.

Figure 3-13 Line order of the 100 Mbit/s crossover cable



Technical Specifications

Technical specifications of Ethernet cable are shown in Table 3-9.

Table 3-9 Technical specifications of Ethernet cable

Item	Description
Connector type	RJ45 connector (crystal head)
Cable type	Category 5 unshielded twisted pair (UTP-5) or shielded twisted pair (STP)
Color	Dark grey
Characteristic impedance	100.0Ω

Item	Description
Inner conductor wire diameter	0.510mm
Breakdown voltage	500.0V
Inner conductor DC impedance	93.8Ω/km
Quantity of cores	8
Frequency range	0~100MHz
Frequency attenuation	22dB/100m@100MHz

3.6 Rack Alarm Cable (BH4.851.021B)

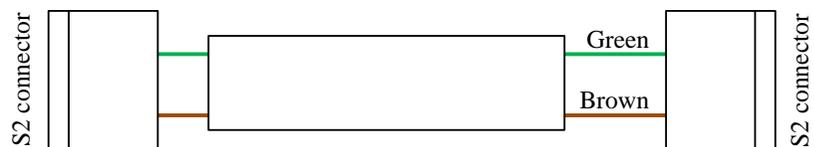
Application

Rack alarm cable is used to connect with rack alarm device to control alarm signal output of the device.

Appearance and Structure

Rack alarm cable is composed of S2 connectors and alarm cables, whose appearance and structure are shown in Figure 3-14.

Figure 3-14 Diagram of rack alarm cable's appearance and structure



Technical Specifications

Table 3-10 shows technical specifications of rack alarm cable.

Table 3-10 Technical specifications of rack alarm cable

Item	Description
Connector	S2 connector
Cable color	Green and brown
Cable length	2.5m

3.7 E1 Cable

Application

E1 cable is used to connect E1 interface of equipment card, realizing the transmission of E1 signal. E1 cable type depends on different forms of interfaces. See E1 cable types in Table 3-11.

Table 3-11 E1 cable types

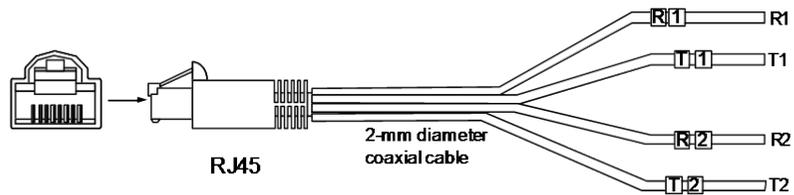
Cable type	Cable model	Suitable card type
Dual E1 socket cable	BH4.850.107	EP01/EP03
Dual E1 socket cable	BH4.850.123	EP01/EP03
12E1 cable	BH4.850.124D	EP01A

3.7.1 Dual E1 Socket Cable (BH4.850.107)

Appearance

Appearance diagram of dual E1 socket cable (BH4.850.107) is shown in Figure 3-15.

Figure 3-15 Dual E1 socket cable (BH4.850.107) diagram



Pin Assignments

Table 2-14 shows pin assignments of dual E1 socket cable (BH4.850.107).

Technical Specifications

Table 3-12 shows technical specifications of dual E1 socket cable (BH4.850.107).

Table 3-12 Technical specifications of dual E1 socket cable (BH4.850.107)

Item	Description
Cable type	Coaxial cable
Cable length	10m
Color	Grayish white
Connector type	RJ-48C crystal head
Gauge	SYV-75-2

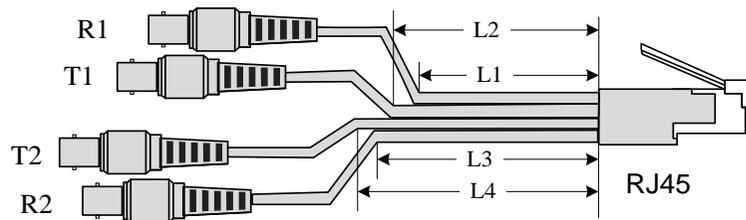
Item	Description
Characteristic impedance	75Ω
Diameter	2mm
Maximum current	28A

3.7.2 Dual E1 Socket Cable (BH4.850.123)

Appearance

Dual E1 socket cable (BH4.850.123) is composed of 1 RJ45 crystal head and 4 BNC heads, whose appearance diagram is shown in Figure 3-16.

Figure 3-16 E1 cable (BH4.850.123) diagram



Pin Assignments

Table 2-14 shows pin assignments of dual E1 socket cable (BH4.850.123).

Technical Specifications

Table 3-13 shows technical specifications of dual E1 socket cable (BH4.850.123).

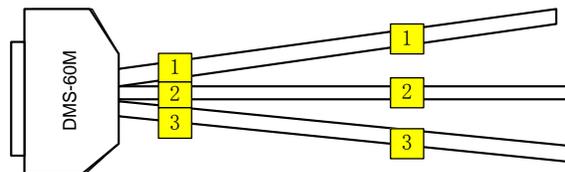
Table 3-13 Technical specifications of dual E1 socket cable (BH4.850.123)

Item	Description
Cable name	RJ45/BNC connector adapter cable
Cable type	SYV75-2-1 (diameter: 2mm, coaxial cable)
Connector	RJ45 crystal head, BNC head
Cable length	L1=20cm; L2=25cm; L3=30cm; L4=35cm

3.7.3 12E1 Connection Cable (BH4.850.124D)

Appearance

The 12E1 connection cable (BH4.850.124D) consists of a DMS-60M plug and an audio cable, as shown in the Figure 3-17.

Figure 3-17 12E1 connection cable (BH4.850.124D) diagram


Pin Assignments

Table 2-18 shows pin assignments of 12E1 connection cable (BH4.850.124D).

Technical Specifications

Table 3-14 shows technical specifications of 12E1 connection cable (BH4.850.124D).

Table 3-14 Technical specifications of 12E1 connection cable
(BH4.850.124D)

Item	Description
Cable type	Program control cable
Connector	D.JC.DMS-60M

4 Device Installation and Usage

4.1 Device Installation

4.1.1 Chassis Installation

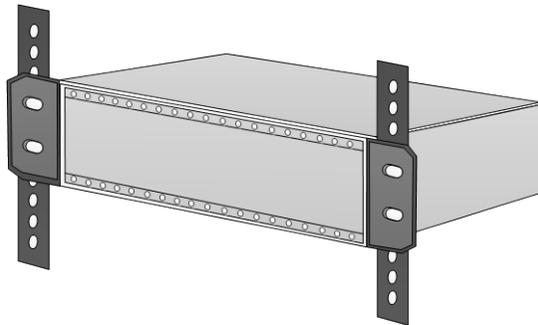
Step 1 Mark the position with a marking pen.

- a) DHODT-LMXE.VX chassis is 4U high; the fixed holes in the mounting ears correspond to the mounting holes in the mounting bracket.
- b) Install captive nuts.

Step 2 Install the chassis into chassis cabinet or rack.

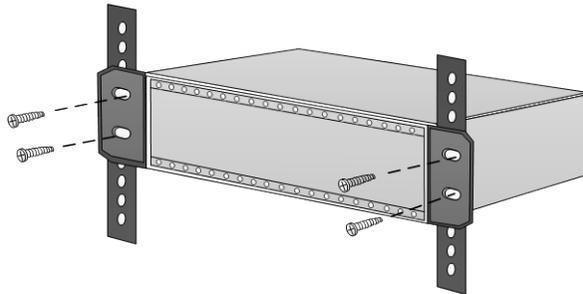
Installing DHODT-LMXE.VX requires one person to hold the chassis and put it into cabinet or rack, as shown in Figure 4-1.

Figure 4-1 Put into cabinet or rack.

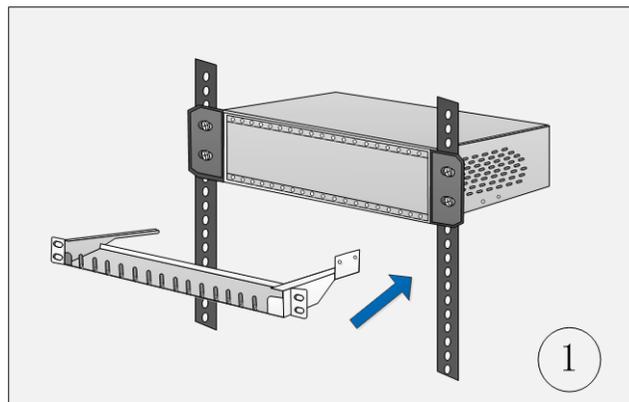


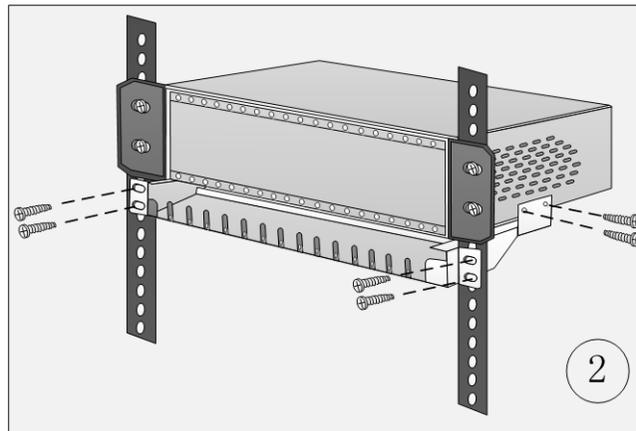
Step 3 Fix the chassis.

Fixing DHODT-LMXE.VX requires a person to hold the chassis by one hand and fix the chassis to the mounting bracket with a screw driver by another hand, and then change the position and fix the other side to the mounting bracket too, as shown in Figure 4-2.

Figure 4-2 Fix the chassis**Step 4** Install the cabling channel.

- a) Put the cabling channel under the chassis closely and push in with moderate force.
- b) Install captive nuts and fix the cabling channel.

Figure 4-3 Install the cabling channel

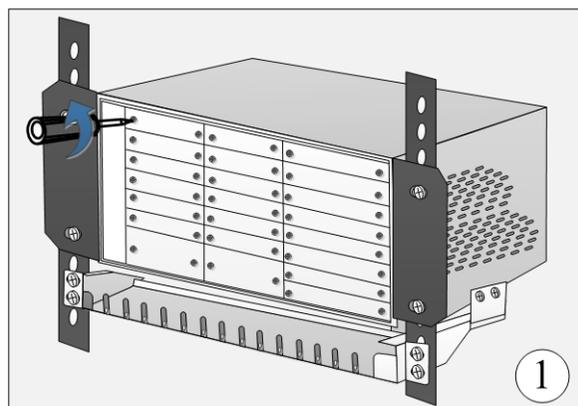


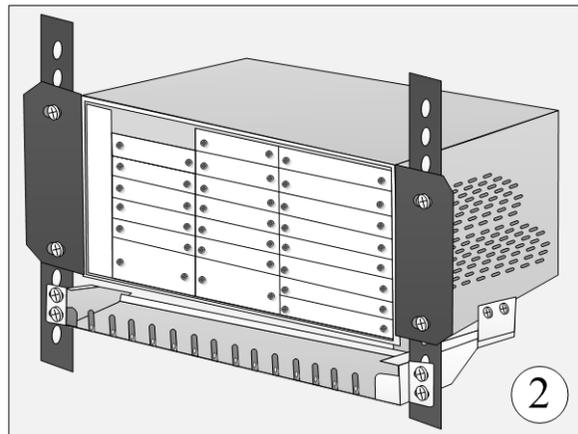
4.1.2 Cards Installation

Step 1 Remove the blind cards.

When removing the blind cards, twist down the screws on the blind cards in the standby slots counterclockwise with a screwdriver and then remove the blind cards. See specific steps are in Figure 4-4.

Figure 4-4 Remove the blind cards

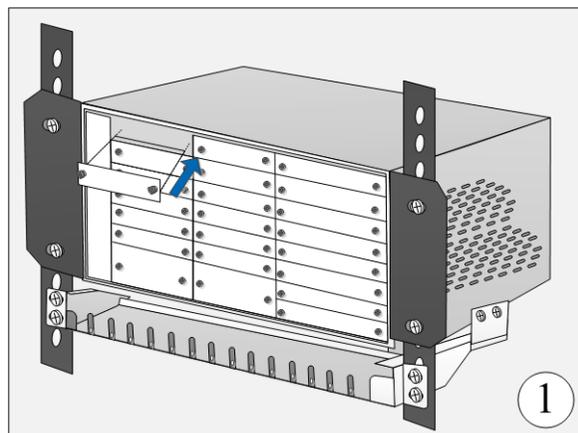


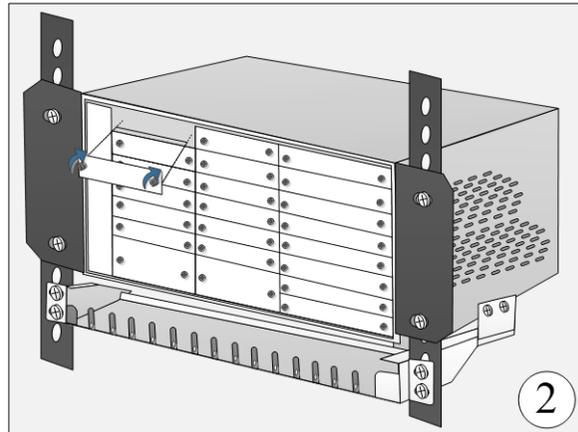


Step 2 Install cards.

- a) Align the both edges of cards to the left and right guides of the chassis, and then push in slowly along the guides till to the back panel of the chassis exactly.
- b) Tighten up the locking screws on the left and right ends of the cards clockwise.

Figure 4-5 Install cards





4.1.3 Installing the Ground Wire

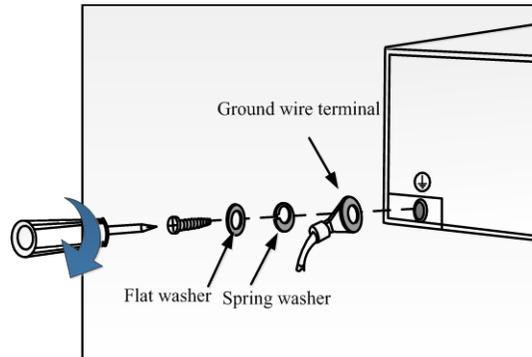
The ground wire sent with the device is as shown below:

Figure 4-6 The ground wire



Specific connection steps are as follows:

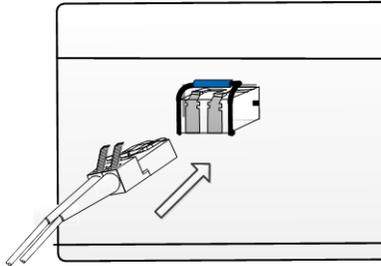
- Step 2** The grounding hole is located on the left mounting era of the device.
- Step 3** Successively place the flat washer, the spring washer and the ground wire terminal around the grounding terminal according to the order shown in Figure 4-7, tighten up the grounding terminal to the ground interface of the device clockwise.
- Step 4** Connect the other end of the ground wire to the grounding apparatus like the grounding terminal of the rack or the on-site grounding bar.

Figure 4-7 Connecting the ground wire

4.1.4 Connecting the Fiber

Step 1 If LC/PC dual-fiber SFP optical module is used, insert optical module into device optical port, respectively remove the dust caps on the optical module and the optical fiber, aim the head of the fiber at the optical module port and insert it into the port with moderate force, as shown in Figure 4-8 and Figure 4-9.

Figure 4-8 Insert optical module

Figure 4-9 Connecting the fiber**CAUTION**

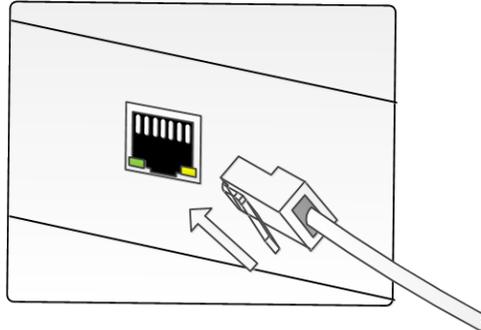
- SC/PC dual-fiber optical module socket marked with (↵ is optical signal output, while the one marked with ↶) is optical signal input.
- Using double fiber SFP optical module, the directions of input and output should be consistent with the triangular mark of SFP optical module, as shown in Figure 4-8. Be careful not to reverse Tx and Rx.
- When optical fiber connector is inserted or pulled, do not directly pull the optical fiber. When no optical fiber is connected, please ensure that the protection plug is inserted to prevent dust from entering.

4.1.5 Connecting the Ethernet Cable

Step 1 Select proper cable according to the cable path, and then select straight through cable or crossover cable according to the link partner device, finally, make an Ethernet cable according to 3.5 .

Step 2 Aim one RJ45 connector of the cable at the card's Ethernet port; insert it into the port with moderate force, as shown in Figure 4-10.

Figure 4-10 Connecting the Ethernet cable



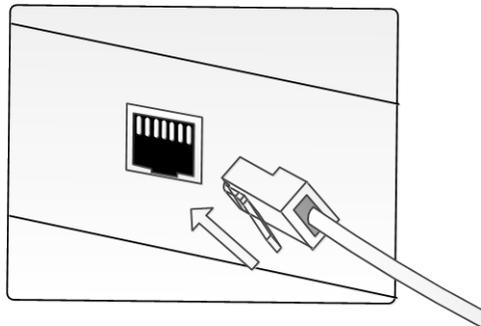
Step 3 Aim RJ45 connector on the other end of cable at the link partner's Ethernet port; insert it into the port with moderate force.

4.1.6 Connecting the Console Cable

Step 1 Make a Console cable according to the pin definition.

Step 2 Aim the crystal head of Console cable to the Console port, and then insert it into the port with moderate force, as shown in Figure 4-11.

Figure 4-11 Connecting the Console cable



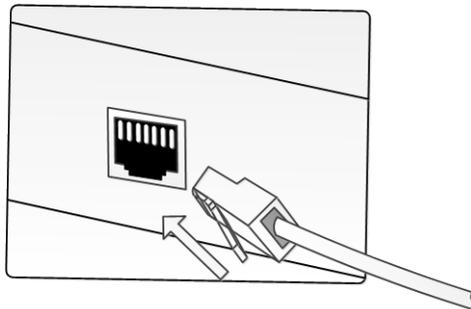
4.1.7 Connecting the E1 Cable

Connecting the Dual-E1 Socket Cable

120 Ω Impedance Port

- Step 1** Make E1 cable according to the pin definition in Table 2-14.
- Step 2** Aim one crystal head of cable at the device's dual-E1 socket; insert it into the port with moderate force, as shown in Figure 4-12.

Figure 4-12 Connecting dual-E1 socket cable (120 Ω)

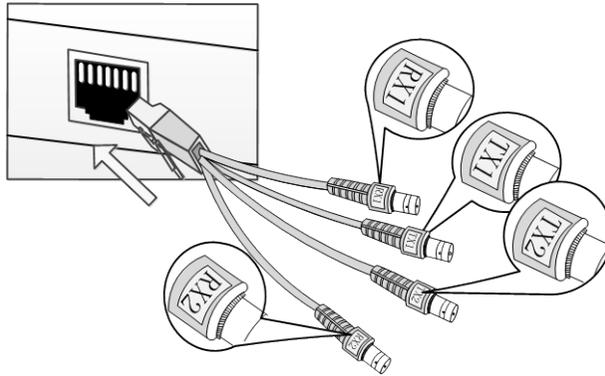


- Step 3** Connect crystal head on the other side of the cable with user's device.

75 Ω Impedance Port (BH4.850.123)

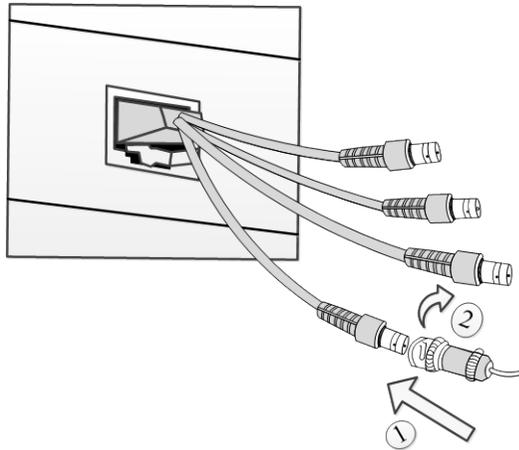
- Step 1** Convert dual-E1 socket to BNC socket by interface conversion cable BH4.850.123 sent with the device, as shown in Figure 4-13.

Figure 4-13 Connecting the interface conversion cable



Step 2 Aim the bayonet of BNC cable male interface at the standoff of interface conversion cable BH4.850.123's BNC interface, then insert it into the standoff with moderate force and turn it right to the slot, as shown in Figure 4-14.

Figure 4-14 Connecting dual-E1 cable (BH4.850.123)





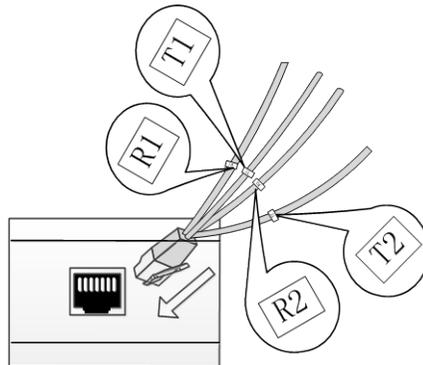
CAUTION

The BNC interface of BH4.850.123 interface conversion cable is marked with "TX1" for the first E1 signal output, with "RX1" for the first E1 signal input; with "TX2" for the second channel E1 signal output, and with "RX2" for the second channel E1 signal input. Note that the input and output do not reverse.

75Ω Impedance Port (BH4.850.107)

- Step 1** Aim the RJ45 connector of dual-E1 cable BH4.850.107 at the device's dual-E1 socket; insert it into the socket with moderate force.

Figure 4-15 Connecting dual-E1 cable (BH4.850.107)



- Step 2** Connect another end of dual-E1 cable BH4.850.107 to the user's device port.



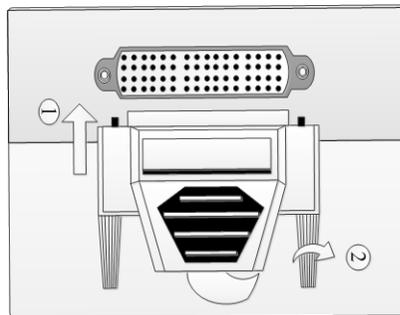
CAUTION

There are signal definition tags adhered on dual E1 cable BH4.850.107. “T1” is the 1st E1 signal output, “R1” is the 1st E1 signal input; while “T2” is the 2nd E1 signal output and “R2” is the 2nd E1 signal input. Be careful not to reverse input and output.

Connect DMS-60M Socket Cable

Step 1 Aim the DMS-60M connector of 12E1 cable (BH4.850.124D) at the device’s DMS-60M port; insert it into the port with moderate force. Tighten the screws at both ends of cable clockwise, as shown in Figure 4-16.

Figure 4-16 DMS-60M port cable connection

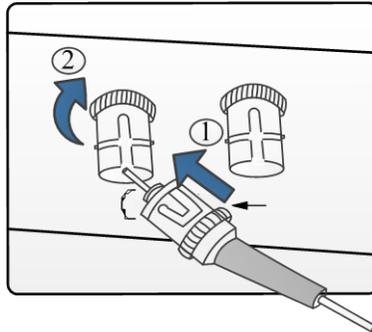


Step 2 Connect another end of 12E1 cable (BH4.850.124D) with the user’s device.

4.1.8 Connecting the C37.94 Port Cable

Aim the bayonet of ST/FC male interface at the standoff of the device’s BNC interface, then insert it into the standoff with moderate force and rotate it right to the slot clockwise, as shown in Figure 4-17.

Figure 4-17 Connecting the C37.94 port cable



CAUTION

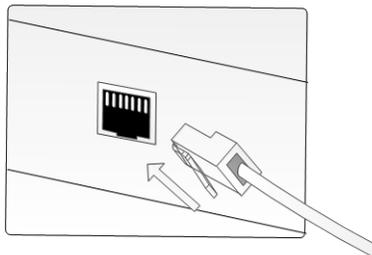
↪ is the optical signal output, ↩ is the optical signal input.

4.1.9 Connecting the Clock Signal Cable

Connecting BITS Port Cable

- Step 1** Make Bits port cable according to the pin definition in Table 2-8.
- Step 2** Aim the crystal head of Bits port cable at the device bit port; insert it into the port with moderate force.

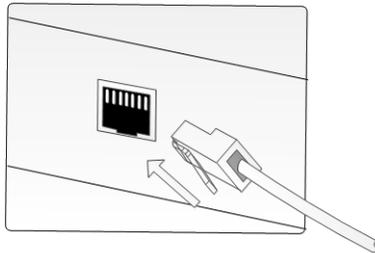
Figure 4-18 Connecting Bits port cable



Connecting 1PPS TOD Port Cable

- Step 1** Make 1PPS TOD port cable according to the pin definition in Table 2-9.
- Step 2** Aim the crystal head of 1PPS TOD port cable at the device 1PPS TOD port; insert it into the port with moderate force.

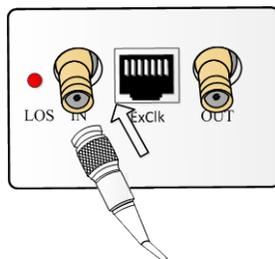
Figure 4-19 Connecting 1PPS TOD port cable



Connecting the LA01 Clock Interface Cable

- Step 1** If CC4-type 75Ω 2Mbit/s external clock input is needed, aim the male interface of CC4-type 75Ω coaxial cable at CC4 socket marked with “IN” on LA01 card, and then insert it into the socket with moderate force, as shown in Figure 4-20.

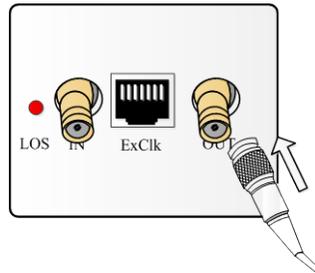
Figure 4-20 Connect CC4-type 75Ω clock input signal cable



- Step 2** If CC4-type 75Ω 2Mbit/s external clock output is needed, aim the male interface of CC4-type 75Ω coaxial cable at CC4 socket marked with “OUT”

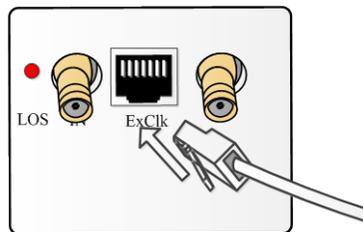
on LA01 card, and then insert it into the socket with moderate force, as shown in Figure 4-21.

Figure 4-21 Connecting CC4-type 75Ω clock output signal cable



Step 3 If RJ48-C 120Ω clock signal is needed, make a cable according to the line definition in Table 2-18. Aim the connector of the cable at RJ48C interface on LA01 card, and then insert it into the interface with moderate force.

Figure 4-22 Connecting RJ48-C 120Ω clock signal cable



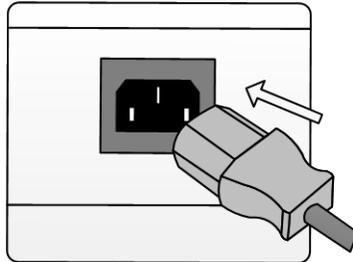
 **NOTE**

75Ω and 120Ω clock ports cannot be used at the same time.

4.1.10 Connecting the Power Cord

Step 1 When using AC220 power supply, aim AC power connector of IEC standard power cord sent with the device at standard AC ~220V power socket on the device, then insert it into the socket with moderate force, as shown in Figure 4-23.

Figure 4-23 Connecting AC power cord

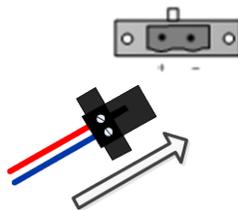


CAUTION

- The electrode in the middle of AC power socket is the protection grounding. Make sure the protection ground is rightly connected when installing the device.

Step 2 When using DC-48V power supply. Aim the DC power cord connector at the device socket, and then insert it into the socket with moderate force, as shown in Figure 4-24.

Figure 4-24 Connecting DC power cord





CAUTION

The red line of the DC power cord means high voltage level, i.e. using -48V DC power supply. The blue line of the power cord means low voltage level, i.e. -48V.

4.2 Post-installation Check

Table 4-1 Post-installation check items

Number	Descriptions	Method
1	There are no other things placed on the chassis	Check
2	The screws must be secured correctly	Check
3	All the cables are bound with proper tightness. The space between the cable ties is even, and the remaining parts of the cable ties are cut off neatly. All cable ties face the same direction, keeping the overall appearance nice	Check
4	Signal cables must be routed according to the engineering design	Check
5	Signal cables should not be damaged or broken, and there should not be any joints on the cable	Check
6	The connectors of the signal cable must be neat and intact. The connectors must be connected correctly and firmly. The tips of the connectors must be connected securely	Check

Number	Descriptions	Method
7	Signal cables must be laid horizontally or vertically without crossing, and must be bundled moderately at the turning (crossing is allowed for cables within 1m outside the cabinet)	Check
8	Labels at both ends of the signal cable must be marked correctly, clearly and neatly	Check
9	The routing of power cables and ground cables must comply with the engineering design. This helps maintenance and expansion	Check
10	The power cable and ground cable must adopt an entire segment of copper core. The cable should have no connection in the middle or scratch on the skin	Check
11	The power cables and ground cables must be corrected correctly and reliably	Check
12	The cross-sectional area of the power cable and ground cable must comply with the engineering design, meeting the requirements of running the equipment	Check
13	The power cables, ground cables and signal cables must be routed separately	Check
14	The power cables and ground cables must be routed horizontally and vertically without crossover. Proper margins must be reserved at the turning	Check
15	The identifiers on things like the power cable and ground cable must be correct, legible and neat	Check

Number	Descriptions	Method
16	The optical fibers routed outside the cabinet must be protected in a corrugated pipe and cabling trough, and must be protected from being extruded by other cables and goods	Check
17	The optical fibers must be protected in a corrugated pipe when being routed into the cabinet, and the corrugated pipe must be laid inside the cabinet. The length of the corrugated pipe inside the cabinet must not exceed 100mm, and the corrugated pipe must be fastened and bundled reliably	Check; measure
18	Curvature radius of the optical fiber must be 20 times larger than the diameter of the optical fiber. Generally, the curvature radius of the optical fiber must be greater than or equal to 40mm. There should be no sharp components on the routing path of the optical fibers	Check; measure
19	Place optical fiber pairs in order and bind them carefully with optical binders	Check

4.3 Power on

After connecting the power cord, turn on the power switch and enter the configuration process (bootstrapping), power LED is on, indicating normal power supply, about 30 seconds later, RUN LED on the MX02 card blinks, indicating the device enters the working state.

Check alarm LEDs; preliminarily check if the device works normally. When ALM LED on the MX02 card is on, it indicates alarm occurs to the

device; a further check is needed. If LOS LED of optical card is on, it needs to check the device's optical ports to see whether they are correctly connected, whether optical line attenuations are excessive and whether optical modules are correctly selected. Green and yellow LEDs at Ethernet electrical port indicate the working status of corresponding Ethernet port.

5 Opening and Maintenance

5.1 Device Management

NM and CONSOLE ports on the front panel of DHODT-LMXE.VX are used as management ports, which support SNMP, and CLI.

The default IP address of DHODT-LMXE.VX is 192.192.4.2; the IP address mask is 255.255.255.0.

The management methods of DHODT-LMXE.VX are as follows:

1. CLI: To log in CLI, hyper terminal is used through CONSOLE serial port, or Telnet is used through NM port. Telnet command format: Telnet IP, e.g. Telnet 192.192.4.2. The password is “Admin123”. The protocol adopted by hyper terminal is: baud rate: 115200bps; data bit: 8; parity bit: none; stop bit: 1.
2. SNMP: SNMP V1 and SNMP V2c, using access control based on community. The SNMP packet which does not comply with community recognized by device will be discarded. Different communities can have Read-Only access authority or Read-Write access authority. The community with Read-Only authority can only query device information, and the community with Read-Write authority can also configure the device. By default, the system has created a community with Read-Only authority named Public and a community with Read-Write authority named Private. The default

configuration cannot be deleted or modified. You can create new communities if required. Trap function is supported. Trap means that the device automatically sends unrequested information to NM, to report urgent events.

3. EzView NMS: For details, please refer to the online help of the software.

Remote in-band IP address can be used to implement remote in-band monitoring function. One device in network is configured as Master node, and other devices are configured as Slave nodes. Only one Master node can exist in the network. At in-band mode, Master node should be configured to route or bridge, and configuration of Slave nodes is ineffective. If remote in-band IP address and management IP are not in the same subnet, in-band mode is route; if they are in the same subnet; in-band mode is the bridge. In addition, in-band management port should be configured. Master node and Slave nodes are connected through in-band management port, which is usually NNI port.

5.2 Monitoring Software

For detailed instruction of the network management monitoring software of DHODT-LMXE.VX hybrid multiplexer, please refer to *NMS Manual's online help*.

6 Troubleshooting

When fault occurs, first find out the position of alarm through the alarm indication on device front panel (whether it is device fault, or transmission line fault), and then deal with it accordingly. The following part is an instruction of judgment of common faults and solution measures.

Phenomenon	Possible fault cause	Solution measure
PWR LED is off Power supply is abnormal	Power supply voltage does not meet the requirements	Check if the power input is normal; adjust the power supply voltage to the working range
	Power switch is not on	Turn on power switch
	Power connection line is loose	Tighten the power line
	Internal fuse is blown	Replace the fuse
	Device fault	Replace the device

Phenomenon	Possible fault cause	Solution measure
LOS LED is on No light reception alarm	Optical fiber is not connected, or sending and receiving fibers are reversed, or transmission fiber has fault	Check if the optical fiber is intact; check if the optical connector is in good contact
	Excessive line attenuation	Check optical joints to see if they are in good contact; clean the optical connector
	Optical power overload	If the optical power is overload, an attenuator is needed
	Optical module fault	Replace optical module
	Local device failure	Replace the device
	Fault of link partner device connected by optical fiber	Check the device connected
	The wavelengths of the single-fiber module and the link partner device connected are the same	Select single-module devices with different emission wavelengths
Green LED at Ethernet socket is off	Network cable is low-qualified or line order is wrong	Replace network cable
	Using straight-through network cable in manual mode	Please use crossover network cable in manual mode

Phenomenon	Possible fault cause	Solution measure
	Electrical port and link partner configurations are not matched	Please modify electrical port configuration of this device or peer device
Yellow LED at Ethernet socket is off	Perhaps half-duplex mode is set	Normal phenomenon
	The Ethernet interface of one end is set to auto-negotiation mode, and interface of the other end is manual full-duplex mode	Normal phenomenon, self-negotiation interface must work at half-duplex mode. Please configure devices of both ends to in the same way
SDH/MSTP Ethernet service is blocked	GFP loss of frame delineation alarm occurs, generally caused by wrong service setting	Check the low-order alarm first to see if the channel setting is normal
	The Tag property of the port is not consistent the link partner	Keep the Tag property of the port consistent the link partner
Ethernet service in packet transmission network is blocked	Wrong Tunnel router limit	Check if the source/destination nodes are correct; check if in/out tags of the adjacent NE are consistent; check if the next IP is correct

Phenomenon	Possible fault cause	Solution measure
	Wrong PW configuration	Check if in/out tags of the adjacent NE are consistent; check if Tunnel ID connected with the adjacent NE PW is correct
	The Tag property of the port is not consistent the link partner	Keep the Tag property of the port consistent the link partner
	Port speed limiting is 0	Modify the port speed limiting value
Packet loss of Ethernet service	Packet loss of ETH service due to different port modes is generally caused by different working modes of the interfaces	Check working modes of the interfaces of the interconnected Ethernets and keep consistent, the case that auto-negotiation on one side and forced 100M in full-duplex mode on the other side is forbidden

Phenomenon	Possible fault cause	Solution measure
	<p>Packet loss of ETH service due to the network cable is generally caused by using Cat 3 cable which is designed for 10M Ethernet as the transmission media of 100M Ethernet service. Currently most of the Ethernet interfaces are 100M, so a large number of CRC packet errors will occur if Cat 3 cable is used, which leads to packet loss. The problem of poor contact between connectors caused by crimping the crystal heads of Cat 5 cable or Cat 5 e cable first by Cat 6 cable also produces a number of packet losses.</p>	<p>Check the network cable to ensure correct network cable production</p>
	<p>Port optical power is abnormal or unstable</p>	<p>Please check optical power, solutions are the same with “LOS LED on”</p>

Phenomenon	Possible fault cause	Solution measure
	Port traffic speed limit configuration is too low, or the source /destination configurations are not consistent	Please check the traffic speed limit configuration of devices at both ends
	Packet loss of ETH service caused by channel errors, including the errors caused by optical fiber attenuation, which is a main reason of packet loss	Check if there are channel errors; Check if Optical fiber attenuation is excessive
	Packet loss caused by the device or the card	Confirm this by replacing it with other types of devices or cards
E1 interface alarm	RJ-48C, dual E1 connector fault	Adjust the connector
	E1 cable is not connected or sending and receiving pins are reversed	Connect the cable correctly
	The connection of DDF is loose	Check the connection of DDF to see if it is firm;
	E1 tributary card fault	Replace E1 tributary card
	Partner device E1 signal alarm	Replace partner device

Phenomenon	Possible fault cause	Solution measure
Forwarding of the link aggregation port is blocked	Link aggregation member port failure	Please ensure that the physical layer of Ethernet port is Up; If the status of the member port is Up, please ensure that both ends of each cable is connected to the correct corresponding device and interfaces
	The number of the link aggregation member ports of the two ends is different	Please add the physical interface of the device to the link aggregation group correctly
	Unsuccessful negotiation among link aggregation ports under static LACP mode: member port failure that cause timeout negotiation of LACP protocol packets	Please try to connect the cable to the other idle port, and add the port to the link aggregation group
	Unsuccessful negotiation among link aggregation ports under static LACP mode: one end device of the link is configured with static LACP mode, while the other end is not	Please configure devices of the two ends correctly

Phenomenon	Possible fault cause	Solution measure
Users in the VLAN cannot visit each other	The status of physical interface is Down	Please ensure the physical layer of Ethernet port is Up
	User terminal IP addresses are not in the same network segment	Please ensure that the user terminal IP addresses of users that need to intercommunicate are in the same network segment
	Wrong VLAN configuration	Whether the interfaces that need to intercommunicate has added to VLAN, if not, please add the interfaces to the specified VLAN and also ensure interface type is configured correctly
The service is blocked after configuring QinQ	The outer TPID value of QinQ cannot be identified by the linked devices	Please ensure outer TPID value of QinQ of each device is the same
	Outer VLAN is not established, making ports fail to add outer VLAN	Please ensure the outer VLAN that need to be added has been established, otherwise the device cannot add outer VLAN tag for the output messages

Phenomenon	Possible fault cause	Solution measure
	Flexible QinQ is configured, but the coming VLAN tags of user messages are not within the specified scope, thus they cannot be identified by the device	Please ensure VLAN tags of user-side messages are within the configuration scope of adding outer VLAN
ACL cannot filter customer traffic normally after configuration	Packets do not match with the user-defined ACL rules	Modify user-defined ACL, making it match with the information in the packets
	Packets match with other ACL that has higher priority	Subject to the rules that has higher priority
The device cannot be logged in through CONSOLE NM port	RS232 cable is wrongly connected	Check if RS232 cable is correctly connected to the device's CONSOLE NM port and PC serial port
	Serial port parameter is wrongly configured	Please configure serial port parameter correctly
The remote end cannot be monitored	DCC configuration is different from the link partner	Please change DCC channel bytes of both ends to ensure consistency

Phenomenon	Possible fault cause	Solution measure
	E1 monitoring channel is not connected	Check if E1 monitoring channel settings of both ends are correct, make sure that the E1 channel is not set for transmission service
	Ethernet inband monitoring channel is not connected	Check if inband IP address is set correctly Please make sure that the Ethernet service channel is normal to ensure normal Ethernet inband monitoring

If problem occurs during installation or usage, please deal with it through the above measures. If problem persists, please contact Changzhou Bell Data Communicataion Equipments Co.,Ltd. for technical support.

7 Technical Specifications

7.1 Monitoring Interface

SNMP Interface	
Connector	RJ-45
Rate	10/100M
Supported protocol	SNMP

Console Interface	
Connector	RJ-45
Electrical specification	RS-232

7.2 STM-1 Optical/Electrical Signal Port

STM-1 Port	
Transmission rate	155520kbit/s \pm 4.6ppm

STM-1 Port	
Line code format	Scramble NRZ
Optical interface properties	Determined by the optical module
Connector	Standard configuration LC: dual-fiber bidirectional transmission (SFP socket)
	Selected configuration/S: LC single-fiber bidirectional transmission (SFP socket)

7.3 STM-4 Optical Signal Port

STM-4 Port	
Transmission rate	622080kbit/s \pm 4.6ppm
Line code format	Scramble NRZ
Optical interface properties	Determined by the optical module
Connector	Standard configuration LC: dual-fiber bidirectional transmission (SFP socket)
	Selected configuration/S: LC single-fiber bidirectional transmission (SFP socket)

7.4 STM-16 Optical Signal Port

STM-16 Port	
Transmission rate	2488320kbit/s \pm 4.6ppm
Line code format	Scramble NRZ
Optical interface properties	Determined by the optical module
Connector	Standard configuration: LC dual-fiber bidirectional transmission (SFP socket)
	Selected configuration/S: LC single-fiber bidirectional transmission (SFP socket)

7.5 STM-64 Optical Signal Port

STM-64 Port	
Transmission rate	9953280kbit/s \pm 4.6ppm
Line code format	Scramble NRZ
Optical interface properties	Determined by the optical module
Connector	Standard configuration: LC dual-fiber bidirectional transmission (SFP socket)

STM-64 Port	
	Selected configuration/S: LC single-fiber bidirectional transmission (SFP socket)

7.6 Ethernet Port

7.6.1 10/100/1000Base-Tx Port

Specification	Description
Rate	10/100/1000M
Interface standard	Comply with IEEE 802.3, IEEE-802.3u, IEEE 802.1Q, IEEE 802.1p standard
Work mode	Auto-negotiation, forced 10/100/1000M full-duplex, 10/100M half-duplex
Connector	RJ-45 socket

7.6.2 100/1000Base-SX/LX Port

Specification	Description
Rate	100/1000M
Interface standard	IEEE 802.3z
Work mode	Auto-negotiation, 1000M full-duplex, 100M full-duplex
Connector	SFP socket

Specification	Description
Optical interface properties	Determined by the optical module

7.6.3 10GBase-SR/LR Port

Specification	Description
Rate	10GE
Interface standard	IEEE 802.3, IEEE 802.3ae, IEEE 802.1Q, IEEE 802.1p, IEEE 802.1ad, IEEE 802.1d, IEEE 802.1w, IEEE 802.3ad, IEEE 802.3ah, IEEE 802.1ag, Y1731
Work mode	Auto-negotiation
Connector	SFP+ socket
Optical interface properties	Determined by the optical module

7.7 C37.94 Optical Port

Parameter	Specifications
Transmission rate	2048kbit/s \pm 100ppm
Service data rate	N \times 64kbit/sN (1-12)

Parameter	Specifications
Optical port property	Determined by optical module
Connector	ST/PC
Standards	IEEE C37.94TM-2002 standard

7.8 E1 Signal Interface

E1 Signal Interface	
Bit rate	2.048 Mbps \pm 50ppm
Line code format	HDB3
Impedance	75 Ω unbalanced interface/120 Ω balanced interface
Connector	Dual-E1 socket, DMS-60M socket

7.9 Audio and Asynchronous Data Port

7.9.1 Traditional Phone Port and Signaling

Interface Parameters

Parameter	Specifications	
Switching-side	Off-hook impedance	<500 Ω

Parameter	Specifications	
	On-hook impedance	>10K Ω
User-side	Loop impedance	$\leq 2000\Omega$ (including the phone)
	Free circuit voltage	$\leq 50V$
	Loop current	25mA
	Off-hook threshold	8mA
	Polarity reversion delay	<50msec
	Dialing	Pulse dialing monpulse distortion < 5msec The total distortion of in-band tone dialing meets the requirements of voice ports
	Off-hook delay	<100msec

Ringling Current

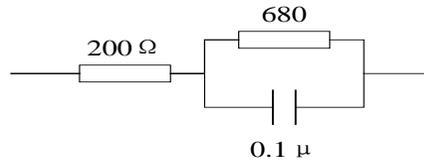
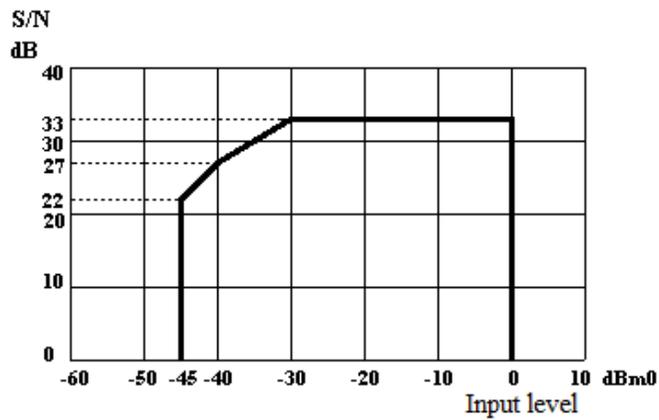
Parameter	Specifications	
FXS ringing current	Frequency	25Hz \pm 3Hz
	Amplitude	75V \pm 5Vrms

Parameter	Specifications	
generator	Ringing current delay	<50ms
	Total output power	≤5 W (per chassis)
FXO ringing current detection	Amplitude range	38Vrms (Minimum)

Voice Specifications

Parameter	Specifications
Impedance	600Ω or ternary impedance, as shown in Figure 7-1
Audio range	300 Hz~3400 Hz
Encoding law	G.712A law of ITU-T recommendation
2-wire interface level	2-wire Tx: 0dBr ± 0.5dBr 2-wire Rx: -3.5dBr ±0.5dBr
Return loss	300-600Hz >12dB 600-3400Hz >15dB
Frequency response	300-3400Hz complying with ITU G.712
Air Noise	≤-65dBm0p
Gain	-45dB~+3dB (Error less than ±0.5dB)
Total SNR	Comply with ITU G.712 sample as shown in Figure 7-2

Parameter	Specifications
Standards	G.711, G.712

Figure 7-1 Ternary impedance

Figure 7-2 Total SNR sample of 2W interface


7.9.2 Special Interfaces

2/4-wire Voice

Parameter	Specifications
Impedance	600 Ω
Encoding law	G.711 A law of ITU-T recommendation

Parameter	Specifications
Return loss	300-3400Hz >20dB
Frequency response	300-3400Hz complying with ITU G.712
Air noise	≤-65dBm0p
Total SNR	Complies with ITU G.712 sample, as shown in Figure 7-2
Interface level	4-wire Tx: 0dBr ± 0.5dBr (default) 4-wire Rx: 0dBr ± 0.5dBr (default)
Adjustment accuracy	0.1 dB
standards	G.711, G.712

Asynchronous Data Port

Parameter	Specifications
Port level	Complies with RS-232/V.24 standard or RS-422/RS-485/V.11 standard
Port rate	≤19.2kbit/s asynchronous data
Standards	V.24, V.11

64 K Co-directional Data Port

Parameter	Specifications
Port type	64Kbps co-directional data port

Parameter	Specifications
Port rate	64kbit/s±100ppm
Impedance	120Ω (balanced)
Line encoding	Co-directional encoding
Line waveform	Complies with 64K co-directional port pulse sample in G.703
Port number	8
Connector	RJ-48C

7.10 Order/Overhead Interfaces

Order/Overhead Interfaces	
Order interface	RJ11, supporting dual-audio dialing
Asynchronous RS232 interface	DB9, V.11 electrical interface, rate ≤19.2kb/s

7.11 External Clock Input/Output Port

Specification	Description
External clock input	2MHz, 2Mbit/s
External clock output	2MHz, 2Mbit/s

Specification	Description
Connector	CC4 or RJ45 socket
Interface standard	G.703

7.12 External Time Synchronous Port

Specification	Description
Electrical Attributes	RS422
Connector	RJ45 socket

7.13 Physical or Electrical Attributes

Physical or Electrical Attributes	
Chassis size	Size without mounting brackets (W×D×H): 167mm×248mm×444mm Size with mounting brackets (W×D×H): 167mm×248mm×482mm
DC power	PWR01A: Input: -48 V (-36V ~ -60V) Output: 5V 150W, 12V 200W
AC power	PWR02A: Input: ~220V (165V ~ 265V) Output: 5V 100W, 12V 200W

Physical or Electrical Attributes	
Power consumption	Maximum power consumption (typical configuration) <350W
Operation temperature	0~ 45°C
Operation humidity	10-90%RH (non-condensing)

Appendix Terms and Abbreviations

Terms

E

Encapsulation Encapsulation is a technique used by layered protocols in which a low level protocol accepts a packet from a higher level protocol, then places it in the data portion of the lower-level frame. Such as an IP packet from IP protocol is placed into the data portion of 802.1Q, its outer-layer is encapsulated by 802.1Q frame head, so as to form a VLAN frame structure

Ethernet Linear Protection Switching (ELPS)

ITU-T G.8031 standard based APS (Automatic Protection Switching) protocol is an end to end protection technology used to protect an Ethernet connection. It includes two kinds of linear protections: linear 1:1 protection switching and linear 1+1 protection switching.

Ethernet Ring Protection Switching (ERPS)

ITU-T G.8032 standard based Automatic protection switching (APS) protocol is a dedicated protocol used in link layer protocol of Ethernet ring. Normally, in Ethernet ring, it can prevent broadcast storm which is caused by data loop, when a failure occurs to Ethernet ring link or equipment, it can rapidly switch to the backup link to ensure rapid business recovery

L

Label Label is a group of symbols which are used to identify certain block of data or program segment in the program. In MPLS, label is a short identifier with fixed length and local significance, used as a unique identification for forwarding equivalence class (FEC) which a packet belongs to.

Link Aggregation One logical aggregation group is formed through aggregating multiple physical Ethernet interfaces and the physical links in the same aggregation group is seen as one logical link, so as to implement link protection and load sharing between devices, greatly enhance reliability of service between devices, and enhance the bandwidth without upgrading the hardware.

M

Metropolitan Area Network MAN is a large computer network that provides Internet connectivity for LANs in a metropolitan region, its geographic scope falls between a WAN and LAN. MAN can use optical fiber as its transmission medium, it can also be used as the backbone network

Q

QinQ (802.1Q in 802.1Q) QinQ is (also called Stacked VLAN or Double VLAN) extended from 802.1Q, defined by IEEE 802.1ad recommendation. Basic QinQ is a simple layer-2 VPN tunnel technology, encapsulating outer VLAN Tag for client private packets at carrier access end; the packets take double VLAN Tag passing through trunk network (public network). In public network, packets only transmit according to outer VLAN Tag, the private VLAN Tag are transmitted as data in packets

S

SyncE It is a technology which can use Ethernet link stream to recover clock, similar to the SDH clock synchronization quality. SyncE provides synchronous frequency with high precision. Differ from the traditional network which only conduct synchronization based on data packet at the receiving node, internal clock synchronization mechanism of SyncE node is in real time

Abbreviations**A**

ACL	Access Control List
ADM	Add-Drop Multiplexer
APS	Automatic Protection Switching

C

CoS	Class of Service
-----	------------------

D

DCC	Data Communication Channel
DSCP	Differentiated Services Code Point
DS	Differentiated Services

E

EFM	Ethernet in the First Mile
E-LAN	Ethernet-LAN
E-Line	Ethernet-Line
ELPS	Ethernet Linear Protection Switching
EoPDH	Ethernet Over Plesynchronous Digital Hierarchy
EoS	Ethernet Over Synchronous Digital Hierarchy
ERPS	Ethernet Ring Protection Switching
E-Tree	Ethernet-Tree
EVC	Ethernet Virtual Connection
I	
IP	Internet Protocol
IEC	International Electro technical Commission
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
L	
LACP	Link Aggregation Control Protocol
LB	Loop Back
M	
MAC	Medium Access Control
MSTP	Multi-Service Transfer Hybrid multiplexer

STM-64 Synchronous Transmission Module Data Rates: 9953.28Mbit/s

STP Spanning Tree Protocol

T

TDM Time Division Multiplex

ToS Type of Service

V

VLAN Virtual Local Area Network

W

WRED Weighted Random Early Detection